

Means towards congruence: An activity-theoretical approach

Kristian Liam Goddard

Submitted in accordance with the requirements for the degree of

Doctor of Philosophy

The University of Leeds

Leeds University Business School

August 2025

Intellectual Property and Publication Statements

I confirm that the work submitted is my own and that appropriate credit has been given where reference has been made to the work of others.

This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

For M., my parents and Charlie.

Abstract

Scholars of the Cultural Historic Activity Theory (CHAT) tradition have long regarded activity as invariably laced with contradiction(s). These can build up, and possibly create disturbances for practice. In some circumstances, they can provoke intentional improvement initiatives so revolutionary that the motive and object are recast. More recently, enthusiasm is found in what might be considered its counterpart: congruence. Far from impeding activity, these sources of stability are praised with promoting its continuity. The present study explores congruence. Specifically, it examines the equally intentional means by which it is worked towards. The role(s) of bricolage and improvisation attract heightened scrutiny, as do areas of challenge. This interpretive, qualitative study employs a practice theory, activity theory. Critical incident technique (CIT) is also appropriated. Empirical work was carried out in IT provision in UK academia; 22 IT practitioners from 6 UK universities participated in semi-structured interviews (SSI), contributing qualitative data. Qualitative data analysis was undertaken. A tri-fold conceptualisation results. Foremost, seven heterogeneous means towards congruence are unearthed: information behavior (IB); working together; change(s) to/of tool(s) and/or resource(s); conduct relative to rule(s) and/or norm(s); workarounds; improvisation; and bricolage. These are further conceptualised as interacting constituents of greater congruence efforts. For the final facet, challenges to and/or associated with overarching congruence efforts are presented in six areas. These include: tool(s) and/or resource(s); comprehension and/or understanding; social conflict; labour; adherence to rule(s) and/or norm(s); and unrealised, potential risk(s). Once outlined fully, the contribution to academia is emphasised, as is value to practice. Limitations are acknowledged and opportunities for future research are recognised.

Keywords: Cultural Historic Activity Theory (CHAT), congruence, bricolage, improvisation, critical incident technique.

Table of contents

List of Figures	16
List of Tables	17
Abbreviations.....	18
1 Introduction	21
1.1 Introduction.....	21
1.2 Background.....	21
1.3 Purpose and research questions (RQs).....	23
1.4 Approach	24
1.5 Theoretical contribution	24
1.6 Thesis structure	25
1.7 Summary and conclusion	27
2 Literature review: CHAT tradition and congruence, other influence.....	28
2.1 Introduction.....	28
2.2 Soviet Russian beginnings of activity theory	28
2.2.1 Introduction	28
2.2.2 First generation: Lev Vygotsky.....	29
2.2.3 Second generation: Alexei Leontiev	31
2.3 Western interest in activity theory	34
2.3.1 Introduction	34
2.3.2 Third generation activity: Yrjö Engeström	34
2.3.3 Contradictions and change, evidenced	38
2.4 CHAT concept of congruence: A recent and contemporary development	41
2.4.1 Introduction	41
2.4.2 Introducing and characterising the concept.....	41
2.4.3 Congruence and continuity, evidenced	42
2.4.3.1 Information systems (IS) the UK ambulance service	42
2.4.3.2 “Mobile technology” in the UK police	47
2.4.3.3 “Digital storytelling” in Canada	51

2.4.3.4	Social media use at a Scandinavian software company.....	53
2.4.3.5	“Mending” in Finnish healthcare.....	55
2.4.4	Reflecting on the nature/character of congruence	57
2.5	Congruence: Discerning and addressing theoretical gap(s)/deficit(s)	58
2.5.1	Introduction	58
2.5.2	Shortcomings in conceptual understanding.....	58
2.5.3	Formulating research questions (RQs) 1 and 2	59
2.6	Other influence.....	59
2.7	Integrating bricolage and improvisation.....	63
2.8	Summary and Conclusion	64
3	Literature Review: Bricolage	65
3.1	Introduction.....	65
3.2	Characterising and clarifying the concept	65
3.3	Entrepreneurship.....	66
3.3.1	Introduction	66
3.3.2	Pertinent literature.....	66
3.3.3	Summary: Bricolage in entrepreneurship	79
3.4	Academic research	81
3.4.1	Introduction	81
3.4.2	Pertinent literature.....	81
3.4.3	Summary: Bricolage in academic research.....	86
3.5	Emergencies	88
3.5.1	Introduction	88
3.5.2	Pertinent literature.....	88
3.5.3	Summary: Bricolage in emergencies	95
3.6	Information Technology (IT) & Information Systems (IS)	97
3.6.1	Introduction	97
3.6.2	Pertinent literature.....	97
3.6.3	Summary: Bricolage in IT & IS	103
3.7	On reflection: The bricolage literature	104
3.8	Summary and conclusion	105

4	Literature review: Improvisation	106
4.1	Introduction.....	106
4.2	Characterising and clarifying the concept	106
4.3	Connecting improvisation and bricolage	107
4.4	Early interest: The arts.....	108
4.4.1	Introduction	108
4.4.2	Pertinent literature.....	108
4.4.3	Summary: Improvisation in the arts.....	112
4.5	Crises, emergencies and extreme events	113
4.5.1	Introduction	113
4.5.2	Pertinent literature.....	114
4.5.3	Summary: Improvisation in crises, emergencies and extreme events	124
4.6	New Product Development (NPD)	126
4.6.1	Introduction	126
4.6.2	Pertinent literature.....	126
4.6.3	Summary: Improvisation in NPD	138
4.7	Information Technology (IT) & Information Systems (IS)	139
4.7.1	Introduction	139
4.7.2	Pertinent literature.....	139
4.7.3	Summary: Improvisation in IT & IS	150
4.8	On reflection: The improvisation literature	151
4.9	Bricolage and improvisation: Discerning and addressing theoretical gap(s)/deficit(s) 152	
4.10	Summary and conclusion	154
5	Methodology.....	155
5.1	Introduction.....	155
5.2	Purpose and research questions (RQs).....	155
5.3	Underlying philosophy.....	155
5.3.1	Introduction	155
5.3.2	Philosophy in research	156
5.3.3	Contrasting positivism with interpretivism	156
5.3.4	Interpretive stance	159

5.4	Practice theory	160
5.4.1	Introduction	160
5.4.2	Practice in research	160
5.4.3	Practice, three ways	161
5.4.3.1	A phenomenon: Empirical	161
5.4.3.2	A perspective: Theoretical	162
5.4.3.3	A philosophy: Philosophical	163
5.4.4	Practice at present	164
5.5	Activity theory	164
5.5.1	Introduction	164
5.5.2	CHAT-associated philosophy.....	164
5.5.3	Theoretical framework.....	166
5.6	Critical Incident Technique	168
5.7	Empirical setting: IT provision in UK academia	170
5.8	Target sample: IT practitioners	171
5.9	Recruitment process.....	172
5.9.1	Introduction	172
5.9.2	University A	173
5.9.3	Expanding beyond one university	174
5.9.4	University B	174
5.9.5	University C	175
5.9.6	Other active efforts	176
5.10	Resultant sample and reflecting on skew	176
5.11	Gathering data.....	178
5.11.1	Introduction	178
5.11.2	Alternative data collection methods.....	179
5.11.3	Interviews, semi-structured (SSI).....	180
5.11.4	Design of SSI protocol	182
5.11.5	Accompanying documentation and ethics.....	184
5.11.6	Conducting interviews	184
5.12	Analysis.....	185
5.12.1	Introduction	185
5.12.2	Analysing qualitative data.....	185
5.12.3	Reasoning: Deduction, induction and abduction.....	186

5.12.4	Early analysis: Thematic coding with NVivo	188
5.12.5	Advanced analysis: Introducing tabulation	188
5.12.5.1	Critical incident log	189
5.12.5.2	Means and Challenges lists.....	192
5.12.6	Consulting academic literature	194
5.13	Summary and conclusion	195
6	Findings and discussion: Activity of IT provision in UK academia	196
6.1	Introduction.....	196
6.2	Single activity system and constituent elements.....	196
6.2.1	Introduction	196
6.2.2	Single activity system	197
6.2.3	Constituent elements.....	197
6.2.3.1	Subject(s).....	198
6.2.3.2	Object/motive/outcome.....	198
6.2.3.3	Tool(s)/resource(s).....	199
6.2.3.4	Community	199
6.2.3.5	Division of labour.....	199
6.2.3.6	Rule(s)/norm(s)	200
6.3	Multiple activity systems, shared object	201
6.4	Considering contradictions	201
6.5	Occurrence of critical incidents	203
6.6	Progressive presentation of tri-fold conceptualisation.....	203
6.7	Summary and conclusion	205
7	Findings and discussion: (RQ 1) How congruence is reached in practice	206
7.1	Introduction.....	206
7.2	First five means towards congruence	207
7.2.1	Introduction	207
7.2.2	Means: Use of identical/similar terms, character and significance.....	207
7.2.3	Information behaviour	209
7.2.3.1	Introduction.....	209
7.2.3.2	Pertinent literature	210
7.2.3.3	Manifesting as means towards congruence	211

7.2.3.4	Empirical evidence.....	211
7.2.3.4.1	Outlook slow	211
7.2.3.4.2	Results inaccessible	212
7.2.3.4.3	Dropbox reimbursement	213
7.2.3.4.4	Cluster: door fault(s)	214
7.2.3.4.5	A “proactive” approach	215
7.2.3.4.6	Cluster: door fault(s) (II)	216
7.2.3.4.7	Essay submission software	217
7.2.3.4.8	Denial of Service (DoS)	218
7.2.3.5	Succinct summary: Information behaviour	218
7.2.4	Working together	218
7.2.4.1	Introduction.....	218
7.2.4.2	Pertinent literature	219
7.2.4.3	Manifesting as means towards congruence	220
7.2.4.4	Empirical evidence.....	220
7.2.4.4.1	Unable to assist	220
7.2.4.4.2	Apple expert	221
7.2.4.4.3	Essay submission software (II).....	221
7.2.4.4.4	Outlook or mouse?.....	223
7.2.4.4.5	a/v in teaching spaces	223
7.2.4.5	Succinct summary: Working together	224
7.2.5	Change(s) to/of tool(s) and/or resource(s)	224
7.2.5.1	Introduction.....	224
7.2.5.2	Pertinent literature	225
7.2.5.3	Manifesting as means towards congruence	226
7.2.5.4	Empirical evidence.....	226
7.2.5.4.1	Major incident process.....	226
7.2.5.4.2	My Print: “technical solution” and “special queue”	227
7.2.5.4.3	Online lecture check-in.....	228
7.2.5.4.4	Compromised account process	229
7.2.5.5	Succinct summary: Change(s) to/of tool(s) and/or resource(s).....	229
7.2.6	Conduct relative to rule(s) and/or norm(s)	230
7.2.6.1	Introduction.....	230
7.2.6.2	Pertinent literature	230
7.2.6.3	Manifesting as means towards congruence	231
7.2.6.4	Empirical evidence.....	231

7.2.6.4.1	Use of ticketing and/or similar and/or related system(s)	231
7.2.6.4.2	Outlook or mouse? (II)	232
7.2.6.4.3	a/v in teaching spaces (II)	233
7.2.6.4.4	Compromised account process (II)	233
7.2.6.4.5	Cluster: suspect bag	233
7.2.6.4.6	Change passwords	234
7.2.6.5	Succinct summary: Conduct relative to rule(s) and/or norm(s)	234
7.2.7	Workarounds	234
7.2.7.1	Introduction	234
7.2.7.2	Pertinent literature	235
7.2.7.3	Manifesting as means towards congruence	238
7.2.7.4	Empirical evidence	238
7.2.7.4.1	Lecture microphones	238
7.2.7.4.2	Dropbox reimbursement (II)	239
7.2.7.4.3	New printing facility	239
7.2.7.4.4	My Print: "technical solution" and "special queue" (II)	241
7.2.7.5	Succinct summary: Workarounds	242
7.2.8	Succinct summary: First five means towards congruence	242
7.3	Summary and conclusion	242
8	Findings and discussion: (RQ 2) The role(s) of bricolage and improvisation	244
8.1	Introduction	244
8.2	Bricolage and improvisation: Final two means towards congruence	245
8.2.1	Introduction	245
8.2.2	Pertinent literature	245
8.2.3	Manifesting as means towards congruence	246
8.2.4	Empirical evidence	246
8.2.4.1	Results inaccessible (II)	248
8.2.4.2	Meeting requests	250
8.2.4.3	Open day	252
8.2.4.4	Compromised account process (III)	255
8.2.4.5	Laptop spillage	257
8.2.4.6	Server resets	259
8.2.4.7	Lack of a testing environment	261
8.2.4.8	Poor ticketing system	264
8.2.4.9	2-factor authentication	266

8.2.4.10	Retired academic	268
8.2.4.11	Data centre outage	272
8.2.4.12	Routine power testing	276
8.2.4.13	A “proactive” approach (II)	278
8.2.5	Succinct summary: Bricolage and improvisation, final two means towards congruence.....	279
8.3	Summary and conclusion	279
9	Findings and discussion: Interaction and (RQ 3) Challenges	281
9.1	Introduction.....	281
9.2	Interaction of heterogeneous means towards congruence.....	282
9.2.1	Introduction	282
9.2.2	Explaining interaction: Serial and/or parallel	282
9.2.3	Empirical evidence	286
9.2.3.1	“Own problems”	286
9.2.3.2	Open day (II)	287
9.2.3.3	Major incident process (II).....	288
9.2.3.4	Essay submission software (III)	290
9.2.4	Succinct summary: Interaction.....	291
9.3	Challenges to and/or associated with congruence efforts	292
9.3.1	Introduction	292
9.3.2	Challenges: Character and significance	292
9.3.3	Tool(s) and/or resource(s)	293
9.3.3.1	Introduction.....	293
9.3.3.2	Manifesting as a challenge	294
9.3.3.3	Empirical evidence.....	294
9.3.3.3.1	Retired academic (II)	294
9.3.3.3.2	Unable to print colour	295
9.3.3.3.3	Denial of Service (DoS) (II).....	296
9.3.3.4	Succinct Summary: Tool(s) and/or resource(s)	297
9.3.4	Comprehension and/or understanding.....	297
9.3.4.1	Introduction.....	297
9.3.4.2	Manifesting as a challenge	297
9.3.4.3	Empirical evidence.....	298
9.3.4.3.1	Dropbox reimbursement (III).....	298

9.3.4.3.2	Undergraduate admissions database	298
9.3.4.4	Succinct summary: Comprehension and/or understanding	299
9.3.5	Social conflict	299
9.3.5.1	Introduction.....	299
9.3.5.2	Manifesting as a challenge	300
9.3.5.3	Empirical evidence.....	300
9.3.5.3.1	Change passwords (II)	300
9.3.5.3.2	Server maintenance	301
9.3.5.3.3	Data centre outage (II)	302
9.3.5.4	Succinct summary: Social conflict.....	303
9.3.6	Labour	303
9.3.6.1	Introduction.....	303
9.3.6.2	Manifesting as a challenge	303
9.3.6.3	Empirical evidence.....	304
9.3.6.3.1	Server maintenance (II)	304
9.3.6.3.2	PCs without endnote.....	305
9.3.6.3.3	Eduroam	306
9.3.6.4	Succinct summary: Labour	307
9.3.7	Adherence to rule(s) and/or norm(s)	307
9.3.7.1	Introduction.....	307
9.3.7.2	Manifesting as a challenge	307
9.3.7.3	Empirical evidence.....	308
9.3.7.3.1	Data centre outage (III)	308
9.3.7.3.2	Compromised account process (IV).....	309
9.3.7.3.3	New printing facility (II)	310
9.3.7.4	Succinct summary: Adherence to rule(s) and/or norm(s)	311
9.3.8	Unrealised, potential risk(s)	311
9.3.8.1	Introduction.....	311
9.3.8.2	Manifesting as a challenge	311
9.3.8.3	Empirical evidence.....	311
9.3.8.3.1	2-factor authentication (II)	311
9.3.8.3.2	Cluster: suspect bag (II)	312
9.3.8.4	Succinct summary: Unrealised, potential risk(s).....	313
9.3.9	Succinct summary: Challenges	313
9.4	Summary and conclusion	314

10	Conclusion.....	315
10.1	Introduction.....	315
10.2	Background.....	315
10.3	Purpose and research questions (RQs).....	316
10.4	As approached.....	317
10.5	Theoretical contribution	317
10.5.1	Introduction	317
10.5.2	Facet A: Heterogeneous means towards congruence.....	318
10.5.3	Facet B: Forms of interaction	320
10.5.4	Facet C: Areas of challenge	320
10.5.5	A tri-fold conceptualisation.....	322
10.5.6	Succinct summary	322
10.6	Contribution to academia.....	322
10.6.1	Introduction	322
10.6.2	CHAT tradition.....	323
10.6.3	Bricolage and improvisation	324
10.6.4	Other academic literature.....	324
10.6.5	Succinct summary	325
10.7	Value to practice	325
10.8	Limitations and future research	326
10.9	Summary and conclusion	328
	References	329
	Appendices	347
	Appendix A. Semi-structured interview protocol	347
	Appendix B. Participant information sheet	349
	Appendix C. Participant information sheet (financial incentive)	351
	Appendix D. Consent form	353
	Appendix E. Consent form (financial incentive).....	354
	Appendix F. Ethical approval for initial university.....	355
	Appendix G. Ethical approval for £10 incentive.....	356

Appendix H. Ethical approval to collect data from other universities	358
Appendix I. Ethical approval to outsource interview transcription	360
Appendix J. Tabulation (Kajamaa and Engeström, 2014).....	362
Appendix K. Critical incident log (first page).....	363
Appendix L. Means list (first page)	364
Appendix M. Challenges list (first page)	365

List of Figures

Figure 1. Mediated human behaviour (left) and Typical re-formulation (right).....	30
Figure 2. Activity System model.....	35
Figure 3. Two Activity Systems Interacting.....	36
Figure 4. Expansive cycle of learning actions	39
Figure 5. IT provision in UK academia as a single activity system	197
Figure 6. IT provision in UK academia as multiple activity systems	201
Figure 7. From research questions to theoretical contribution	204
Figure 8. Parallel and Serial bricolage patterns/arrangements	285
Figure 9. Facet A: Heterogeneous means towards congruence.....	318
Figure 10. Facet B: Forms of interaction	320
Figure 11. Facet C: Areas of challenge	320
Figure 12. A tri-fold conceptualisation.....	322

List of Tables

Table 1. Sample of IT practitioners.....	177

Abbreviations

2FA	2-factor authentication
AIM	Automotive Interior Manufacturer
AIMTech	Adaptation Information Management and Technology
ANT	Actor Network Theory
A/P	Accounts Payable
AP-HP	Assistance Publique-Hôpitaux de Paris
AVR	Analogue Voice Radio
B2B	Business to Business
BCP	Business Continuity Planning
BBC	Big Brake Company
CAD	Computer-Aided Design
CC	Carbon copy
CCU	Coronary Care Unit
CDM	Critical Decision Method
CIT	Critical Incident Technique
COBIT	Control Objectives for Information and Related Technologies
CR	Critical realism
CRADLE	The Center for Research on Activity, Development and Learning
CHAT	Cultural Historical Activity Theory
CSD	Customer Support Department
CV(s)	Contextual Variable(s)
CWS	Cooperative Work Systems
DBA	Database Administrator
DoS	Denial of Service
DPE	Design Proceeds Execution
DSS	Decision Support System
DWTS	Danish Wind Turbine Test Station
EAT	Engeströmian Activity Theory
ECG	Electrocardiogram
EPA	Environmental Protection Agency
ERP	Enterprise Resource Planning
ESRC	Economic and Social Research Council
GDPR	General Data Protection Regulation
G.M.	General Motors

GPO	Group Policy Object
GPS	Global Positioning System
GTR	Global Team Room
GUI	Graphical User Interface
HCI	Human Computer Interaction
HLM	Hierarchical linear modeling
HIS	Health Information System
IB	Information Behaviour
IC	Incident Commander
ICS	Incident Management System
ICT	Information and Communication Technology/Technologies
IE	Internet Explorer
IEC	International Electrotechnical Commission
IM	Information Management
IPT	International Project Teams
ICT	Information and Communications Technology
IQ	Interview question
IS	Information System(s)
ISO	International Organization for Standardization
ISD	Information System Development
IPT	International Project Team
ISE	Information Systems Evolution
ISS	Information System Security
ISS	Interpretive Social Science
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITPOSMO	Information, Technology, Processes, Objectives and values, Staffing and skills, Management systems and structures, Other resources
ITSM	Information Technology Service Management
ITSS	Incident Tracking Support System
JANET	Joint Academic NETwork
JI	Jazz improvisation
LION	Logistics, Information, Operations, and Networks Group
LUBS	Leeds University Business School
LYCSYS	Love Your City, Share Your Stories
MBS	Manchester Business School

MHS	Mobile Health System
MIS	Management Information System(s)
NHS	National Health Service
NPD	New Product Development
NPIA	National Police Improvement Agency
NREL	National Renewable Energy Laboratory
NYC	New York City
OMS	Organizational Memory Systems
OS	Operating System
PA	Personal assistant
PC	Personal Computer
PLS	Partial Least Squares
PRMS	Petroleum Resources Management System
PRMS	Product and Resource Management Systems
PSIC	Punctuated Socio-technical IS Change
RACI	Responsible, Accountable, Consulted, Informed
RQ	Research question
SBU	Strategic Business Unit
SDI	Selective distribution of information
SERI	Social Energy Research Institute
SIS	Strategic Information System(s)
S-O	Subject-object
S-R	Stimulus-response
SSI	Semi-structured interview
SWAT	Special Weapons And Tactics
UNIX	Uniplex Information and Computer Systems
UoL	University of Leeds
UoM	The University of Manchester
UK	United Kingdom
US	United States
USB	Universal Serial Bus
VLE	Virtual Learning Environment
WTC	World Trade Center
XEDM	Extreme Event Decision Making
ZPD	Zone of Proximal Development

1 Introduction

1.1 Introduction

The Cultural Historical Activity Theory (CHAT) tradition enjoys an extensive and well-documented history (e.g. see Leontiev, 1977; 1981; Engeström, 1987; 2001; Kaptelinin and Nardi, 2006; 2012; Kaptelinin, 2014; Bakhurst, 1991; 2009; Miettinen et al., 2009). Among its more established ideas, the concept of congruence (Allen et al., 2013) is relatively new and remains undeveloped. The present study advances theoretical understanding of congruence -and by extension contributes to the broader CHAT tradition. This opening chapter gently introduces the research and thesis.

Section 1.2 establishes brief background; from the modest body of extant research on congruence, two studies are emphasised to have been especially influential (Allen et al., 2013; Karanasios and Allen, 2014). Section 1.3 presents the study's purpose and research questions (RQs). Section 1.4 then overviews the approach. Section 1.5 previews the eventuating theoretical contribution: a tri-fold conceptualisation. The remaining thesis structure is outlined in Section 1.6. Before progressing, Section 1.7 summarises and concludes the chapter.

1.2 Background

This section establishes brief background.

Activity theory is also referred to as "cultural-historical activity theory" (Wilson, 2006b) i.e. CHAT. Noted by Kaptelinin and Nardi (2012: 12), its "immediate conceptual origins... [reside] in Russian/Soviet psychology of the 1920s and 1930s". Activity theory's "development" is linked to Lev Vygotsky, Sergei Leonidovich Rubinshtein, Alexander Luria and Alexei Leont'ev: its "four founders" (Wilson, 2006b). It can be understood to have "evolved through three generations of research" (Engeström, 1996, cited by Engeström, 2001: 134). Engeström (2001: 134) attributes the "first" and "second generation[s]" to Vygotsky (1978) and Leont'ev (1981), respectively.

Activity theory emerged "in the West in the field of educational research" (Wilson, 2006b). Its "best known advocate" in the West is Engeström (Allen et al., 2008). That is, "Finnish educational researcher", Yrjö Engeström (Kaptelinin, 2014). Engeström (2001: 135; originally Engeström, 1987) packaged his own work as "the third generation of activity theory". He put forward "a model of collective activity, the "activity system model" (a.k.a. "Engeström's triangle")" (Kaptelinin, 2014). Indeed, "a collective, artifact-mediated and object-oriented activity system,

seen in its network relations to other activity systems, is taken as the prime unit of analysis” (Engeström, 2001: 136).

“Activity systems”, Engeström (2000b: 960) argues, “are in constant movement and internally contradictory”. He recognises the “central role of contradictions as sources of change and development” (Engeström, 2001: 137). Contradictions do not equate to “problems or conflicts”; rather, they “are historically accumulating structural tensions within and between activity systems” (Engeström, 2001: 137). Contradictions “generate disturbances and conflicts, but also innovative attempts to change the activity” (Engeström, 2001: 137). “Expansive transformations” are a “possibility” (Engeström, 2001: 137). Such is achieved “when the object and motive of the activity are reconceptualized to embrace a radically wider horizon of possibilities than in the previous mode of the activity” (Engeström, 2001: 137).

More recently, Allen et al. (2013) have appended to these ideas. Citing Murphy and Rodriguez-Manzanares, 2008a: 1063), they “initially define a contradiction straightforwardly “as a tension, contrast, denial, or opposition between two propositions”” (Allen et al., 2013: 840). In respect of an “activity system”, “contradictions” denote “a misfit within elements, between them, between different activities, or between different developmental phases of a single activity....[and so] manifest themselves as problems, ruptures, breakdowns, and clashes” (Allen et al., 2013: 840, citing Kuutti, 1999: 34).

Although Allen et al. (2013: 841) appreciate the CHAT idea of “contradictions leading to change”, they argue “it is also important in concrete research to recognize what we call congruencies, which foster reproduction rather than change” (Allen et al., 2013: 841) [italics omitted]. They suggest their own empirical work “illustrate[s] and develop[s] the notion of congruencies as stabilizing forces within activity systems” (Allen et al., 2013: 841). Thus far, congruence has been studied a handful of times in a variety of empirical settings (Allen et al., 2013; Karanasios and Allen, 2014; Detlor, 2017; Forsgren and Byström, 2018).

Whilst this scholarly interest is encouraging, the extant body of associated literature is modest; correspondingly, the concept of congruence remains undeveloped. Notwithstanding, some of the points raised by Wong (2014) were applicable to the present study. The literature review enabled the student researcher to “identify knowledge gap[s]” (Wong, 2014). In particular, it illuminated “what we do” and “don’t know” (Wong, 2014). In turn, this influenced the formulation of “interesting research questions” (Wong, 2014).

Two past studies were especially influential (Allen et al., 2013; Karanasios and Allen, 2014). Most generally and from close consultation of Allen et al. (2013), it was perceived that congruence may be worked towards intentionally; more specifically, improvisation was read to be significant. Neither of these points were pursued by Allen et al. (2013), and so were sensed as shortcomings in conceptual understanding. From careful consideration of Karanasios and Allen (2014) and supervisory discussion, making do and bricolage came to be of interest. Karanasios and Allen (2014) did not consider as much, and so this was also regarded as a theoretical gap/deficit in understanding.

Improvisation and making do (as understood in respect of bricolage) were each suspected as way(s) i.e. means by which congruence can be worked towards intentionally. Attention turned to the existing academic literatures on the concepts of improvisation and bricolage. In spending time reviewing past academic work, the student researcher came to interpret "that with respect to both improvisation and bricolage, there is only a finite comprehension of potential situational factors that might represent aids or hindrances to ongoing efforts" (Goddard, 2015: 23). This is also a theoretical gap/deficit in understanding.

1.3 Purpose and research questions (RQs)

This section presents the purpose and research questions (RQs).

Careful consultation with the extant literature and supervisory discussion of it influenced the present study's purpose and research questions (RQs). The purpose of the present study is to advance theoretical understanding of congruence: a relatively new and as yet undeveloped CHAT concept. It examines intentional ways in which activity is influenced to continue i.e. means towards congruence. It is especially intrigued by the role(s) of bricolage and/or improvisation towards this. In addition, it is interested in what influences/mediates efforts towards congruence in practice.

The purpose can be appreciated in light of select scholarly insight. Whetten (1989: 490) gives thought to the "Building Blocks of Theory Development"; after e.g. Dubin (1978), he contends "a complete theory must contain four essential elements". Importantly, "What and How [merely] describe; only Why explains" (Whetten, 1989: 491). In that the study attends to the why, it explains. For Gregor (2006: 619), assessing theory in information systems (IS) research, "Explanation" is one of "four primary goals of theory" [*italics omitted*]. The study's "Theory Type" can be considered "Explanation" insofar as it "Says what is, how, why, when, and where" (Gregor, 2006: 620). Its "theory provides explanations" (Gregor, 2006: 620).

Aligning with the study's purpose, three research questions (RQs) were formulated. These were subsequently refined, to:

RQ 1. How is congruence reached in practice?

RQ 2. What role(s) do(es) bricolage and improvisation play towards this?

RQ 3. What influences/mediates efforts towards congruence in practice?

1.4 Approach

This section overviews the approach.

The present study's approach can be characterised by reference to a number of its interconnected methodological attributes. Foremost, the study is interpretive and qualitative. It employed a practice theory, activity theory (Nicolini, 2013). A "methodology", the study also cites Critical Incident technique (Flanagan, 1954) (CIT) as an influence. Empirical work was carried out in the setting of IT provision in UK academia. UK universities typically offer an assortment of information technology (IT) product(s) and/or service(s) to their population of users. IT is used regularly and may be essential. Yet, critical incidents can occur.

The target sample was IT practitioners. Where available, IT practitioners' first-hand interpretive, subjective, qualitative insights assisted in answering the RQs and therefore served the purpose. Through a process of recruitment, the resultant sample is an aggregate of 22 IT practitioners from 6 UK universities. Qualitative data were gathered/collected by the semi-structured interview method; these were audio recorded and transcribed. Correspondingly, qualitative data analysis was undertaken. Analysis was extensive, and in retrospect, traces of abductive reasoning are perhaps perceptible. The theoretical contribution eventuated.

1.5 Theoretical contribution

This section previews the eventuating theoretical contribution.

The study's theoretical contribution is a tri-fold conceptualisation comprising three facets (Facets A-C). Facet A provides seven heterogeneous means towards congruence. These are: information behaviour; working together; change(s) to/of tool(s) and/or resource(s); conduct relative to rule(s) and/or norm(s); workarounds; bricolage; and improvisation. Each alone is found to fall short of exhaustive explanation; it is often worthwhile referring to other(s). IT practitioners

typically pursue multiple heterogeneous and interacting means in overarching congruence efforts. To a lesser extent and effect, other people e.g. non-IT staff and IT users may also engage in means towards congruence.

Facet B attends theoretically to the interaction of heterogeneous means towards congruence. Two forms are proposed: serial and parallel. It is acknowledged that greater efforts may exhibit serial *and* parallel patterns/arrangements. Although IT practitioners typically undertake multiple heterogeneous and interacting means in overarching congruence efforts -and, to a lesser extent and effect, other people may also assume means towards congruence- it is accepted that congruence is not guaranteed.

Facet C foregrounds challenges to and/or associated with greater, overarching congruence efforts in six areas. These are: tool(s) and/or resource(s); comprehension and/or understanding; social conflict; labour; adherence to rule(s) and/or norm(s); and unrealised, potential risk(s). From the discussion of empirical evidence, it becomes apparent that there can be multiple, compounding challenges. In all and as suggested, Facets A, B and C constitute a tri-fold conceptualisation: the study's theoretical contribution. This, in turn, is integrated i.e. placed into the broader CHAT tradition.

1.6 Thesis structure

This section outlines the remaining thesis structure.

Chapter **2. Literature review: CHAT tradition and congruence, other influence** is the first of three to review existing academic literature. It concentrates principally on the CHAT tradition and congruence. Ordered chronologically, it rewinds to work in Soviet Russia; attention then turns to Western advances. Theoretical gap(s)/deficit(s) influence the first two research questions (RQs 1 and 2). Other influence is briefly recognised. The integration of bricolage and improvisation into the study is explained.

Chapter **3. Literature review: Bricolage** is the second of three to appraise past academic literature. Focusing on bricolage, it characterises the concept and explores work in four areas. Reflections are relayed.

Chapter **4. Literature review: Improvisation** is the last to look at past academic literature. Concentrating on improvisation, it characterises the concept. Improvisation and bricolage are

connected. Work on improvisation is assessed in four areas, and the literature reflected on. Theoretical gap(s)/deficit(s) influence the third research question (RQ 3).

Chapter **5. Methodology** addresses methodological matters, as pertain to the present study. It begins by reiterating the purpose and research questions (RQs). It elaborates on: philosophy; practice theory; activity theory; Critical incident technique; the empirical setting; target sample; recruitment process; resultant sample; data gathering; accompanying documentation and ethics; and analysis.

Chapter **6. Findings and discussion: Activity of IT provision in UK academia** is the first of four to present and discuss the study's findings. It sets the scene, instilling an activity-theoretical understanding of the general work of IT provision activity in UK academia. It considers contradictions and the occurrence of critical incidents. It also previews how subsequent findings and discussion chapters progressively present the tri-fold conceptualisation.

Chapter **7. Findings and discussion: (RQ 1) How congruence is reached in practice** is the second of four to present and discuss the study's findings. It presents the first five of seven heterogeneous means towards congruence, comprising Facet A.

Chapter **8. Findings and discussion: (RQ 2) The role(s) of bricolage and improvisation** is the third of four to present and discuss the study's findings. It discusses the final two of the seven heterogeneous means towards congruence, exhausting Facet A.

Chapter **9. Findings and discussion: Interaction and (RQ 3) Challenges** is the last to present and discuss the study's findings. Foremost, it addresses the interaction of heterogeneous means towards congruence: Facet B. It then presents challenges to and/or associated with congruence efforts in six areas: Facet C.

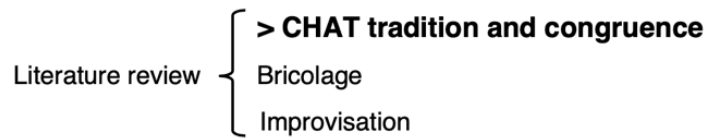
Chapter **10. Conclusion** concludes the research and thesis. It recalls the study's background, reiterates the purpose, research questions (RQs) and approach. It presents the theoretical contribution: a tri-fold conceptualisation. The contribution to academia is emphasised, as is value to practice. Limitations are acknowledged and opportunities for future research recognised.

1.7 Summary and conclusion

The Cultural Historical Activity Theory (CHAT) tradition boasts a long and well-documented history (e.g. see Leontiev, 1977; 1981; Engeström, 1987; 2001; Kaptelinin and Nardi, 2006; 2012; Kaptelinin, 2014; Bakhurst, 1991; 2009; Miettinen et al., 2009). Yet, its relatively recent concept of congruence (Allen et al., 2013) is undeveloped. The present study augments theoretical understanding of congruence. As such, it adds to the CHAT tradition more broadly. This initial, now outgoing chapter, introduced the study and thesis.

Section 1.2 set up brief background. From the few academic articles on congruence, two were acknowledged as particularly influential (Allen et al., 2013; Karanasios and Allen, 2014). Section 1.3 presented the study's purpose and research questions (RQs). Section 1.4 went on to overview the approach. Section 1.5 gave just a glimpse of the eventuating theoretical contribution, a tri-fold conceptualisation. Penultimately, Section 1.6 offered an outline of the thesis structure. In accordance, attention now turns.

2 Literature review: CHAT tradition and congruence, other influence



2.1 Introduction

As signalled, the present study furthers theoretical understanding of congruence: a relatively new and as yet undeveloped activity theory concept. By contrast, the broader CHAT tradition boasts a long-established history. But as Kaptelinin and Nardi (2006: 29-30) note, “the underlying ideas of the theory are difficult to grasp” before considering their provenance. This, the first of three literature review chapters (see graphic, above), focuses principally on CHAT and the concept of congruence; it charts and attributes key activity theory developments to provide a sturdy foundation.

Section 2.2 rewinds to the Soviet Russian beginnings of activity theory. In the field of psychology, attention is directed to the interests and inaugural inputs of Lev Vygotsky and Alexei Leontiev. Their contributions are isolated as precursory to Western advances, subsequently explored by Section 2.3. Originally from the field of education, Finnish researcher Yrjö Engeström is most heavily credited (e.g. Wilson, 2006b). Among several ideas, emphasis is placed on the contended “role of contradictions as sources of change and development” (Engeström, 2001: 137). Select empirical works exemplify.

Against this, it becomes possible to appreciate congruencies as complimentary “stabilizing forces” instead “foster[ing] reproduction” (Allen et al., 2013: 841). Section 2.4 assesses associated works and reflects on the nature/character of congruence. Section 2.5 discerns theoretical gap(s)/deficit(s), influencing the first two research questions (RQs 1 and 2). Briefly, Section 2.6 recognises other influence. Section 2.7 then turns to how the concepts of improvisation and bricolage were integrated into the present study. Lastly, Section 2.6 summarises and concludes.

2.2 Soviet Russian beginnings of activity theory

2.2.1 Introduction

This section returns to Soviet Russian psychology, where scholarly interest in activity emerged. In order, Section 2.2.2 begins by examining the inaugural inputs of Lev Vygotsky (1978): efforts establishing a “first generation”; Section 2.2.3 then turns to consider Alexei Leontiev (1981),

whose work is credited with contributing a “second” (Engeström, 2001: 134). This supports a segue to more recent, Western interest and advances (Section 2.3).

2.2.2 First generation: Lev Vygotsky

Suggested from the outset, activity theory in a primitive form can be traced to 19th century Russia (Miettinen et al., 2009). More specifically, it came from “Soviet cultural-historical psychology” (Kuutti, 1996: 25). Representing its “major founder” (Zinchenko, 1995: 37), Lev Vygotsky is widely acknowledged (Holzman, 2006). As Bakhurst (1991) observes, he was dissatisfied with the psychology research of his time. For one, different schools deployed disparate methods; these often stood in conflict. From Vygotsky’s perspective and if the discipline was to adequately attend to consciousness -its “principle object of analysis” in his view- then something needed to be done (Bakhurst, 1991: 61).

In accordance, he sought a “*unifying* theoretical approach” (Bakhurst, 1991: 61) [italics added]. Recited by Bakhurst (1991: 63), Russian psychologists typically subscribed to one of two, mutually exclusive takes on “the [human] mind”. “Objectivist” inquiries overlooked anything intrinsic to the head; rather, superficial accounts of behaviour were framed as “stimulus-response” (S-R) (Bakhurst, 1991: 61). Opposing this were the “subjective-empirical” scholars (Bakhurst, 1991: 63). Although the latter group recognised *some* utility in the S-R relation, it was their preference to deploy “introspectionism” (Bakhurst, 1991: 63). This mechanism permitted the capture of consciousness from the complementary, subjective angle (Bakhurst, 1991: 63).

Vygotsky (1962) disfavoured this apparent distinction between human behaviour and mind (Gay and Hembrooke, 2004). Notwithstanding, he was shrewd in discerning that these ostensibly incommensurate stances each valued the S-R mechanic in that it sufficiently depicted human behavior (Bakhurst, 1991). His distinct and comparably advanced approach addressed his grievances (Bakhurst, 1991). From *his* reading of Marx (Bakhurst, 1991; Nicolini, 2013), Vygotsky established a “Marxist psychology” (Edwards and Daniels, 2004: 107).

Psychology, Vygotsky posited, should assist in differentiating humans from animals (Kozulin, 1986). For him, the former and focal group exclusively “mediate between stimulus and response” by mobilising tools (Bakhurst, 1991: 64) e.g. a hammer (Kaptelinin and Nardi, 2012). Mediation of this relationship however, may similarly come from signs (Engeström, 1987) or language (Bakhurst, 1991) (see Figure 1).

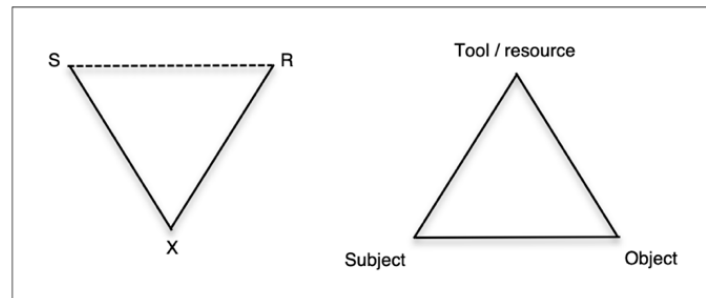


Figure 1. Mediated human behaviour (left) and Typical re-formulation (right)

(adapted from Engeström, 2001; Allen et al., 2013; Kaptelinin and Nardi, 2012; originally Vygotsky, 1978)

Vygotsky located signs (Engeström, 1987) and language as “psychological tools” (Bakhurst, 1991: 65). Kaptelinin and Nardi (2012) offer algebra to demonstrate. These “ideational and material apparatuses” share a propensity to mediate and enable “all [human] practices” (Nicolini, 2013: 106). Whereas other species tend to engage squarely with their environment, mediation is peculiar to human activity (Kaptelinin and Nardi, 2006). The notion of “cultural mediation of actions is commonly expressed as the triad of subject, object and mediating artifact” (Engeström, 2001: 134) (right, Figure 1). Observed by Allen et al. (2013: 839), it is a “basic model of activity”.

Stemming from Soviet Russia, these ideas are already pertinent to the present study. IT practitioners in academia draw on tools in their activity. They can take a physical/material form, e.g. as generic as a standard telephone or as specialist as data recovery software. They can also be psychological in character, e.g. their own relevant knowledge. Whilst both material and psychological tools bear on the activity, only the latter were held to “transform natural mental processes into ... mental processes mediated by culturally developed means” (Kaptelinin and Nardi, 2006: 42). For Vygotsky, these were the “*higher mental functions*” exclusive to humanity (Kaptelinin and Nardi, 2006: 42-43) [italics in original]. They exclusively “imply and require reflective mediation, [i.e.] consciousness of one’s (or other person’s) procedures” (Engeström, 1987: 78).

Vygotsky (1978) accounted for this differential by arguing that “during human evolution ... mediation moved from an external to an internal plane” (Nicolini, 2013: 106). “Internalization” suggests mediation is increasingly assumed by intrinsic -rather than extrinsic- means (Kaptelinin and Nardi, 2006: 43). It represented an “internal reconstruction of external activity” (Bakhurst, 1991: 78): an *appropriation*, rather than a carbon copy (Kaptelinin and Nardi, 2006). Most

importantly and above all else, it worked to shun the pre-existing subjective/objective divide (Kaptelinin and Nardi, 2012).

The notion further allowed Vygotsky (1978) to reconcile the individual with the collective (Kaptelinin and Nardi, 2012). His “universal law of psychological development” stipulated that “psychological functions” initially reside *between* people (Kaptelinin and Nardi, 2012: 19). A contemporary illustration of this could be a learner driver. With time, the student assumes increasing responsibility for each constituent driving task, such that they are eventually able to drive by themselves (Kaptelinin and Nardi, 2012). The difference between a student’s solitary performance –and the same exhibited in the presence of a mentor- is labelled the “zone of proximal development” (ZPD) (Kaptelinin and Nardi, 2012: 19).

ZPD resulted from work which sought to comprehend how children learn (Kaptelinin and Nardi, 2012). Referring to these efforts, Bakhurst (1991: 78) acknowledges how it is precisely “through participation in, and internalization of, social forms of activity, that... [a] child’s mind is [in fact] *created*” [italics in original]. But it might be taken from the learner-driver scenario, that internalization, as a “theory of concept acquisition” (Bakhurst, 1991: 81) is not confined to children. Kozulin (1986: 264) identifies Vygotsky’s more general proposition that “consciousness” *itself* results from “socially meaningful activity” or “Tdtigkeit” [italics omitted].

Originating from work undertaken in Soviet Russian psychology, these ideas again stand out as relevant to the present study. Although expounded more fully in Chapter 5, it is noted now that they have both an epistemological and methodological bearing. In the former respect, “what counts as knowledge” (Creswell, 2013: 20) is the insight and experience of IT practitioners. To follow Vygotsky’s thinking, participation in this mediated activity will have theoretically led these IT practitioners to an understanding of the function -unmatched by non-staff. Methodologically, this would seem to substantiate the acquisition of these practitioners’ qualitative interpretations (Chapter 5).

2.2.3 Second generation: Alexei Leontiev

Certainly if Vygotsky is regarded a “mentor” (Kaptelinin, 2014), then Leontiev played the role of “disciple” (Kaptelinin and Nardi, 2006: 36). For Kaptelinin and Nardi (2006: 29), the “most authoritative exposition of activity theory” is contained in *his* manuscript (Leontiev, 1978). Leontiev melded -and in some cases “elaborated” on- insights from the “cultural historical” approach “into a system of concepts and principles” (Kaptelinin and Nardi, 2006: 50).

The notion of “object-orientedness” (Kaptelinin, 2014) is perhaps most pressing among these. Leontiev (1977: 4) is firm in claiming “the very concept of activity... implies the concept of the *object* of activity”; for an activity to lack one, he stresses, is nonsensical [italics added]. “The main thing that distinguishes one activity from another lies in the difference between their objects” (Leontiev, 1977: 6). Indeed, “the object of activity endows it with a certain orientation” (Leontiev, 1977: 6).

The object however, is alleged to “appear in two forms”; in the first respect, it occupies an “independent existence” (Leontiev, 1977: 4). In this capacity it commands the subject to engage in activity. At the same time however, the object can also be regarded a “mental image”; the subject acquires this via “practical contact with the objective world” (Leontiev, 1977: 4). In essence, by engaging in activity. In Leontiev’s (1977: 6) “terminology”, an activity’s object equates to its “motive”, i.e. its peculiar motivation [italics omitted]. It can be “both material and ideal” (Leontiev, 1977: 6). In all, “different activities are distinguished by their motives” (Leontiev, 1977: 6).

As understood by Kaptelinin and Nardi (2012: 24), “activity” may on the one hand refer to any sort of “subject-object [S-O] interaction” (Kaptelinin and Nardi, 2012: 24). But taken in its stricter sense, it labels instances in which the object equates to a “motive” (Kaptelinin and Nardi, 2012: 24-25) i.e. “the object that the subject *ultimately needs* to attain (Kaptelinin, 2014) [italics added]. Hence the observation that “needs” catalyse human activity in the first place (Kaptelinin and Nardi, 2006: 60). These tricky ideas are brought to life by Leontiev’s (1981) example of an historic hunting activity.

Recounted by Kaptelinin and Nardi (2006), it chronicles the efforts of hunters with a shared motivation towards food. Co-ordinated, they divided responsibilities twofold: one group startled the game, provoking it to move to a specific area. The second positioned themselves stealthily; anticipating its company, they would then pounce. Immediately, Leontiev, (1981) can be seen to transcend Vygotsky’s outlook, which concentrated on the individual (Engeström, 2001). In fact his (Leontiev, 1978) ideas take their influence from Karl Marx, for whom “work” denoted a “collective endeavour” (Nicolini, 2013: 108). Crucially however, Leontiev (1981) is eager to dwell on how the hunters’ need(s) would have remained unmet by scaring the game alone.

Kaptelinin and Nardi (2006: 62) clarify “actions” are just “components of activity”. Activity nests individual actions (Kaptelinin and Nardi, 2012) “or [alternatively,] a chain” (Leontiev, 1977: 7) or “sequence” thereof (Kaptelinin and Nardi, 2006: 62). These work towards interim “goal[s]”, which at face value may discord with the greater object; resultantly, they can only be understood

relative to the “*collective activity*” (Kaptelinin and Nardi, 2006: 58) [italics added]. The separation of disparate action(s) and their corresponding goal(s) reflects an apparently deliberate “division of labor” (Kaptelinin and Nardi, 2006: 58).

On this, Tolman (1999: 72-73) reasons that a “degree of consciousness” must have resided between delegates of the different roles, given that scaring the game away appears counterproductive. Leontiev (1981) notes similar with regard to the second group. According to Williams et al. (2007: 3), “intersubjectivity” appears to have assisted in the coordinated effort, and with that the eventual grasp of the “*common object*” [italics added]. Whilst the distinction between activity and action is acknowledged as important (Engeström, 2001), that wasn’t Leontiev’s last word.

In all, he disclosed “*three hierarchical layers*” (Kaptelinin, 2014) [italics added]. The lowest is occupied by “operations” (Kaptelinin and Nardi, 2006: 62) [italics omitted]. Unlike actions these do not consult consciousness (Karanasios, 2014); instead they merely represent “routine processes” that alter actions in relation to the conditions against which they occur (Kaptelinin and Nardi, 2012: 27). Characteristically, actions are short-lived with “clearly identifiable beginning and end” points (Nicolini, 2013: 108). Importantly, “movement[s]” can occur between the “levels” (Nicolini, 2013: 109) of this “objective, mediated structure” (Miettinen et al., 2012: 350).

Illustrating, Nicolini (2013) recites Leontiev’s (1978) example of changing gears in a manual car. In the beginning this may involve careful deliberation, but with time –and more pertinently, practice- the action may become an operation requiring little effort. Inversely and in the event of failure, an operation might become an action (Kaptelinin, 2014) inasmuch as it newly demands alertness (Kaptelinin and Nardi, 2006). As Kaptelinin and Nardi (2012: 27) point out, “transformations can also take place between activities and actions”. If what was once a goal “become[s] a motive”, then the former action newly becomes an activity (Kaptelinin and Nardi, 2012: 27). Activity theory further posits that any human activity is seen to embrace “both internal and external components” (Kaptelinin, 2014).

Whereas the former accounts for the share occurring inside a person’s head, the latter refers to anything extrinsic (Kaptelinin and Nardi, 2006). The pair are married by “processes of mutual transformations” known as “internalization” and “externalization” (Kaptelinin, 2014). Incidentally, Kaptelinin and Nardi (2006) illustrate with a computer user: over time, s/he can stop looking down at the keyboard because s/he *internalized* each character’s whereabouts. Vitally however, a share of the activity remains external: the *physical* need to press the keys.

This notion of internalization resonates with Vygotsky's, of the same name (Section 2.2.2), which dealt more acutely with the internalization of "higher mental functions" (Kaptelinin, 2014).

Here it signifies "*any* redistribution of internal and external components of an activity that results in a shift from the external to the internal" (Kaptelinin, 2014) [italics added]. This notion is relevant to the present study, given that IT practitioners undergo specialised training designed to encourage the internalization of function and/or role-specific competence. Indeed throughout their careers, lesson(s) are put to the test. This portrays utility in another of Leontiev's ideas: "*externalization*", which refers to the polar opposite of processes (Kaptelinin, 2014) [italics added]. It might manifest as straightforwardly as inking an idea (Kaptelinin, 2014). In the context of IT provision in academia -and as suggested- this might equate to an IT practitioner putting previously internalized/learned solution(s) to task.

Whereas Vygotsky considered mediators of the mind, Leontiev took interest in those mediating "object-oriented activity" (Kaptelinin, 2014). He kept both types of tool established by Vygotsky. These are argued to "shape the way human beings interact with reality", i.e. the subject-object relation (Kaptelinin et al., 1995: 192). CHAT has a unique regard for technology; this is emphasised as valuable to the present study in Chapter 5. From the outgoing review, it is clear that Soviet scholars made important early contributions to the CHAT tradition. Considerable efforts have been made to attribute these accurately. But interestingly and whilst Leontiev understood activities could be performed by "social entities" (Kaptelinin, 2014), he stopped shy of building on Vygotsky's visual offering (Engeström, 2001) (Figure 1).

2.3 Western interest in activity theory

2.3.1 Introduction

This section transitions to assess subsequent, Western interest and advances in activity. Most immediately, Section 2.3.2 examines the theoretical additions and assumptions introduced by Yrjö Engeström: augmentations cited as amounting to a "third generation" activity theory (Engeström, 2001: 135; originally Engeström, 1987). Empirical work is leveraged in Section 2.3.3 to evidence its utility.

2.3.2 Third generation activity: Yrjö Engeström

Western interest in activity theory emerged in education, the initial area of Finnish researcher Yrjö Engeström (Wilson, 2006b). Widely credited as its champion (Allen et al., 2008), his advances are packaged as a "third generation" (Engeström, 2001: 135; originally Engeström,

1987). These are expanded and exemplified below, as prerequisite for properly understanding congruence. Its suitability for the study is touched on; this is picked up by the methods chapter (Chapter 5).

Engeström (1987) explicated the “larger social context” (Allen et al., 2011: 781) by depicting the “societal elements” of activity (Turner and Turner, 2001) (Figure 2). These include its community, division of labour and rules (Allen, 2011). In short, a community labels a collective of individuals -themselves subjects- with a common interest in the activity’s object (Daniels, 2004). Division of labour captures “the division of tasks and the status relations between actors”; rules meanwhile, modulate action (Daniels, 2004: 123).

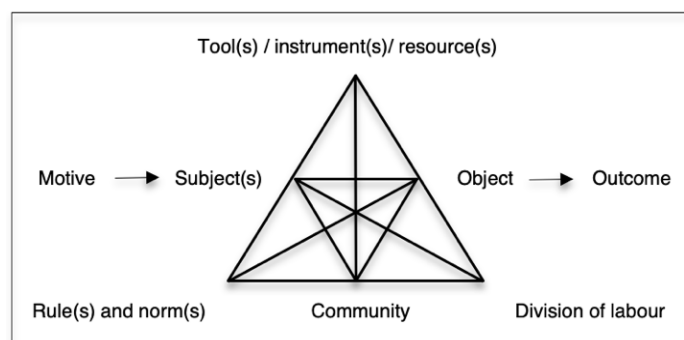


Figure 2. Activity System model

Adapted from Engeström (1987) and Allen et al. (2011)

These elements “distinguish it from individual action” (Prenkert, 2010: 654). Crucially, the enhancements bring novel “meditational means” (Kaptelinin, 2014). As with Leontiev, the subject and object continue to be mediated by tools or instruments. In a move forwards however, subject(s) are shown to engage with the greater community by adhering to rule(s). Communities, moreover, are acknowledged to attain the object by dividing the labour. The features introduced by Engeström (1987) are helpful to the present study.

Summarised in the methods chapter (Chapter 5), IT provision in the context of UK academia comprises a community. The workload is distributed among individual IT practitioners. At the same time, attention can be directed to how the action(s) of individuals -and of the community at large- are mediated by rule(s) and/norm(s). But “when studying complex real-life phenomena, applying [only] one activity system model is often not sufficient” (Kaptelinin, 2014). Indeed Engeström (2001: 136) insists that “a collective, artifact-mediated and object-oriented activity system, *seen in its network relations to other activity systems*, is taken as the prime unit of

analysis” [italics added] (Figure 3). Analytical attention is broadened, beyond the scope of Vygotsky and Leontiev.

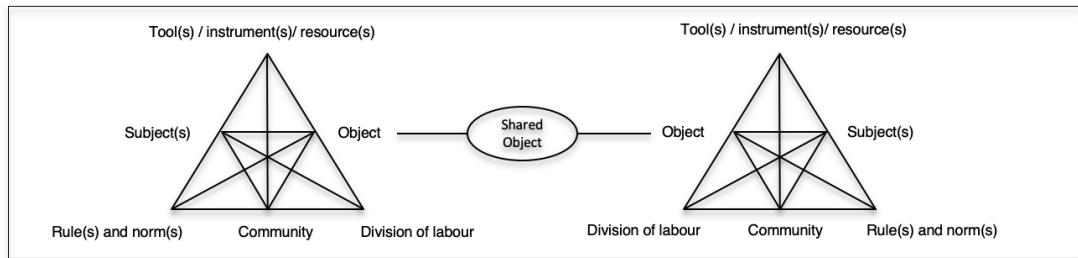


Figure 3. Two Activity Systems Interacting

Adapted from Engeström (2001: 136) and Allen et al. (2014: 427)

That different parties converge around a “potentially shared or jointly constructed object” is pertinent (Engeström, 2001: 136). Although institutions differ, the local IT function typically comprises distinct groups of IT practitioners; external parties may also be involved (Chapter 5). Further and in some instances where congruence is worked towards, evidence exposes an affirmative “multi-voicedness” (Engeström, 2001: 136). Transcending merely IT practitioner(s), third-generation activity theory is additionally able to accommodate both users e.g. students, and non-IT university staff. Where analytically useful, each of these parties can be considered as occupying their own related activity system(s). At several points, the discussion of findings (Chapters 6-9) demonstrates the worth of this particular theoretical faculty.

“A key tenet of Engeström’s framework is that activity systems are constantly developing”; this is premised on Everaldo Ilyenkov’s (2008) dialectical logic (Kaptelinin, 2014). Kaptelinin (2014) conveys this Russian philosopher’s ideas by positioning them next to “traditional logic”. For the latter, contradictions signal untoward issues in “abstract” or “concrete” systems; these must be resolved if it is to be regarded “perfectly logical” again (Kaptelinin, 2014). But reasonably and because “perfectly logical systems do not *need* to be changed”, they can remain the same “indefinitely” (Kaptelinin, 2014) [italics added]. As such, traditional logic “typically” lacks a regard for “development” (Kaptelinin, 2014).

In contrast, dialectical logic emphasises “dialectical development”, i.e. the propensity for “development driven by contradictions” (Kaptelinin, 2014). From this perspective, Kaptelinin (2014) explains that whereas so-called ““superficial” contradictions” might be quashed, “deeper” ones “cannot be simply resolved once and for all”. Remedial fixes are seen to be short-lived, not least because they can plausibly provoke further contradictions. These concerns - unmatched by traditional logic- inform how a study should proceed (Kaptelinin, 2014).

Similar sentiment can be found elsewhere. From their own literature review, van de Ven and Poole (1995: 525) locate a “Dialectical Motor” among alternative “Change Theories”. Through this lens, Robey et al. (2002: 19) later interpreted an ERP implementation as a “dialectic process involving forces promoting and opposing change”. The discourse establishes a link between opposition and/or contradictions –and change and/or development.

With activity theory, Engeström (2001: 137) begins by identifying the “primary contradiction” of Capitalism: that between “use value and exchange value of commodities”. This opposition “pervades *all elements* of activity systems” (Engeström, 2001: 137) [italics added]. On the basis that these are “open systems”, Engeström (2001: 137) reasons that an activity might import a “new element from the outside”, e.g. a “new technology”. But this could feasibly clash with pre-existing parts of the triangle, provoking what he further terms “an aggravated *secondary contradiction*” (Engeström, 2001: 137) [italics added].

Engeström (2001: 137) appears keen however, to clarify that “contradictions are *not* the same as problems or conflicts” [italics added]. Rather, they represent “historically accumulating structural tensions within and between activity systems” (Engeström, 2001: 137). He offers four kinds: “Primary”, “Secondary”, “Tertiary” and “Quaternary” (Engeström, 1987; Engeström, 2001). Foremost, primary contradictions are “inner contradictions” residing “*within*” any individual aspect of the activity (Engeström, 1987) [italics in original]. Kaptelinin (2014) offers the example of medication (i.e. an instrument or tool): on the one hand it carries biological expectations, but on the other, it has a monetary cost. The technical tool(s) used by IT practitioners can be thought of similarly.

Secondary contradictions occur “between” elements of activity (Kaptelinin, 2014). Kaptelinin (2014) illustrates with the example of a medical solution (i.e. a tool), that for whatever reason is inappropriate for the would-be receiver(s) (i.e. the subject). In IT provision in academia, technical facilities may fail to help specific users: this could equally be considered a contradiction between the activity’s tool(s) and subject(s). Tertiary contradictions exist between the object or motive of an incumbent activity system -and the object or motive of a “culturally more advanced form” of the same activity (Engeström, 1987). Kaptelinin (2014) notes how “resistance to change” may compromise the development of an activity. In the context of IT provision in academia, a hypothetical example might relate to the introduction of new computing product(s) and/or service(s).

Finally and in contrast to the former three, quaternary contradictions are seen to span the “network of activity systems” (Kaptelinin, 2014). In particular and as Kaptelinin (2014) notes, contradictions of this type condition the relation between those triangles “involved in the production of a joint outcome”. Empirical findings (Chapters 6-9) from the present study certainly support this suggestion in the context of IT provision. In keeping with the assumptions of dialectical logic, these are argued to possibly build up and “generate disturbances and conflicts” (Engeström, 2001: 137). These are discerned here as challenge(s) to practice. Yet they also “offer possibilities for expansive developmental transformations” (Engeström, 2000b: 960). Engeström (2001: 137) in fact hails them as “*sources of change and development*” [italics added].

2.3.3 Contradictions and change, evidenced

More precisely and in associated empirical work, contradictions are shown to catalyse “innovative attempts to change the activity” (Engeström, 2001: 137). Engeström’s (2001: 137) interventionist work epitomises “expansive transformation”, achieved “when the object and motive are reconceptualized to embrace a radically wider horizon of possibilities”. Satisfying this threshold marks a “collective journey through the zone of proximal development” (Engeström, 2001: 137; Engeström, 1987: 174) - a reworking of Vygotsky’s term [italics omitted].

Initially undertaken by Engeström (1999) and Engeström et al. (1999), evidence was gathered in the context of children’s healthcare in Finland (Engeström, 2000b). Traditionally, healthcare practitioners would adhere to “critical pathways” to oversee the patient journey (Engeström, 2000b: 965). Unfortunately however, there were a number of inadequacies associated with these “normative guidelines” (Engeström, 2000b: 965). Most immediately, they were only suited to solitary medical diagnoses; understandably however, patients could have more than one. As a result, additional and distinct pathways were created to correspond.

For Engeström (2000b: 965), this unenviable state of affairs represented a secondary contradiction: the critical pathways tool/instrument was inadequate when attending to “complex cases” (Engeström, 2000b: 965). The activity’s object is identified as “Patients moving between primary care and hospitals” (Engeström, 2000b: 965). Yet problematically, this was at odds with both established hospital rules and the division of labour: physicians were expected to take full responsibility for their patients, which meant they assumed the entire workload. For Engeström (2000b: 965), these amounted to additional contradictions in the activity.

The isolation of these issues owes to the approach taken (Engeström, 2000b). Chiming with the outgoing theoretical discussion, researchers initially considered the healthcare system in an historical sense. Only afterwards did they pursue individual patients' journeys through it. The team then conducted what they call "Boundary Crossing Laboratory Sessions", a unique methodology pioneered by Engeström (2000b: 965-6). In all, this comprised ten co-present meetings; these were attended by a disparate delegation of stakeholders e.g. physicians, nurses and managers. At times, the mothers of ill children also took part.

The participants were presented with video footage gathered beforehand, which showed how practitioners went about their professional affairs. As might be anticipated, the material foregrounded several shortcomings. In brief, it exposed insufficient "coordination and collaboration between the different care providers" (Engeström, 2000b: 966). Thankfully however, these manufactured meetings provided ample opportunity for the stakeholders to engage in constructive dialogue; the issues isolated could hopefully be fixed (Engeström, 2000b). Engeström (2000b) depicts the undertaking visually as a cycle (Figure 4).

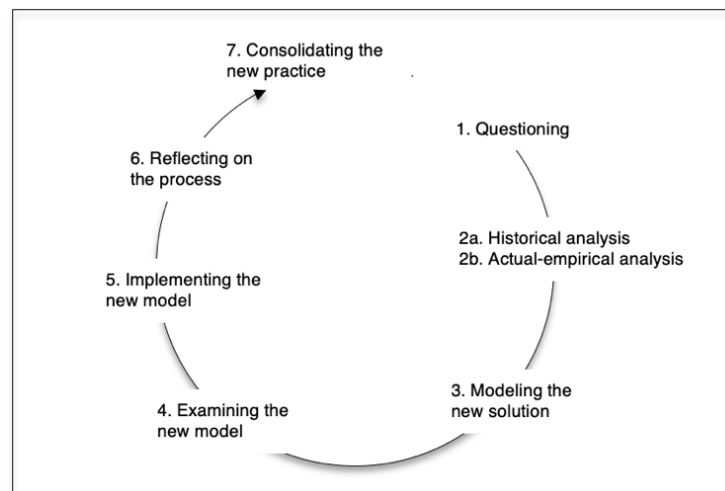


Figure 4. Expansive cycle of learning actions

Adapted from Engeström (2000b: 970)

As can be read, the process was provoked by "questioning" (Engeström, 2000b: 968) [italics omitted]. At this infant stage, stakeholders queried the character of contemporary practice: they considered whether it was optimal. This preceded more substantial "analyses" of "cases" (Engeström, 2000b: 968) [italics omitted]. Together, these stages work towards "finding and defining problems and contradictions behind them" (Engeström, 2000b: 968) [italics omitted]. Following this, "modelling" occurs (Engeström, 2000b: 968) [italics omitted]. That is, of "the new solution, the new instrumentality, the new pattern of activity" (Engeström, 2000b: 968).

In the Helsinki healthcare study, an early proposition thought to address the issues involved producing paperwork for every patient automatically. This idea was dismissed relatively quickly however, when others pre-empted the expanse of labour that would accompany it. For Engeström (2000b: 969), this shows that the stakeholders were “examining the new model” [italics omitted]. Although the suggestion of automatically produced paperwork was in itself disregarded, this did not define the end of the process overall. Rather, alternative ideas were subsequently shared and similarly appraised.

At times, competing propositions were on the table. At the time of publishing, the cyclic process (Figure 4) had not been entirely exhausted. Nonetheless and by engaging with the Boundary Crossing events, those involved had “constructed an expansive solution” that sought to alleviate the outstanding contradictions (Engeström, 2000b: 966). The so-called “care agreement model” has been implemented in practice since May 1998” (Engeström, 2000b: 969). Engeström (2000b: 967) emphasises that this “new instrumentality” in fact overhauled the activity’s incumbent object in both a “temporal” and “social-spatial” sense.

Practitioners had previously considered patients and their diagnoses as one-offs; the novel care agreement however, encouraged a longitudinal mindset. Rudimentary patient-practitioner exchanges were replaced by an approach cognisant of others in the greater healthcare sphere. For Engeström (2000b: 969), this is evidenced by apparent “implementation actions” [italics omitted]. The excerpt describes a junior physician, attending to a premature baby with a lung concern. Having consulted the patient’s file and discerned the issue(s), the physician was seen to diverge from established protocol. Rather than contacting whichever senior physician was available at the time, he instead telephoned one lung specialist in particular.

In a follow-up interview, the physician rationalised his conduct. He reasoned that the lung specialist sought, was in fact specified on the paperwork at his disposal; specifically, their identity occupied the “Care agreement” segment of the form (Engeström, 2000b: 963). The junior physician’s actions at that point, were mediated by both the telephone *and* the content of the new care agreement instrument (Engeström, 2000b). According to Engeström (2000b: 972), “the care agreement model... is a good example of steps toward an emerging type of work organization called here knotworking” [italics omitted]. It explains how predominantly separate parties converge momentarily; once the greater good is addressed, they relinquish association (Engeström, 2000b: 972). But crucially, it is “a longitudinal process” (Engeström, 2000b: 973).

On reflection, long-established CHAT discourse assumes contradictions can build up and present challenge(s) to practice. Equally apparent however, is that recognition of these can provoke practitioners into improvement exercises so revolutionary that core attributes of the activity are changed. Most notably, a “full cycle of expansive transformation” engenders reform(s) to its “object and motive” (Engeström, 2001: 137).

2.4 CHAT concept of congruence: A recent and contemporary development

2.4.1 Introduction

Following the appraisal of contradictions and their association with change, this section introduces the more recent and complimentary concept of congruence. After Allen et al. (2013), Section 2.4.2 begins by rationalising its introduction to the CHAT tradition; as initially formulated, its conceptual character is clarified. Section 2.4.3 goes on to review the modest body of related empirical works; this exercise offers further insight into the nature/character of the congruence concept (Section 2.4.4).

2.4.2 Introducing and characterising the concept

Suggested above, scholars have taken the idea of contradiction(s) and change as their starting point (e.g. Allen et al., 2013; Karanasios and Allen, 2014). For Allen et al. (2013: 840), “contradictions refer to anything within the system that opposes the overall motive of the system, the aim or purpose that subjects within the system are individually or collectively striving toward”. They “threaten the very existence of the system, since an object-oriented activity system is defined in terms of its motive, yet they are likely to be pervasive, and they lead to change or development of the system” (Allen et al., 2013: 840).

After Murphy and Rodriguez-Manzanaras (2008: 1063), they “initially define a contradiction straightforwardly “as a tension, contrast, denial, or opposition between two propositions” (Allen et al., 2013: 840). In respect of the activity system, they are “a misfit within elements, between them, between different activities, or between different developmental phases of a single activity....[and so] manifest themselves as problems, ruptures, breakdowns, and clashes” (Allen et al., 2013: 840, citing Kuutti, 1999: 34). Yet, during a supervisory meeting, David Allen contested the student researcher’s expression, which referred to and/or assumed the “untoward bearing” of contradiction(s).

In their academic article, Allen et al. (2013) juxtapose CHAT with critical realism (CR). Carefully considering the two together allows them to cast light on the respective strengths and weaknesses of each. Resultantly, they come to discern a deficit on the part of CHAT. Specifically, reference is made to Archer's (1995, 1996) "morphogenetic approach": a "methodology for the understanding of both social and cultural change" (Allen et al., 2013: 837) [italics omitted]. On the one hand, its notion of "morphogenesis" is identified as similar to the CHAT idea of "contradictions leading to change" (Allen et al., 2013: 841). On the other, its counterpart capability "morphostasis" -which instead regards "reproduction"- remains curiously unmatched by CHAT (Allen et al., 2013: 841). Characterised as "stabilizing forces within activity systems", Allen et al. (2013: 841) propose the concept of "congruencies" to fill what they feel to be a void (Allen et al., 2013: 841).

2.4.3 Congruence and continuity, evidenced

The concept of congruence is relatively new, and only a few have taken to studying it. As such, it remains undeveloped. Nevertheless and since surfacing, it has been considered in a variety of settings. Reviewed below, these include information systems (IS) in the UK ambulance service (Allen et al., 2013), "mobile technology" in the UK police (Karanasios and Allen, 2014: 529), a "digital storytelling" effort in Canada (Detlor, 2017: 1), and social media use at a Scandinavian software company (Forsgren and Byström, 2018).

A further study about "Mending" in Finnish healthcare is reviewed for its clearly convergent interests (Kajaama and Engeström, 2014: 1). Theoretical gaps(s)/deficit(s) interpreted from readings of two studies in particular (Allen et al., 2013; Karanasios and Allen, 2014) are emphasised to have been especially influential. Although associated academic works remain few, their critical consultation allows for reflection on the nature/character of congruence as understood in the CHAT tradition (Section 2.4.4).

2.4.3.1 Information systems (IS) the UK ambulance service

Introducing the concept, Allen et al. (2013) look at the mediating role(s) of technology in organisational change. In the UK ambulance service, their dual-case approach examines "two related IS implementations in the [respective] Trust" (Allen et al., 2013: 841). They assumed an "interview-based approach" -specifically, semi-structured interviews (SSIs) and observations (Allen et al., 2013: 842). The opening case centres on the handling of heart attacks. Traditionally, paramedics provided basic treatment at the scene and then departed for the hospital.

Whilst the new “mobile health system” (MHS) preserved this option, it offered another (Allen et al., 2013: 843). Responders could alternatively connect the patient to ECG (Electrocardiography) apparatus. The reads would then be sent to CCU (Coronary Care Unit); staff there would return a decision on whether the paramedic ought to administer newly available “clot-busting drugs” (Allen et al., 2013: 843). Using the system in this way enabled quicker treatment, and a greater chance of recovery. There were, however, “unintended consequences” linked to the implementation (Allen et al., 2013: 844).

Allen et al. (2013) analyse contradictions and congruencies in the activity. Issuing the drug was fatal in around 1% of cases, but hooking a patient up to the system and sending the ECG data conferred full responsibility to the CCU. Unsurprisingly, this found appeal: paramedics would apply the tool even when they knew driving straight to the hospital was favourable. This represented a “major contradiction between the subject... and the division of labour” (Allen et al., 2013: 844).

In that responders would utilise the system by default, it brought changes to the activity’s division of labour and its rules/norms. Allen et al. (2013: 844) also associate it with a primary contradiction between “mental” and “physical” tools, i.e. a paramedic’s prowess vs. the new system. The object was jeopardised: focusing on the MHS tool could detract from caregiving. Early on in the present research, the student researcher was struck by certain point(s)/detail(s)/aspect(s), writing in the transfer document:

“Again in the ambulance service, their further case explored paramedic use of a recently introduced mobile information system. Its proper utilisation necessitated that the ambulance remain stationary whilst ECG data were returned to the hospital base. But this introduced a contradiction insofar as the paramedics’ behavior discorded with the reasonable expectations of onlookers i.e. that the ambulance promptly depart. The resulting behavior of the paramedics is critical.

Apparently perceiving a need to quell the anxiety of worried relatives, paramedics themselves improvised a solution whereby the procedure was briefly outlined. In essence, they had aimed for and achieved congruency with intent. But further elaboration of how or why they made that particular choice over candidate others, remained beyond the scope of the study. As such, this represents an initial opening for the proposed research”

(Goddard, 2015: 11)

The transfer passage is presented for offering a strong indicator of the student researcher's understanding(s)/interpretation(s) before, and/or at, and/or at approximately the time(s) the

original RQs were formulated -and/or of how this/these understanding(s)/interpretation(s) influenced the formulation of original RQs 1 and 2 (Section 2.5.3). It evinces interest in the idea that “congruency” was “aimed for and achieved... with intent” (Goddard, 2015: 11). The “solution”, more specifically, is recognised as “improvised” (Goddard, 2015: 11).

The student researcher re-read part(s) of the study (Allen et al., 2013) even after the original RQs were formulated, e.g. at the much later time(s) of writing up the final version of the thesis. This improved understanding(s)/interpretation(s) of the study (Allen et al., 2013). In all and regardless of exactly when the student researcher understood/interpreted certain point(s)/detail(s)/aspect(s) of, and/or relating to the study (Allen et al., 2013), this final thesis benefits from comparably more advanced and refined understanding(s)/interpretation(s) than the earlier transfer document.

The contradiction referred to in the transfer passage (Goddard, 2015) can be clarified to have conditioned the subject (paramedics) - community (family, etc.) relation. Setting up the machine i.e. establishing a connection with the hospital and beginning treatment in the ambulance, could take as long as ten minutes. It is for this period that the ambulance had to stay still. The community could perceive this as a delay and grow alarmed. Members of the public had even telephoned “control” (Allen et al., 2013: 845). Grievances were also aired directly to paramedics.

The paramedics came to learn “one of them” should briefly explain the new procedure (Allen et al., 2013: 845). For Allen et al. (2013: 845) it exemplifies “how a contradiction can act as feedback, leading to changes to rules and norms within the activity and a more congruent activity”. It appears that the subject(s) were cognisant of a tension/contradiction and that this prompted the intentional intervention. Yet unlike “expansive transformation” (Engeström, 2001: 137), the activity’s incumbent object remained intact; the goal-driven action(s) served more modestly towards its continued achievement. Ultimately, this promoted stability and continued activity i.e. congruence.

A finer point pertains to the character of the effort. This involved the “paramedic... adapting scripts and routines” (Allen et al., 2013: 845). A project manager conveyed how well-acquainted colleagues “have got a very good routine going” -further disclosing it “is something they haven’t been taught, they’ve developed that themselves” (Allen et al., 2013: 845). Whilst perhaps occasioning change to the rule(s)/norm(s) -and representing routine for some at present- the intentional effort to instil congruence into the activity appears, nevertheless, to have been improvised initially.

Allen et al. (2013) do not formally follow up on the idea of intentional effort(s) to infuse activity with congruence. Nor is the apparent significance of improvisation explored. This represents a theoretical gap/deficit in extant understanding of and around congruence. Below, Section 2.5 expands on how the present study addresses this. Continuing in the immediate however, further findings from the same past work (Allen et al., 2013) also offer valuable theoretical insight.

In the latter of two cases, Allen et al. (2013: 842) sought to understand the uptake of an “incident control system” (ICS). They begin by identifying contradictions in the activity before the new system was introduced. Interpreted as a primary contradiction in the legacy tool, the “analogue voice radio” (AVR) was ageing and routinely failed. For Allen et al. (2013: 846) the “resolution of these contradictions” motivated the implementation decision. The ICS indeed, brought modern functionality. Examples included “instant text transmission to ambulances, a remote tracking network of each ambulance’s location, and satellite navigation for faster arrival on the scene” (Allen et al., 2013: 842).

Interestingly however, “both the decision to implement the [new] systems and the nature of the technology” are also attributed to congruencies (Allen et al., 2013: 846). Allen et al. (2013) emphasise congruence to be both internal and external. Externally, the supplier was motivated by the prospect of having an exemplary system it could show to other would-clientele; this saw them offer the ambulance service a favourable deal. Internally, hospital management felt the system would help them satisfy broader “NHS plans for ambulance services”; paramedics also anticipated benefit (Allen et al., 2013).

On the whole, it was regarded a “successful implementation”; “mean time of despatch” was shortened and responders were equipped with “more and better quality information” (Allen et al., 2013: 846). This acknowledged, the “ICS solution” is noted as “imperfect” (Allen et al., 2013: 846). Referring again to contradictions and congruencies assists Allen et al. (2013: 846) when assessing it “post-implementation”. As a primary contradiction, the system drew so much power that it was capable of depleting a vehicle’s battery. Another is explained insofar as lone paramedics faced the unenviable choice of using the system to look at information *or* drive. In addition, it sometimes displayed sensitive information onscreen that was viewable by anyone proximate -a matter raising legal/ethical issue(s).

There was also the possibility that control room staff could use its navigation feature(s) to invasively track paramedics. But the paramedics were satisfied with assurances from both this

group and management, that it would not be used to this end. In other ways however, these “primary contradictions... were compounded by secondary contradictions between the paramedics and the community” (Allen et al., 2013: 848). With the retired radio, both the control room and ambulances were noisy environments. Whilst the move to the ICS was praised for reducing the volume and offering “more ordered places to work”, it also diminished “social contact” between the groups (Allen et al., 2013: 848).

The prior possibility for “chit-chat” ceased, and the parties felt distanced (Allen et al., 2013: 848). Those in the control room regarded the “reduction in volume... as a positive ... [and felt] the ICS had probably been a net gain” (Allen et al., 2013: 848). But from the perspective of remote responders, it introduced unique problems. The outgoing AVR system had provided a “*public information space*”, allowing them to monitor -and benefit from- continual and up to date radio traffic (Allen et al., 2013: 848) [italics added]. Previously, information was exchanged transparently between paramedics and control room –even between different response crews. It kept everyone on the same page. In some instances, paramedics could even prepare their next move(s) in advance. But unfortunately, the ICS permitted none of this.

This work yields interesting ideas. Most immediately, it indicates how introducing a new technical tool/system can instil congruence. Yet, they also acknowledge negatives. The study further demonstrates utility in understanding pre and post implementation, with reference to contradictions and congruencies. Allen et al. (2013: 849), argue “the introduction of a new tool... had materially changed the community in the short-term”; “in the *longer* term, ... [it] will materially change the level and style of interaction between” those concerned.

For Allen et al. (2013: 849) “the resolution of one set of tensions and contradictions creates new ones which will, in turn, need expansive learning cycles of resolution”. As suggested and before ICS was introduced, the activity exhibited contradictions. “They acted as a source of change... and a form of feedback, which manifested in the form of the ICS” (Allen et al., 2013: 846). It changed the community, yet stopped shy of “expansive transformation”, satisfied “when the object and motive are reconceptualized” (Engeström, 2001: 137). These appear to have remained intact.

Relating to the nature of congruence, it can reside in different places e.g. interior or exterior to the activity. It can be actioned with intent, e.g. by subject(s). On the matter of why it manifests, congruence can stem from concordant interests, e.g. the technology suppliers and the ambulance service. The work also offers understanding of a relationship between contradictions

and congruence. Congruence -or at least goal-driven action(s) working towards it- can be spurred by contradiction(s). Alertness to congruence *and* contradictions -as well as their interplay- is thus evidenced as advantageous.

2.4.3.2 “Mobile technology” in the UK police

The present study found further direction in another early article on congruence. Remaining in the emergency services, Karanasios and Allen (2014: 529) examined the contradictions and congruencies associated with “Mobile technology in mobile work”. In the UK police force, they focus specifically on the “interrelated activities” of “emergence, implementation and use” (Karanasios and Allen, 2014: 532) [italics omitted]. A single case draws on interviewing and observation, triangulated by documentation.

They begin by attributing the system’s *emergence* to two sources. Most immediately, there was a growing perception at the force that the technology available was growing incapable of empowering the remote working characteristic of much police practice. Relatedly, the police envisaged that the mobile technology would go some way towards rectifying an outstanding political matter. Karanasios and Allen (2014: 535) clarify that the “dominant existing work norms” intrinsic to contemporary policing were inherited from an earlier time. Historically, a high level of station-based administration was admissible.

More recently however, higher authorities were outspoken on their preference for officers to be placed “on the beat” i.e. “visible to the public” (Karanasios and Allen, 2014: 535). This “emerging political discourse” was at odds with long-established ways: a contradiction between new and old norms (Karanasios and Allen, 2014: 535). But clearly if police officers could use mobile technology ‘in the wild’, there would be fewer returns to the station. Karanasios and Allen (2014: 535) interpret an “emerging congruency between the new norms, the non-material tools (language) and [the] technology”.

Perceiving it to be viable, the police worked with others at the *implementation* stage. But with striking similarity to the ambulance service’s ICS development (Allen et al., 2013), their private sector partners were motivated by the prospect of “establish[ing themselves] a position in the burgeoning market” (Karanasios and Allen, 2014: 535). “Congruency” came from the “shared object” (Karanasios and Allen, 2014: 535). Again resonating with the ambulance service’s ICS development, each party was eager to see an operational system reach fruition.

In addition, the suppliers were conscious that this implementation could eventually provide them a route to other prospective customers. The police knew this as well, and Karanasios and Allen (2014) illustrate how they leveraged this advantage. At one point, the supplier hoped to reduce the specification. But from the police perspective, this would have introduced “usability” issues in practice -and so was opposed (Karanasios and Allen, 2014: 536). This was a contradiction embodying the “supplier-buyer” relation (Karanasios and Allen, 2014: 536). Flowing from the favourable power dynamic, the police triumphed.

The evidence uncovers the relevance of power to the alleviation of contradiction(s). When working towards the same object, it indicates how those with a greater share may mobilise it in a way that somewhat overrides the motivation(s) of others. Such a manoeuvre can see the activity continue in a direction of their preference, and possibly, at the expense of those less powerful. Implementation witnessed further congruence. The National Police Improvement Agency (NPIA) was also involved. Like the police, they anticipated the mobile IS would reduce the frequency with which officers would “return to the station” (Karanasios and Allen, 2014: 536). As such, they were happy to provide initial capital injection.

Internal to the police, senior personnel sympathised with the system’s potential. Residing within its subject component, this congruence was instrumental in that it “legitimised” the advancing development: it attracted further investment (Karanasios and Allen, 2014: 536). According to Karanasios and Allen (2014: 537), the “level of congruency” in the two former stages “helps to explain” the same regarding its *use*. Once in operation, various contradictions and congruencies are reported.

Among the contradictions, some officers felt the new tool interfered with norms. Others had a hard time using it as prescribed. In Karanasios and Allen’s (2014: 537) assessment however, the force’s “bottom-heavy hierarchy” meant officers had “little choice”: an “institutional norm” inclusive of its use, emerged as a result. Management also sought to impose its use e.g. by confiscating officers’ traditional paper pads. This did not always work, however: some simply wrote on their hands instead, viewing it to be quicker.

Early in the present research -and in a similar way to the paramedic study (Allen et al., 2013)- the student researcher was attracted by particular point(s)/detail(s)/aspect(s) (Karanasios and Allen, 2014). The transfer document expounded:

“As per the previous study, contradictions during utilisation were numerous, but one in particular is given prominence here. A staged rollout highlighted discontent

among some officers using it: when having all but completed data entry regarding an incident, loss of network reception often necessitated its laborious re-entry. For Karanasios and Allen (2014), the remedial patch serving to improve its functionality represented congruency. But this only came eventually.

Between the time when the problem was recognized –and its eventual address– an interim period is implied. Inquiry into this however, was beyond the scope of the study. During this period, the importance of policing would reasonably have remained. As such, officers were forced to simply tolerate the perceived inadequacies of the technology whilst continuing police work: they had to “make do” (Levi- Strauss, 1972: 17).

Levi-Strauss (1972: 16) originally termed this “bricolage”. Coherently following, the next section explores both of the concepts illuminated here. Explicitly, it considers whether improvisation and bricolage may each represent deliberative means toward congruency.”

(Goddard, 2015: 12)

As previously, the cited transfer passage is firmly indicative of the student researcher's understanding(s)/interpretation(s) before, and/or at, and/or at approximately the time(s) the original RQs were formulated -and/or of how this/these understanding(s)/interpretation(s) influenced the formulation of original RQs 1 and 2 (Section 2.5.3). Officers were read to have “*had to “make do” (Levi- Strauss, 1972: 17)” when “continuing police work” (Goddard, 2015) [italics added]. This was recognised as “bricolage” (Levi-Strauss, 1972: 16).*

Again, the student researcher re-read sections(s) (Karanasios and Allen, 2014), even once the original RQs were formulated. This elevated understanding(s)/interpretation(s) of the study (Karanasios and Allen, 2014). Irrespective of precisely when the student researcher understood/interpreted specific point(s)/detail(s)/aspect(s) of, and/or relating to the study (Karanasios and Allen, 2014), this final thesis comprises more comprehensive and refined understanding(s)/interpretation(s) than the transfer submission.

To expand on the transfer passage (Goddard, 2015), early system usage was plagued by “*functional contradictions*” -deficiencies in its functionality (Karanasios and Allen, 2014: 537) [italics added]. That capturing attention came to light in a pilot: officers would spend time feeding in information, but if the mobile data connection was compromised then all would be lost. This irritated police officers and led to concerns among management that the system would be boycotted. This is again construed as a contradiction, between the new mobile IS tool and antagonised subject(s).

Karanasios and Allen (2014: 537) acknowledge the issue was “resolved technically”, arguing the earlier friction had “fed back into the technology resulting in a congruency between the two”. Practically, a technical solution would have taken time to arrange and/or integrate. Yet the activity would have remained imperative throughout. An interim period is thus discerned, in which officers working towards the object may have had to e.g. tolerate the tool’s shortcomings and/or otherwise go without (Karanasios and Allen, 2014).

At a supervision meeting, the supervisory team recognised resemblance with making do and/or the concept of bricolage. Coined by Levi- Strauss (1972), the term was popularised in IS research by Claudio Ciborra (e.g. 1994). Making do and/or bricolage came to be suspected as way(s) in which the policing activity was made to continue. Karanasios and Allen (2014) do not pursue this, and so it reflects a theoretical gap/deficit in existing understanding of and around congruence. Section 2.5 attends to its address.

Remaining with the study, Karanasios and Allen (2014) note dividends eventually stemmed from the system’s introduction. Traditionally, officers recorded information on paper; it was then necessary for them to enter the same into a computer at the station. The mobile IS meant they only had to do it once, an improvement portrayed as changes to the activity’s rules/norms and labour. Officers increasingly opted for the mobile IS, turning away from the radio technology; this brought relief to its previously populous airwaves.

In the event that officers chose to interact with control room staff the old-fashioned way, doing so was faster. Other practices like person checks could also be completed quicker. Further, the new system improved information quality. Too often in the past, dispatch staff would inadvertently convey inaccurate or incomplete information to officers. The mobile system presented frontline officers with “direct access to information”, reducing the former risk of “Chinese whispers” (Karanasios and Allen, 2014: 538).

For Karanasios and Allen (2014), this exemplifies how congruence experienced in one activity e.g. of frontline officers, can carry positively to neighbouring activities e.g. of dispatch personnel. This is pertinent to the present study, the findings of which demonstrate multiple distinct activities contributing to IT provision in academia (Chapter 6). Additionally and although the mobile IS promoted safety, some officers felt its use could detract from more immediate threat(s): a concern heightened for lone operatives.

Karanasios and Allen (2014) thus pick up on the possibility of unintended consequences. In the policing case, “unexpected contradictions” manifested as “maladaptive behaviours” (Karanasios and Allen, 2014: 538). More generally and on reflection, the two foundational works (Allen et al., 2013; Karanasios and Allen, 2014) offer a flurry of insights relating to the theoretical nature of congruence. In common with the paramedic study (Allen et al., 2013), Karanasios and Allen (2014) evidence how congruence can reside internally or externally to the focal activity.

Congruence can result from improved technical tool(s), a detail presupposing intentional goal-driven action(s). With further similarity to the paramedic study (Allen et al., 2013), congruence is identified *between* parties, e.g. relating to a “shared object”; this played out as seemingly serendipitous, somewhat aligned interests (Karanasios and Allen, 2014: 535). Markedly more than the paramedic study however, the police study conveys how power can significantly shape the trajectory of continued activity.

2.4.3.3 “Digital storytelling” in Canada

Touched on above, academic interest in congruence transcends the context of UK emergency services. In something of a transition, Detlor (2017: 1) carried out a case study which examined a “digital storytelling initiative” in the Canadian city of Hamilton. Run by “two libraries and one municipal cultural department”, “Love Your City, Share Your Stories” (LYCSYS) works by collecting and sharing information about the city’s culture and history -all by digital methods (Detlor, 2017) [italics omitted].

Detlor (2017: 1) specifically sought to “better understand the factors that affect[ed] the implementation”, contending the case “articulates an internal stakeholder’s point of view”. Research questions ask: “What can the LYCSYS example teach us about how these kinds of initiatives are conceived and carried out?” and “What factors foster or impede their implementation and roll-out?” (Detlor, 2017: 11) [italics omitted]. Semi-structured interviews (SSIs) were undertaken with “key informants from the three participating organizations” (Detlor, 2017: 14).

The “research questions informed the design of the interview instrument” (Detlor, 2017: 20). The study also employs activity theory, e.g. its “constructs were used to shape the interview questions” i.e. those in the guide (Detlor, 2017: 20). Towards triangulation, documentation and observational data were also collected and analysed. Observations were “made by the lead researcher”, Brian Detlor (Detlor, 2017: 23). Owing to his involvement with the project’s steering

committee, he was able to benefit from attending and observing “various gatherings and events” (Detlor, 2017: 23-24).

Detlor (2017) found the implementation could be well understood with reference to contradictions and congruencies. Generally, he argues “tensions can reshape a digital storytelling initiative and impact the actions and outcomes of the digital storytelling activity” (Detlor, 2017: 76). Reading Allen et al. (2013) and Karanasios and Allen (2014), he interprets “congruencies” as “opposite to contradictions and tensions” (Detlor, 2017: 12) [italics omitted]. They are “forces within an activity that promote stability and reproduction of the activity in its current form [sic]” (Detlor, 2017: 12). With respect to this initiative, they “helped counterbalance contradictions and tensions” (Detlor, 2017).

Briefly, Detlor (2017: 41) isolates five such “contradictions and tensions”. These related to “choice of cultural icons and stories”, i.e. which to include; “adherence to archival standards”; the “look and feel of developed outcomes”, e.g. the system’s graphical user interface (GUI); and “technical” and “project management” issues (Detlor, 2017: 41). Of most interest however, are the congruencies. The study recognises “six congruence forces”; these “facilitated the LYCSYS initiative moving forward and reaching its original goals” (Detlor, 2017: 68). These are identified as “co-operative partnerships”, e.g. between those responsible for the project; “sufficient funding”, “senior management commitment / leadership”, “good project governance”, “strong community support” e.g. from beneficiaries, and “flexibility”, i.e. openness to changes in the project/how stories were collected.

These are largely self-explanatory. Each is indicative of the form or character “congruent forces” can assume in this context (Detlor, 2017: 68). Most notably, each implies or presupposes intentionality. This acknowledged and although Detlor (2017) does elaborate on all, his assessment is largely kept at this overarching level. There is noticeably less attention on the specific kind(s) or nature of action(s), i.e. means, by which subject(s) or communities work intentionally towards congruence.

Nevertheless and in keeping with the present study’s interpretation of the congruence concept, Detlor (2017: 76) argues “congruencies can help a digital storytelling initiative *stay on track and move the activity forward*” [italics added]. Finally and with echoes of Karanasios and Allen (2014), he reflects on how “contradictions/tensions and congruencies must reach a balance” (Detlor, 2017: 79). This lends to the suggestion that the two should be considered together.

2.4.3.4 Social media use at a Scandinavian software company

Congruence is also of interest to Forsgren and Byström (2018), whose study examined social media in the workplace. In particular, they sought to grasp how knowledge workers made use of it to “maintain coherence within and across work activities” (Forsgren and Byström, 2018: 443). Forsgren and Byström (2018: 444) conducted a case study at a “Scandinavian software company” recognised as “making comprehensive use of multiple social media”.

Although semi-structured interviewing served as the main source of data collection, the study benefits from a rich variety of qualitative methods. Clearly complimentary, these encompass offline and online observations, the “shadowing of a customer project”, and the collation of corporate documents (Forsgren and Byström, 2018: 449). CHAT apparatus -namely the activity system triangle- assists them in understanding the data. Like empirical works reviewed above (Allen et al., 2013; Karanasios and Allen, 2014; Detlor et al, 2017), Forsgren and Byström (2018) focus on contradictions and congruencies. They reason that considering the two “may help to understand how social media is adopted and integrated into the workplace, as well as highlighting potential future innovations and improvements” (Forsgren and Byström, 2018: 448).

The study returns a number of pertinent findings. Forsgren and Byström (2018: 450) concentrate on three activities within the organisation: “Development” i.e. of software, “Sales[,] and Production Management”. Although each works ultimately towards the “completion of projects”, they have distinct motives; this is charged with “complicating the task of settling upon a shared object” (Forsgren and Byström, 2018: 450). Forsgren and Byström (2018: 450) firstly report the “congruencies [contained] within single activity systems”.

In the software development activity, a “notable congruency” associated with the application of social media played out as heightened “transparency in the [same] community” (Forsgren and Byström, 2018: 452). Its use reduced the likelihood of past mishaps, one of which witnessed “two offices” unknowingly working on identical products (Forsgren and Byström, 2018: 452). Another form congruence took was the “preservation and sharing of business critical information”, which the use of a Wiki allowed (Forsgren and Byström, 2018: 452).

Forsgren and Byström (2018: 452-3) further differentiate the development activity’s “focal” object concerned with the “software solutions”, from its “peripheral” object: the “knowledge base”. The “information sharing” made possible by the social media “supported both” (Forsgren and Byström, 2018: 452-3). That is, subjects could draw on its containing content -and share

more when working on novel products. The other activities -sales and production management- made narrower use of social media. This acknowledged, Forsgren and Byström (2018: 453) “identified a single and related congruency” held in common: “horizon scanning”. Whereas the sales activity was motivated to “finding new clients” with services such as LinkedIn, production management employed “internal social media (Yammer)” to better understand the present (Forsgren and Byström, 2018: 453).

Within the software development activity, Forsgren and Byström (2018) also isolate contradictions. A standout example regards “acceptable response rate” -i.e. to queries and such- which is understood to vary by platform (Forsgren and Byström, 2018: 453). Contradictions are only found in the development activity; their absence elsewhere is attributed to comparably “passive use of social media” (Forsgren and Byström, 2018: 455). Forsgren and Byström (2018) further delineate the contradictions and congruencies residing between activities. Generally, they argue social media provided a supportive interface; as a concrete example of congruence, one social media tool, “Yammer”, is credited with offering “an efficient way to share information, locate expertise, and track past experiences, providing awareness of the wider organization” (Forsgren and Byström, 2018: 455). It also enabled informal communication.

Notwithstanding, Forsgren and Byström (2018: 456) observe “contradictions and tensions connected with Yammer”. One example is of a salesperson experiencing issue(s) in obtaining suitable information on the development of new software. For Forsgren and Byström (2018: 456) and “with more potential places to search for information, it might be suggested that several social media options on hand could lead to less coherence”.

On reflection, Forsgren and Byström’s (2018) work is valuable to the present research in a number of ways. Most immediately, its empirical evidence exemplifies how both contradictions and congruence can surround IT professionals operating in a cognate, IT-related context. The study further sheds light on how or where congruence may be attributed: foremost, to the information sharing functionality intrinsic to social media. At the same time however, it is clear from the findings that such tools -as technical and capable as they might be- do not necessarily instil congruence by themselves. Rather, Forsgren and Byström (2018) emphasise how it was their use -or, active application- by the sample of knowledge workers. These insights from the software company add to the traces of intentional congruence touched on already.

2.4.3.5 “Mending” in Finnish healthcare

Before reflecting on what can be read of the congruence concept and its character more generally, it is recognised that other scholars in the CHAT tradition hold convergent interests. Kajaama and Engeström (2014: 1) namely, engage with ideas of “stability and change”. Most notably, they focus on intentionality, i.e. what practitioner(s) -and even patient(s)- do. Although they do not cite congruence explicitly, it remains responsible to review the work. In their own words, Kajaama and Engeström (2014: 1) seek to “deepen our understanding of disruptions of organizational routines and their mending efforts as sources of stability and change in complex organizational settings”.

They take an ethnographic approach in studying a number of hospital sites in Finland. The design is informed by e.g. observing the treatment of patients undergoing various surgical procedures; those responsible were also interviewed. Rather than “major breakdowns”, attention is on “smaller scale, acute disruptions which flow “online” in the everyday work practices” (Kajaama and Engeström, 2014: 6). According to Kajaama and Engeström (2014: 6), these “do not break down a flow of activity but inherently exist in the flow”. More exactly, they refer to “unintentional deviations from the prescribed or customary script in the observable, ongoing flow of actions and events” (Kajaama and Engeström, 2014: 6).

“Understanding and overcoming” such “disruptions” can apparently be achieved with reference to “mending efforts and mending solutions” (Kajaama and Engeström, 2014: 7). As set forth, efforts refer to “the client’s or the caregiver’s efforts to deal with and overcome disruptions” (Kajaama and Engeström, 2014: 7). Kajaama and Engeström (2014: 7) further isolate “two aspects of mending efforts”: “adaptation” i.e. “adjustment”, and “innovation”, which may involve the “creation of new activities”.

Mending efforts may manifest solitarily or be “chain like”, i.e. “temporally and spatially extended”, and/or “collaborative and negotiated collective efforts” (Kajaama and Engeström (2014: 7). These give hope to mending solutions, signifying “successful results from the viewpoint of the object” (Kajaama and Engeström, 2014: 7-8). Both mending efforts and any resulting solutions are equated to “speech actions and other actions” (Kajaama and Engeström, 2014: 8).

Kajaama and Engeström (2014: 12) discern disruption relating e.g. to a “patient’s severe or worsening health”, or the meditating tools. These are suggested to spur mending efforts, of

which 3 kinds are found. The most basic, “technical mending”, tends to be pursued by lone healthcare practitioners and are confined to one activity (Kajaama and Engeström (2014: 13) [italics omitted]. They go on to associate this with so-called “linear agency”, wherein “agency, control and commands from the superiors direct the coordination of the activity” (Kajaama and Engeström, 2014: 24) [italics omitted].

The second kind –“cognitive-emotional mending”- is argued to comprise “psychological aspects” like “cognition, meaning, mental processes and emotions” (Kajaama and Engeström, 2014: 13) [italics omitted]. Although “based on an individual need”, it “requires interaction and reflection” with someone else (Kajaama and Engeström, 2014: 13). As such, mending efforts of this sort occur “between two activity systems” and work towards finding “common ground between their immediate objects” (Kajaama and Engeström, 2014: 24).

Beyond the type of agency associated with technical mending, that flavouring a “cognitive-emotional mending effort corresponds to... dialogical agency”, referring to “cooperation between the parties” e.g. practitioner and patient (Kajaama and Engeström, 2014: 24-25). Finally, the most advanced form of mending effort is labelled “extended collaborative” (Kajaama and Engeström, 2014: 13) [italics omitted]. This melds the former two, and is strictly a “collective act” (Kajaama and Engeström, 2014: 13).

Argued by Kajaama and Engeström (2014: 13), this most comprehensive class “typically temporally and spatially extends the care process of a single patient over multiple intertwined mending efforts and care processes”. Rarer than the other two, they present “iteratively between multiple activity systems and unfold in several steps over longer periods of time” (Kajaama and Engeström, 2014: 24). They can also “require re-negotiation of the participants’ immediate objects... towards a shared expanded object” (Kajaama and Engeström, 2014: 24).

This nuance is noted as necessitating input from multiple parties. Together, they essentially “reinvent” the object of the collective activity (Kajaama and Engeström, 2014: 24). Contemplating, Kajaama and Engeström (2014: 24) reason that these mending efforts should not be considered as a “onetime event[,] but [rather] as a dialectical process across a care process”. For Kajaama and Engeström (2014: 25), this presupposes “distributed transformative agency”: a kind including various caregivers and the patient/client [italics omitted]. This form of agency allegedly “requires expansive organizational learning in which the object of activity is reconstructed”.

Kajaama and Engeström (2014: 25) further illuminate “multidimensional mending”, which signals “flexibly involving and shifting between different mending strategies”. Whilst Kajaama and Engeström (2014) do not explicitly cite the concept of congruence, a number of features and findings from the study remain relevant. Most immediate, is its isolation of three kinds of deliberate “mending efforts [serving] as sources of stability and change in complex organizational settings” (Kajaama and Engeström, 2014: 1).

Although lending only limited insight, the study offers an intriguing sense of the shape -or, rather, the nature/character- of these intentional efforts. Further and although disruptions may well prompt mending efforts, this was not always the case. Moreover and even when executed, mending efforts did not guarantee a successful mending solution. In Kajaama and Engeström’s (2014) conception then, it is important to note that neither disturbances nor mending efforts are in these respects deterministic. Having appraised literature associated with congruence, it is now timely to reflect on the nature/character of the concept.

2.4.4 Reflecting on the nature/character of congruence

Although academic literature on and linked to congruence is meagre, it is encouraging to acknowledge growing interest and that studies have been undertaken in a diversity of domains. These endow a literature-informed impression of its nature/character. Findings illuminate how congruence can assume characteristically different forms, that it can be confined to a single activity or span multiple, and that it may exist or appear serendipitously, e.g. where parties’ interests happen to accord (e.g. Allen et al., 2013).

Attracting heightened attention, however, are inklings that congruence can be worked towards intentionally. The literature, moreover, shows how congruence has been studied. All of those explicitly citing the concept -as well as Kajaama and Engeström’s (2014) related research- take a qualitative approach. Works further evince benefit in applying activity theory vocabulary to sense and analyse stability; congruence is well understood with reference to element(s) of the activity system (Figure 2).

Reflecting, it is equally clear that an alertness to the pre-existing concept of contradictions -and to their interaction with congruence- is important (e.g. Karanasios and Allen, 2014; Detlor, 2017). Comprehension of the empirical evidence is certainly elevated by reference to both. Lastly, the critical consultation of pertinent past works further allows for the interpretation of apparent theoretical shortcoming(s)/deficit(s), and those most influential are explicated below.

2.5 Congruence: Discerning and addressing theoretical gap(s)/deficit(s)

2.5.1 Introduction

Flowing from the review of congruence and associated literature, this section serves several purposes. Section 2.5.2 begins by sensing shortcomings in theoretical understanding; close readings of two studies (Allen et al., 2013; Karanasios and Allen, 2014) are emphasised as especially influential. Section 2.5.3 then explicates the research questions (RQs 1 and 2) as originally formulated and as latterly finalised.

2.5.2 Shortcomings in conceptual understanding

Although the academic interest is encouraging, there are still only a handful of relevant studies. As a result and within the broader CHAT tradition, the concept of congruence remains undeveloped. Illuminating the “current state of the knowledge”, the literature review accentuates a “knowledge gap” in conceptual understanding (Wong, 2014). With respect to the present study, close reading(s)/understanding(s)/interpretation(s) of two past works in particular (Allen et al., 2013; Karanasios and Allen, 2014), influenced direction.

As a reminder, Allen et al. (2013) studied paramedic use of a recently introduced mobile information system (MIS) (Section 2.4.3.1). It meant that for a period, the ambulance had to stay put. This was at odds with witnesses’ expectations of a prompt departure. Briefly outlining the new procedure, paramedics were interpreted in the transfer document to have “aimed for and achieved congruency with intent” -specifically, by improvising (Goddard, 2015: 11). Neither of these points were pursued by Allen et al. (2013), and so were recognised as shortcomings in conceptual understanding.

To similarly reiterate, Karanasios and Allen’s (2014: 532) assessed the contradictions and congruencies associated with the “emergence, implementation and use” of new mobile IS (MIS) in the UK police [*italics omitted*] (Section 2.4.3.2). In the transfer document (Goddard, 2015), it was interpreted that loss of network reception could command officers to re-input data to the system. According to Karanasios and Allen (2014), a remedial patch serving to improve the system’s functionality represented congruency.

The transfer document contended an “interim period is implied” i.e. between recognising and actually addressing the problem (Goddard, 2015: 12). In the transfer document, officers were read to have “*had to* “make do” (Levi- Strauss, 1972: 17)” when “continuing police work” (Goddard, 2015) [*italics added*]. This was recognised as “bricolage” (Levi-Strauss, 1972: 16). Yet

Karanasios and Allen (2014) did not follow up on this, and so it also reflects a theoretical gap/deficit in extant understanding of and around congruence.

2.5.3 Formulating research questions (RQs) 1 and 2

The interpreted shortcomings (Section 2.5.2) perceptibly influenced the first two research questions, as originally formulated in the transfer document:

- “1. How is congruency reached in practice?
2. What role do improvisation and bricolage play towards this?”

(Goddard, 2015: 4)

They were subsequently refined, to their final form:

RQ 1. How is congruence reached in practice?

RQ 2. What role(s) do(es) bricolage and improvisation play towards this?

Although clearly the student researcher understood the first two research questions when formulating and refining them, conceptual clarity improved even afterwards. Research question 1 (RQ 1) asks generally about the intentional ways in which activity -inclusive of incumbent object- is influenced to continue. That is, means towards congruence in practice. In CHAT vocabulary, means can be understood as goal-driven action(s) (Section 2.2.3). Research question 2 (RQ 2) more specifically queries the candidate capacities of bricolage and/or improvisation towards the same.

2.6 Other influence

This section briefly recognises other influence.

The student researcher's thinking, the present study's purpose, RQs, and study generally, were also influenced by other ideas. In particular and when earlier studying at The University of Manchester (UoM), the student researcher was introduced to the work and ideas of Professor Mike Newman, communicated in and outside of lectures -and with overlap- by an article (Lyytinen and Newman, 2008). They do not utilise CHAT and are instead interested in “explaining information systems change” with their “Punctuated Socio-technical IS Change (PSIC) model” (Lyytinen and Newman, 2008: 589-590) [*italics omitted*].

Lyytinen and Newman (2008: 592) perceive “IS change as multi-level change”, recognising the “work system, the building system, and the environment”. They engage in “vertical analysis”, identifying “interdependencies between” the levels; they also employ “horizontal analysis”, assessing “horizontal and temporal interactions” at the work and building system, e.g. “path dependencies” (Lyytinen and Newman, 2008: 592). Following Gersick (1991), they regard “IS change” to be “primarily... episodic”, “punctuated” (Lyytinen and Newman, 2008: 593). They also consider “IS change” to be “socio-technical change” (Lyytinen and Newman, 2008: 594).

Lyytinen and Newman (2008: 594) incorporate “Leavitt’s S-T [socio-technical] model (1964), which regards “organizational systems as multivariate systems of four interacting and aligned components – task, structure, actor, and technology” [italics omitted]. It is a diamond. “Where the four elements are mutually aligned”, the “system state” is “stable”; “system stability” entails “stable relationships within and between the system components and its environment” (Lyytinen and Newman, 2008: 595) [italics omitted]. As understood, this is the same as -or associated with- “system equilibrium” (Lyytinen and Newman, 2008: 595). “System instability” means “the four... are not aligned” (Lyytinen and Newman, 2008: 595) [italics omitted].

Lyytinen and Newman (2008: 595) “distinguish dynamically system trajectories where systems move over time between stable and unstable states generating various patterns of change” (Lyytinen and Newman, 2008: 595) [italics omitted]. Where “any one component becomes incompatible with others due to increased variation... we can observe a structural misalignment... [i.e.] a gap – a property of a system that affects the systems’ behavior and its repertoire of responses” (Lyytinen and Newman, 2008: 595) [italics omitted]. Citing Flanagan (1954), they label “any event that generates a gap a critical incident”; these “form the necessary conditions for a system state to change” [italics omitted].

Lyytinen and Newman (2008: 595) explain “IS change increases variation in multiple, nested socio-technical systems”, that “socio-technical components can misalign at each system level and how IS change result in multiple, concurrent adaptations to increased variance at multiple system levels” [italics omitted]. They consider “IS change... as a set of heterogeneous and somewhat randomized interventions that seek to de-stabilize, establish, or maintain equilibrium at the building and the work system as to generate design options for the organization that will allow it to adapt to its environment” (Lyytinen and Newman, 2008: 595). Their use of language influenced its use in the present study e.g. the word “heterogeneous” is used to refer to different means, the idea that multiple heterogeneous and interacting means comprise larger congruence efforts, and that improvisation and bricolage are two.

Lyytinen and Newman (2008: 595) go on to explain that “a gap can invite two types of responses from the system”: either “other components adapt incrementally as dictated by the system’s deep structure” or it “will re-write... deep structure”. According to Lyytinen and Newman (2008: 598), “specific types of events” termed “interventions” identify “attempts to remove... gaps” [italics omitted]. They “are measures oriented towards one of more socio-technical elements, or a system that can be controlled or manipulated (e.g. work system) as a whole as to mitigate or remove an observed gap” (Lyytinen and Newman, 2008: 598). As understood from Lyytinen and Newman (2008: 595) attempts to remove or mitigate gap(s) are in the interest of alignment and “system stability” -the same as, or associated with- “system equilibrium”; they may, in some sense, attempt to address a critical incident that created it/them.

Lyytinen and Newman’s (2008) ideas were influential. Most generally, to the idea that people (subject(s)/community) may work intentionally, engaging in means which at least attempt to - and may successfully- instil stability into activity/activities i.e. congruence. Also, to the idea that means towards congruence may be prompted/influenced by contradiction(s) and possibly involve attempt(s) to eradicate or ease or eradicate it/them. Their ideas may also have influenced the idea that means towards congruence may be prompted/influenced by critical incident(s), possibly involving attempt(s) to or ease or eradicate it/them.

“The PSIC model portrays IS change as a set of consecutive S-T states[,] some ...in equilibrium and others... not at any point of time, connected by events” (Lyytinen and Newman, 2008: 599). Lyytinen and Newman (2008: 509-613) recognise “antecedents” -apparently synonymous with “antecedent conditions”. “Antecedents are... a set of temporal and other dependency relationships between the socio-technical elements that preceded the event and could be viewed instrumental (i.e. necessary) in producing it” (Lyytinen and Newman, 2008: 599).

One of their figures begins at the left with “antecedent conditions” and shows “a sequence of events related to information system development and change” (Lyytinen and Newman, 2008: 599). From left to right, horizontally and chronologically, it visualises multiple events in individual boxes. “Each box... represents a socio-technical event showing a path-dependent change in a system at one level” (Lyytinen and Newman, 2008: 599). This influenced the student researcher’s idea that multiple heterogeneous means may proceed similarly, comprising larger congruence efforts. Lyytinen and Newman’s (2008: 599) figure ends on the right with “Outcomes”. They also present a more detailed figure, showing “the system change consists of sequences of events... and their interactions” and “at each system level” (Lyytinen and Newman, 2008: 599).

In Lyytinen and Newman's (2008: 598) work, "events can succeed (i.e. remove the gap)". With a "successful intervention", "the event transitions the system into a new equilibrium without affecting the deep structure" (Lyytinen and Newman, 2008: 600). That is, as understood, successfully instilling stability into the system and addressing any associated critical incident. This influenced the student researcher's idea that means towards congruence may successfully infuse stability i.e. congruence into activity/activities, and that this may involve successfully easing or eradicating contradiction(s). It may also have influenced the idea that means towards congruence may successfully ease or eradicate critical incident(s).

For Lyytinen and Newman (2008: 600), a "failed intervention" is where "the event 'fails' and the system retains its current misalignment" i.e. the gap. As understood, it is unsuccessful in instilling stability into the system and addressing any associated critical incident. This influenced the student researcher's idea that means towards congruence may be unsuccessful in infusing stability i.e. congruence into activity/activities, and/or in easing or eradicating contradiction(s). It may also have influenced the idea that means towards congruence may fail to ease or eradicate critical incident(s).

Lyytinen and Newman (2008: 600) also acknowledge the possibility that an "event adds new misalignments [i.e. gaps] into the system state". "Events can... weaken the system's stability" (Lyytinen and Newman, 2008: 598). Following Lyytinen and Newman's (2008) thinking, this would be a critical incident. Additionally and "owing to circularity, interventions can result in unintended second- and third-order effects that produce path-dependant impacts on the system" (Lyytinen and Newman, 2008: 598). These ideas influenced the student researcher's idea that means towards congruence may actually introduce new contradiction(s) -possibly different in kind- into activity/activities, destabilise activity/activities, have unintended effect(s) and/or introduce or prompt critical incident(s).

According to Lyytinen and Newman (2008: 600), "any change can start to traverse across levels". They show "how systems interact hierarchically" using a "vertical arrow"; it points "downwards when a higher level system influences (or seeks to influence) a 'lower' system by intervening in it" and "upwards" to indicate the opposite (Lyytinen and Newman, 2008: 600). "Vertical impacts" are illustrated between the "building" and "work system" (Lyytinen and Newman, 2008: 601). They also accept "some events can result in multiple changes and need to be modelled as one joint change, or defined separately depending on the desired granularity" (Lyytinen and

Newman, 2008: 599-600). Researchers separate “events into parallel work system and building system events” (Lyytinen and Newman, 2008: 601).

These ideas were influential. For example, to the idea that means towards congruence may attempt to and/or have the effect(s) as articulated, in the same and/or other activity system(s) - and at the same time or later. Lyytinen and Newman (2008) demonstrate the PSIC model, offering an elevated explanation of an “IS change process and its outcomes” studied earlier (Newman and Robey, 1992). A further figure starts with antecedent conditions on the left, and from left to right, horizontally and chronologically, visualises multiple “events” in “S-T form” -i.e. the diamond shape- at/in the “Building System”; below, the same for the “Work System” (Lyytinen and Newman, 2008: 602). It shows successive events, with the diamond, some apparently occurring simultaneously at different levels in different systems.

The figure foregrounds "dynamic interactions within and between the work and building system levels" (Lyytinen and Newman, 2008: 604), with the latter denoted by vertical arrows. It also identifies "environmental" and "organizational context" (Lyytinen and Newman, 2008: 602). These are featured in a single figure representing the larger IS change. Lyytinen and Newman's (2008) ideas -and, overlapping- those conveyed by Professor Mike Newman in and outside of lectures at UoM were influential to the present study, even including e.g. to analysis. As appropriate, this is noted in subsequent chapters.

2.7 Integrating bricolage and improvisation

At present and in developing the literature review, it is reiterated that bricolage and improvisation are felt to be significant; RQ 2 specifically queries their candidate capacities as means towards congruence (Section 2.5.3). Naturally it was necessary to integrate the concepts of bricolage and improvisation into the study, and this process owed to student-supervisory discussion. With respect to the police study (Karanasios and Allen, 2014), attention was directed to the reading that officer(s) may have had to tolerate or “put up with” the ill-performing tool(s) in their activity.

In turn, the supervisory team recognised a resemblance with making do and/or the concept of bricolage. Within the field of IS (Information Systems), Claudio Ciborra was identified and recommended as a significant scholar. Following this, the student researcher acquired books containing a number of his essays (e.g. Ciborra, 1994; 1996; 1999). Although in his own right Ciborra has done much to popularise the notion of “bricolage” in the IS discipline, it became

clear that the label was a borrowed one. Works cited Levi-Strauss -a French anthropologist- as having coined the term. Cognisant of this, the student researcher sought a copy of his seminal contribution: *The Savage Mind* (1962); doing so endowed an impression of the concept as formulated originally. Relevant literature was also sought from academic journals; this comprised both conceptual and empirical contributions from an assortment of subject areas.

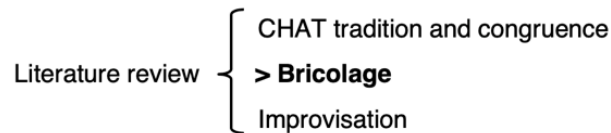
Signalled above, interest in improvisation was also stimulated by scrutiny of past work (Allen et al., 2013). The student researcher searched for relevant material, discovering a wealth of literature reflecting interest from a number of academic disciplines. As literature relating to bricolage and improvisation was assimilated, it became clear that the concepts are cognate, and are often considered together. The product is presented in Chapters 3 and 4, which attend to each, respectively.

2.8 Summary and Conclusion

As indicated, the present study advances theoretical understanding of congruence: an undeveloped activity theory concept. In this -the first of three literature review chapters- Section 2.2 traced the CHAT tradition back to Soviet Russia. Writings by Lev Vygotsky and Alexei Leontiev were acknowledged as antecedent to contemporary, Western contributions. Section 2.3 attributed the most noteworthy to Yrjö Engeström. The “role of contradictions as sources of change and development” (Engeström, 2001: 137) was underscored.

In so doing, it became possible to grasp the more recent and complimentary assertion that “congruencies... foster reproduction rather than change” (Allen et al., 2013: 841) [italics omitted] (Section 2.4). Associated works were appraised, and the nature/character of congruence reflected on. Section 2.5 discerned theoretical gap(s)/deficit(s), feeding into the first two RQs (1 and 2). Section 2.6 briefly recognised other influence. Focus turned to integrating bricolage and improvisation (Section 2.7). Chapters 3 and 4 review the existing academic literature on each concept, respectively.

3 Literature Review: Bricolage



3.1 Introduction

Established previously, the study pursues the perceived prospect that congruence (Allen et al., 2013) may be worked towards intentionally; it seeks to comprehend the contributory, stabilising, goal-driven action(s) of subject(s) or communities. Although RQ 1 accommodates any kind of intentional behaviour, RQ 2 focuses more discriminately on the role(s) of improvisation and bricolage. In accordance with the graphic (above), the second of three literature review chapters examines past interest in bricolage.

Most immediately, Section 3.2 characterises and clarifies the concept. Following this, works from a broad variety of areas are reviewed. These include studies of entrepreneurship (Section 3.3); academic research (Section 3.4); emergencies (Section 3.5); and Information Technology (IT) & Information Systems (IS) (Section 3.6). Each is summarised, and understanding steadily accumulates. It is then possible to reflect on the bricolage literature more generally (Section 3.7), before summarising and concluding (Section 3.8).

3.2 Characterising and clarifying the concept

Originating in France (Moorman and Miner, 1998b), the popularised notion of “bricolage” is widely recognised as stemming from the work of Lévi-Strauss (1972: 16). He posited that whereas engineers obtain resources as necessitated by their present undertaking, “bricoleur[s]”, in contrast, carry a surplus of eclectic bits and pieces they only *hope* will suffice (Lévi-Strauss, 1972: 17). A bricoleur’s historic encounters represent opportunities for him or her to hoard anything they speculate will demonstrate utility in the future. These cumulatively collected “means” comprise the “repertoire” from which bricoleurs leverage resource(s) to meet the demands of the present enterprise (Lévi-Strauss, 1972: 17).

Baker et al. (2003: 270) discern how Lévi-Strauss (1966: 17) “variously declares “tools”, skill “repertoires” and even pieces of myths as resources available to bricoleurs”. Some resources may be more versatile than others, serving numerous purposes. The repertoire also imposes constraints on the bricoleur, however. For one, and because the functionality of each individual instrument was established *a priori*, those mobilised are unlikely to have been designed for the

“current project” (Lévi-Strauss, 1972: 17). The array available is “always finite” (Lévi-Strauss, 1972: 17).

This, in turn, means a “limited set of combinations” (Duymedjian and Rüling, 2010: 140). Baker and Nelson (2005: 333) recognise “recombination of resources for new purposes” as a further facet of Lévi-Strauss’ (1967) conception. Characteristically, bricoleurs “make do with ‘whatever is at hand’” (Lévi-Strauss, 1972: 17). Whilst Baker and Nelson (2005: 333) recognise Lévi-Strauss (1967) did not himself define bricolage, they offer: “making do by applying combinations of the resources at hand to new problems and opportunities”.

Prior academic interest in bricolage is now elaborated. Researchers from a diversity of disciplines have conveyed enthusiasm towards the concept of bricolage (Duymedjian and Rüling, 2010). According to Duymedjian and Rüling (2010: 136), associated contributions vary with respect to “conceptual clarity”, “variety”, “stance” and “levels of analysis”. Whereas some set off to study bricolage, others just find it; it can also be interpreted in other works. The review that follows comprises all of these.

3.3 Entrepreneurship

3.3.1 Introduction

Bricolage has attracted substantial interest from scholars, especially “within entrepreneurship and innovation literature” (Mateus and Sarkar, 2024: 833). This section looks at entrepreneurship. In order, Section 3.3.2 reviews: Baker and Nelson’s (2003) study of modest-sized companies with few resources; Baker and Nelson’s (2005) research on entrepreneurs offering unmatched services in resource-scarce settings; work by Baker et al. (2003) unearthing improvisation *and* bricolage in infant companies; an inquiry into “social entrepreneurship” at “social enterprises”, by Domenico et al. (2010: 681); Garud and Karnøe’s (2003) juxtaposition of two wind turbine developments; and briefly, Mateus and Sarkar’s (2024) recent literature review. Section 3.3.3 summarises.

3.3.2 Pertinent literature

Suggested above, academics interested in entrepreneurship have shown ample interest in the concept of bricolage. This body of literature has done much to advance the notion as originally conceived by Lévi-Strauss (1972). As such, and where this is the case, time is taken to carefully unpack the most significant among the contributions. The first work reviewed was undertaken

by Baker and Nelson (2003). Their grounded theory study embraced the notion of bricolage as they sought to understand “attempts by small, resource-constrained businesses to accomplish a variety of tasks” (Baker and Nelson, 2003).

Interviews and observations informed a qualitative, longitudinal assessment of two settings. The first were a group of 12 modest-sized, “low-technology” company owners; the second were a group of employees working at “knowledge-intensive” companies (Baker and Nelson, 2003). Their contribution is multifaceted. Foremost, Baker and Nelson (2003) identify “two patterns of bricolage among proprietors”: “parallel” and “serial”. Each arrangement accounts for how multiple instances of bricolage can associate. The former is associated with a slowdown or altogether stalling of progress. The latter, by contrast, is linked to the expansion of companies. These ideas are of intrigue to the present study, and so each is expanded.

Working from a vast repertoire of resources, entrepreneurs engaged in parallel bricolage worked on multiple “projects” -inclusive of and/or equivalent to bricolage- simultaneously (Baker and Nelson, 2003: 3). The varied nature of the tasks was conducive to such hoarding. In the event that adequate resource(s) were unavailable, these entrepreneurs would reorder their work in the hope that the necessary tools would be available by the time they resumed it. This approach, however, meant the majority of a bricoleur’s resources remained unused much of the time. Further and because so many tasks were carried out simultaneously, progression on each was minimal. Baker and Nelson (2003) emphasise that few of these entrepreneurs’ interests grew into much; typically, nor did their companies.

The expansion of companies is instead associated with serial bricolage. In contrast to the parallel orientation, entrepreneurs executing bricolage serially “worked primarily on one or a very few projects [-inclusive of and/or equivalent to bricolage-] at any given time” (Baker and Nelson, 2003: 3). Outcomes “were combined with other resources at hand to provide the inputs for the next in a series of interconnected bricolage episodes” (Baker and Nelson, 2003: 3). It also endowed entrepreneurs a better comprehension of the resource(s) they might later require. This continual advance of tasks enabled their businesses to expand.

Whilst Baker and Nelson (2003) identify two general approaches to bricolage, they stress that the types of behaviour constitutive of bricolage per se were universal. Stark differences however, were highlighted in the so-called “bricolage cycle[s]” of entrepreneurs and the employees. That is, the specific instance of bricolage through to its “behavioral consequences” (Baker and Nelson, 2003). For entrepreneurs, bricolage was excited by their own “can do” attitude; they rarely allowed resource constraints -or poor training- to hold them back. They

were enthusiastic towards the prospect of attempting all kinds of task. In what Baker and Nelson (2003) suggest is a “self-reinforcing cycle”, this exposure widened business owners’ skills; this, in turn, led them to tackle “more diverse projects”.

Unfortunately, the same was not mirrored by employees. They were instead prompted by “requests” from the business owners, and continued to contribute essentially just what was necessary (Baker and Nelson, 2003: 4). Also and because only the attributable employee grasped the bricolage product properly, its upkeep became their responsibility going forwards. Baker and Nelson (2003) thus note how their equivalent “bricolage cycle appeared to be self-arresting”. Baker and Nelson (2003) summarise the contributions of their work, and these are pertinent to the present study.

Among entrepreneurs, they valuably distinguish the two patterns of bricolage. Their findings further shine light on what might provoke engagement in bricolage, and on “distinctly different outcomes for future task and behavioural diversity” (Baker and Nelson, 2003). Notably, the consequences of bricolage were identified at both individual and company levels. More generally, Baker and Nelson (2003) credit engagement in bricolage with explaining the difference between successful companies –and those struggling with like resources. They continue to contend a “capacity for bricolage”, i.e. the ability of a firm to “make do with the resources at hand” (Baker and Nelson, 2003).

Familiar insights feature in another study by the same scholars. Baker and Nelson (2005: 336) drew on data collected for previous studies; these were two sets pertaining to modest-sized companies, each with few resources and identified as “facing a variety of opportunities and threats”. The first concerned companies that had managed to remain operational in a deprived area. Data collection had initially involved visiting and taking notes on as many as 40 firms. They signal how in keeping with Grounded Theory (Glaser and Strauss, 1967), their “data collection strategy” adapted with their comprehension (Baker and Nelson, 2005: 337).

Baker and Nelson (2005: 337) were intrigued to realise some outfits were better able to manage with “fewer resources” than others. They directed their efforts to companies felt to be “particularly good at getting by” (Baker and Nelson, 2005: 337). Baker and Nelson (2005: 337) emphasise that they only “serendipitously” found the notion of bricolage (Lévi-Strauss, 1967) helpful in understanding. Based on their findings and thinking in the extant literature, they define bricolage as “making do by applying combinations of the resources at hand to new problems and opportunities” (Baker and Nelson, 2005: 333).

They stress it has “three elements” (Baker and Nelson, 2005: 333). Citing Levi-Strauss (1967) and others, they explicate what they regard to be its “characteristics” -as “resources at hand”, “recombination of resources for new purposes” and “making do” (Baker and Nelson, 2005: 333-334). Over a 2-year period, they focused on 16 companies apparently adept at bricolage. As they progressed, they paid similar attention to 9 comparable companies identified for not exhibiting bricolage in the same way. The second set of data stemmed from four case studies that had examined “employment practices in young knowledge intensive firms” (Baker and Nelson, 2005: 337). Interviews were conducted with stakeholders e.g. entrepreneurs, management, and even customers. Baker and Nelson (2005: 339) argue they gained understanding from “being on site”; they performed observation of “real-time activities”.

Among the companies not partaking in bricolage was a car repair shop. According to Baker and Nelson (2005: 340), its owner had “modelled his business on [the] G.M. dealerships” at which he had previously been employed; this proprietor insisted on doing things “the right way”. Although he does not explicate as much, it might be inferred from this that bricolage –and/or other strategies- would be perceived to lack the rigour of conventional approaches. Baker and Nelson (2005: 340) say that “in the remaining 20 firms, we frequently observed each of the elements of bricolage... separately”.

The most frequently noted was a “reliance on the resources at hand” (Baker and Nelson, 2005: 340). Baker and Nelson (2005: 340) stress that although “bricolage, combining all three elements, occurred much less frequently”, it had “more interesting results”. They suggest “the three elements of bricolage interacted to create unique services” (Baker and Nelson, 2005: 340). They further contend “it was the presence of all three elements simultaneously that allowed these firms to enact idiosyncratic resource environments and rendered them unique” (Baker and Nelson, 2005: 340).

One electronics repair firm was experiencing reduced demand for its normal services. Whilst trading, it had amassed an assortment of bits and pieces e.g. transformers. The owner was conscious of a specific problem in coal mines, and so assembled some of the components into an instrument valuable to technicians. Where his own skillset fell short, e.g. in welding, he drafted in an acquaintance. Some units were subsequently sold. The account offers several theoretical insights. Immediately, it is clear that bricolage was enabled by the entrepreneur’s knowledge of an industrial problem. Further, the overarching effort is seen to have been collaborative. The bricolage product moreover, was always envisaged to assist others. Yet inasmuch as it also provided the entrepreneur a temporary income stream, palpable benefit was enjoyed first-hand.

New service stemming from bricolage is further evidenced at a motorcycle repair shop. The proprietor was alerted to a customer whose bike had a deformed front wheel. Instead of providing an extensive repair immediately, the owner made do with a simple screwdriver for diagnostics. Rather than charging the customer, he advised him to keep an eye on how the motorcycle performed. The entrepreneur knew his tactics were abnormal.

The entrepreneur eyed with enthusiasm, the customer's "sand-cast engine block" for "a potentially lucrative restoration" (Baker and Nelson, 2005: 343). For Baker and Nelson (2005: 343), what came from "rejecting industry practice" was the possibility of proffering an unmatched service. Bricolage "creates something from nothing", no less, "making do by testing socially constructed constraints" (Baker and Nelson, 2005: 342).

Entrepreneurs engaged in bricolage differently. Baker and Nelson (2005: 343) distinguish "parallel" and "selective bricolage". Like its earlier designation (Baker and Nelson, 2003), the former labels circumstances comprising multiple qualifying projects simultaneously. After Star and MacMillan (1990), they note that business owners engaged in parallel bricolage were keen at "scavenging" resources; this meant they ended up with a "diverse resource trove" (Baker and Nelson, 2005: 344) [italics omitted].

Rather than benefitting from organised education or training, "most" of the entrepreneurs exercising parallel bricolage "had informally picked up a variety of skills" (Baker and Nelson, 2005: 345). Whilst not unique to parallel pursuits, those exhibiting it would more often be happy to overlook laws and industry norms. They routinely tried their luck, attaining a grasp of which they ought to follow -and which they could continue to neglect. This permitted entrepreneurs to provide new services (Baker and Nelson, 2005). In one illustrational tale, a business owner was met with a customer whose car exhaust had broken. Instead of offering the customer a replacement exhaust, he made do with a used catalytic converter; this posed several risks e.g. environmental hazard and substantial fines, but these were overlooked.

For Baker and Nelson (2005: 346) however, "perhaps most importantly, [were] the network ties that helped to sustain parallel bricolage". Citing past works (Portes and Sensenbrenner, 1993; Uzzi 1997), they suggest it was an "embedded multiplex" (Baker and Nelson, 2005: 346). For example, establishing bi-directional "obligations" "sustained the exchange of inexpensive nonstandard products and services"; "firms... [could] make use of the inputs provided by network members" (Baker and Nelson, 2005: 346).

Akin to the "self-reinforcing cycle" (Baker and Nelson, 2003, above), this meant a "mutually reinforcing pattern" (Baker et al., 2005: 347) [italics omitted]. The resources, the willingness to

overlook “standards and practices”, and the nature of their networks, combined to “encourage” attempts at “broad sets of challenges” (Baker et al., 2005: 347). Entrepreneurs’ skillsets would be augmented, meaning they were even more ready to chase additional challenges; the range of available resources resultantly expanded.

Those engaged in parallel bricolage “created new services from physical inputs that other firms rejected” (Baker and Nelson, 2005: 349). Baker and Nelson (2005) nevertheless note potential negatives. These companies could be so preoccupied by the types of project and customer they were dealing with, that it “isolated... [them] from richer markets and impeded the development of organizational focus and routines that might [have] support[ed] profitability” (Baker and Nelson, 2005: 349).

Company growth is instead associated with “selective” bricolage, which denotes more discriminate engagement (Baker and Nelson, 2005: 349). In one illustration, an entrepreneur had a trailer park that was -at the time of purchase- littered by used trailers. Initially he and a staff member would extract components from some, integrating them into the “better units” (Baker and Nelson, 2005: 350). The pair also established relations with select clients, allowing them to “occupy abandoned trailers for free” in exchange for repairing them (Baker and Nelson, 2005: 350). Moreover and although the entrepreneur did not technically own the discarded trailers, he understood that the local authority -the sheriff- would not inspect as much.

After a while however, the entrepreneur’s strategy turned away from bricolage. He drew up agreements, with “draconian” detail “regarding the conduct of tenants” (Baker and Nelson, 2005: 350). Prior “network ties” could therefore be cut, and undesirable tenants ejected (Baker and Nelson, 2005: 350). Further and instead of seeking “additional service out of worn, failing, or obsolete resources”, i.e. “coaxing”, the trailer park owner insisted on buying new (Baker and Nelson, 2005: 347). The entrepreneur came to disfavour bricolage. Although “the park continued to display vestiges of the old approach”, turning his back on bricolage “led to freedom from the need to engage in a high degree of coaxing” (Baker and Nelson, 2005: 350). It enabled the entrepreneur to improve the “day-to-day operation”, and meant he could concentrate on “trying to generate growth and on exploring related ventures” (Baker and Nelson, 2005: 350).

Selective bricolage manifested in other ways. In some companies, it could be “temporary” and/or exercised only by certain “departments or functions” (Baker and Nelson, 2005: 350). This indicated the distribution of “permissions” i.e. the authorisation of “shortcuts”, so long as the designated task was completed with no extra resources (Baker and Nelson, 2005: 350-351). Again however, negatives could accompany. With echoes of their previous work (Baker and

Nelson, 2003, above), Baker and Nelson (2005: 351) suggest this kind of selective bricolage can be “self-arresting”.

In two instances, bricolage products fashioned on the premise of “requests and permissions” necessitated coaxing to the extent that their upkeep eventually “dominate[d] the jobs of those involved” (Baker and Nelson, 2005: 351). As a matter of intrigue, Baker and Nelson (2005: 351) explain that the companies demonstrating selective bricolage did so more than once. Crucially however, “they seemed to have been able to limit bricolage, often to just one or two domains” (Baker and Nelson, 2005: 351). By curbing it, they were able to steer clear of the “self-reinforcing cycles of parallel bricolage” (Baker and Nelson, 2005: 351).

One exemplar is an entrepreneur with mining industry experience. When mining facilities shut down, he learned about “cleanup” (Baker and Nelson, 2005: 351). In establishing his own company, he obtained an “abandoned strip mine essentially for free” and second-hand resources cheaply (Baker and Nelson, 2005: 352). Experimenting and combining the resources, “he developed a number of unconventional approaches to cleanup” -but which nevertheless offered “workable solutions” (Baker and Nelson, 2005: 352).

His approach when ridding a pond of carbon, moreover, trumped convention. He next familiarised himself with Environmental Protection Agency (EPA) standards; these levels, it transpired, were sufficient to keep fish. At this point he began a fish farm. The enterprise was so outlandish it garnered wide interest, winning him an award. Drawing on the “government contacts” he had formed and mobilising the “visibility”, he inked a “contract to use his now-pristine lake to raise trout” (Baker and Nelson, 2005: 352).

Towards the end of their article, Baker and Nelson (2005: 353) present a model associating bricolage with a “penurious environment”. From the company standpoint, this “presents new challenges, whether opportunities or problems, without providing new resources” (Baker and Nelson, 2005: 353). One option is to set about obtaining those necessary; another is to sidestep the problem or opportunity (Baker and Nelson, 2005: 353). Alternatively, and as evidenced, a company operating in a penurious environment may execute a strategy flavoured by bricolage (Baker and Nelson, 2005).

Baker and Nelson (2005) emphasise eagerly that some companies may be better than others at engaging in bricolage. As such, they coin the corresponding term “bricolage capabilities”: this perceives bricolage to be a valuable competence (Baker and Nelson, 2005: 357). Logically following, they surmise that “bricolage capabilities will provide survival advantages during the periods of low resource stocks experienced by most new firms, even in generally munificent

environments” (Baker and Nelson, 2005: 357). Where competition is rife, they contemplate how “a decline in available resources might have a positive overall effect on firms with strong bricolage capabilities” (Baker and Nelson, 2005: 357). To their own acknowledgement however, this remains speculation.

Notwithstanding, their findings “show emphatically that firms engaged in entrepreneurial bricolage often create something from nothing” (Baker and Nelson, 2005: 356). Although not a “full understanding”, Baker and Nelson (2005: 360) observe how “bricolage seemed to elicit and provide opportunities for the exercise of organizational capacities and behaviors such as creativity, improvisation, and social skills”. It “appears to create a context in which such behaviors are encouraged” (Baker and Nelson, 2005: 354). Pertinently, “bricolage often appeared as the cause of improvisation” (Baker and Nelson, 2005: 360).

Staying in entrepreneurship, improvisation and bricolage are also of interest to Baker et al. (2003). They employed “three samples of young firms”, specifically, “knowledge-intensive new businesses” (Baker et al., 2003: 255). Most generally, they uncover evidence of improvisation both as companies are being established, and in the conduct of newly formed firms; bricolage is also found to feature significantly at each of these stages.

For their “primary sample”, Baker et al. (2003: 257) drew on “25 firms in the computer training and air pollution consulting industries”. They undertook semi-structured interviews with “founding” and “senior” managers; employees were also interviewed (Baker et al., 2003: 257). In two thirds of cases they performed participant observation; documentation was also collected. These data were originally sought for a study on “job creation and change” (Baker, 1995; Baker and Aldrich, 1994; Aldrich, 1999, cited by Baker et al., 2003: 257).

For comparison and contrast, they also “observed two other groups of firms” (Baker et al., 2003: 257). The first were 21 B2B (Business to Business) software companies; foremost, the data served another “study of start-up human resource practices” (Baker et al., 2003: 258). The group of second supplementary data related to “22 faulty start-ups encountered during a 6-year period across five universities” (Baker et al., 2003: 257). Baker et al. (2003: 257) explain that “data from the supplementary samples were gathered through formal pilot interviews, direct observation, informal discussions with members of founding teams and unstructured and semi-structured interviews”. They assume an inductive approach and make a number of propositions. The design, however, is incapable of affording “independent tests” (Baker et al., 2003: 256).

From the plethora of insights offered, those most pertinent are foregrounded. Beginning generally, reanalysing the primary data revealed how 68% of the companies established in fact improvised rather than adhering to a “Design-execution” strategy i.e. planning firstly (Baker et al., 2003: 261). “Founding teams” moreover, evinced bricolage in that they “drew on resources readily at hand” (Baker et al., 2003: 264). Baker et al. (2003: 265) express how “across our samples, founders made use of an extraordinarily broad variety of means and resources at hand during and after founding”. These included “customers, financing, suppliers, office space, advice and employees” (Baker et al., 2003: 265).

But according to Baker et al. (2003: 265), “founders’ comments suggested that they relied on their pre-existing networks as their *primary means* of access to the welter of resources needed during and after founding” [italics added]. This they term “network bricolage” (Baker et al., 2003: 265) [italics omitted]. It denotes a “dependence on pre-existing contact networks as the means at hand” (Baker et al., 2003: 265-269). For Baker et al. (2003: 265), it differs markedly from the kind of “resource-seeking” that involves “attempting to find new useful network contacts” - perhaps by “networking”- so as to obtain “resources through people who were previously strangers”.

When companies were newly being established, network bricolage showed in relation to opportunities. Indeed, “many cases of improvisational founding involved network bricolage with respect to founding opportunities” (Baker et al., 2003: 265). Their interpretation is interesting inasmuch as they view “the opportunity around which the firm is founded” as a “type of resource” in itself (Baker et al., 2003: 265). Elaborating on how this unfolded, Baker et al. (2003: 265) explain how these “founders” were talking with someone they already knew “from their current or prior jobs”. During the conversation, they would happen to learn of “opportunities to start businesses -- without searching for them” (Baker et al., 2003: 265). Stumbling upon these, they “responded... by simultaneously designing and executing firms that exploited the opportunities at hand” (Baker et al., 2003: 265).

Further, and albeit less typically, Baker et al. (2003: 265) even encountered network bricolage in “DPE foundings”. That is, those foundings in which the design of the strategy proceeded its execution (Design Precedes Execution). Illustrating, “one trainer and one environmental consultant were offered opportunities” in this way, but then continued by conducting “careful research” and planning before proceeding (Baker et al., 2003: 265-6). As suggested, “founders [also] made active and instrumental use of their networks after start-up” (Baker et al., 2003:

266). For Baker et al. (2003: 266), this manifested significantly in the “recruitment and selection of employees”: getting people on the payroll.

They cite “good comparative data” with respect to the primary sample, and note “network bricolage in recruitment was [similarly] prevalent in the faculty firms” (Baker et al., 2003: 266). But negatives could come with this kind of network bricolage. One scientist signed up academics and students, but this introduced issues. The company lacked the foundational business knowledge essential to “an efficient production process” (Baker et al., 2003: 267). Curiously however, cognisance of as much did not cause an abandoning of the “existing personal and professional network” for this purpose (Baker et al., 2003: 267).

In their primary sample, Baker et al. (2003) further found network bricolage to aid with respect to physical things. This included, for example, “borrowing office space, equipment and money from friends and prior employers” (Baker et al., 2003: 267). Notably, it could also transcend “physical and financial resources to include business practices and help with solving various problems” (Baker et al., 2003: 267). So far, research has provided rich insight into bricolage and its role(s) in entrepreneurship. A number of these have been foregrounded as particularly relevant to the present study.

Domenico et al. (2010: 681) are also alert to this academic area, and their study shows how the applicability of bricolage extends beyond those with commercial interests -to the related realm of “*social entrepreneurship*” [italics added]. Their work ultimately contributes an extended “social bricolage” concept, comprising six components (Domenico et al., 2010: 683). Domenico et al. (2010) begin by closely considering the extant literature; this enables them to identify the former three. The first is “making do with what is at hand” (Lévi-Strauss, 1967: 17, cited in Domenico et al., 2010: 684).

Again influenced by past works (e.g. Baker and Nelson, 2005, above), the second is a “refusal to enact (or be constrained by) limitations” (Domenico et al., 2010: 687) [italics omitted]. For Domenico et al. (2010), the third is improvisation. This also follows past thinking (e.g. Baker et al., 2003: 256), for whom bricolage is “a construct frequently used to describe the resource set invoked by improvisation” (Domenico et al., 2010: 686). Their own qualitative study draws from 8 cases, reflecting a range of social enterprises in the UK. Each was informed by semi-structured interviewing with pertinent personnel. They would begin with the person in charge, e.g. a chief executive; data collection would proceed by pursuing subsequent interviews with others isolated as significant. This was triangulated by observations and documentation.

Most generally and although the literature-reported aspects retain relevance in social enterprise, Domenico et al. (2010: 699) return three more: “social value creation”, “stakeholder participation”, and “persuasion” [italics omitted]. An “inductive coding strategy using Atlas.ti uncovered the categories of social bricolage” (Domenico et al., 2010: 689). These ideas are now expanded. Making do was observed uniformly. Echoing Baker and Nelson (2005, above), it could involve “creating something from nothing”, e.g. “a new market or providing a new service” (Domenico et al., 2010: 689).

It was also expressed by employees using otherwise unneeded resources in present applications, or by exploiting “hidden or untapped resources” missed by others (Domenico et al., 2010: 689). In one example, a new service aimed to provide a specific deprived area with such facilities as education. Its success spurred “growth”, and triggered “further demand for services that were subsequently delivered” more widely (Domenico et al., 2010: 691). For Domenico et al. (2010: 691), they had created “something from nothing”. According to the chief executive, it brought “a host of other opportunities” (Domenico et al., 2010: 691-2).

Another enterprise obtained an accountancy outfit’s unwanted computers -“refurbishing them for community use”- rather than outlaying for new (Domenico et al., 2010: 692). Elsewhere, an interviewee recounted an epiphany moment in which he thought of exploiting the wind to create a “sustainable wind energy project” (Domenico et al., 2010: 692). Domenico et al. (2010) recognise it was not being used by others.

Suggested above, the second component was informed by Baker and Nelson’s (2005) idea of a bricoleur’s “refusal to enact limitations”; empirical findings see it become a “refusal to be constrained by limitations” (Domenico et al., 2010: 692) [italics omitted]. Some social enterprises established “legally distinct” commercial arms, syphoning money to “socially oriented activities” (Domenico et al., 2010: 693). This “counter[ed] the limitations of resource-poor environments” (Domenico et al., 2010: 693).

Further, and “in the social entrepreneur’s response to resource scarcity”, findings indicated improvisation occurred (Domenico et al., 2010: 694). This was apparent in the curation of an enterprise’s “board members” (Domenico et al., 2010: 694). While recognising risk(s), prospective candidates would at least be given a chance, because it “created social value by fostering community engagement through active participation and dialogue” (Domenico et al., 2010: 694).

The study reveals the three aspects of bricolage read in past literature; empirical evidence “illustrate[s] how the concept of bricolage relates to the creation and management of social enterprises” (Domenico et al., 2010: 695). But “three further processes” come to light (Domenico et al., 2010: 695). These are “social value creation, stakeholder participation, and persuasion” (Domenico et al., 2010: 698) [italics omitted]. Foremost, and citing several works (Dees, 1998; Dees and Anderson, 2003; Peredo and McLean, 2006; Zahra et al., 2009), Domenico et al. (2010: 695) suggest that for social enterprises, “the aim of creating social value is a defining characteristic”. Such might include “generating employment opportunities” (Domenico et al., 2010: 698).

Although seemingly self-explanatory, the last two, “stakeholder participation, and persuasion” are tightly related and relevant (Domenico et al., 2010: 698). One social enterprise was interested in “developing wind turbines” (Domenico et al., 2010: 696). Recited by Domenico et al. (2010: 696), they “used community stakeholder participation to secure the consent of a local land owner”. Additionally however, persuasion was necessary. Indeed, the study found “persuasive tactics by informants to acquire resources”, and, that “persuasion was used to convince stakeholders of the potential usefulness of resources and assets and of the business case for social value creation” (Domenico et al., 2010: 696).

It is of intrigue to the present study that the required resource(s) could possibly reside with and belong to others, raising questions linked to what might happen if any persuasion was/were unsuccessful. Reflecting on the study, Domenico et al. (2010: 698) claim to have tailored the “generic concept of bricolage” to “social entrepreneurship”. In “social bricolage”, “the [6] constructs combine to form a contextualized amalgam of social action capabilities that can be leveraged by social entrepreneurs in their efforts to create social value” (Domenico et al., 2010: 698).

Another point is pertinent. In particular and despite the augmentations, Domenico et al. (2010: 699) continue to “contend that the process of social bricolage is associated with resource-poor environments in which the lack of resources pushes the social enterprise to use all available means to acquire unused or underused resources that are capable of being leveraged in a different way” towards this end. Similar sentiment is sensed elsewhere.

Complimenting the works above, Garud and Karnøe (2003: 277) look more broadly to various parties interacting in “technology entrepreneurship”. They assume a “comparative” angle in assessing the wind turbine development trajectories of Denmark and the US (Garud and Karnøe,

2003: 278). Denmark's "bricolage" strategy is recognised for "deploying [only] modest resources" (Garud and Karnøe, 2003: 278), yet it outperformed the "breakthrough" ambitions of the US (Garud and Karnøe, 2003: 279). According Garud and Karnøe (2003: 285), there were "key differences" in how "design and production engineers became involved in the two paths".

In the US, "engineering science knowledge" informed how they tackled design (Garud and Karnøe, 2003: 286). They began with a sophisticated blueprint, "took large steps in design scale-up, and did not engage in much product development in-between stages" (Garud and Karnøe, 2003: 285). Differentially, the Danes started "without an appreciation of the complexities involved" (Garud and Karnøe, 2003: 285). With no "explicit theoretical knowledge on turbine aerodynamics", their "practical engineers" sufficed with experience of manufacturing "agricultural machinery" (Garud and Karnøe, 2003: 285).

While starting with a comparably crude plan, they improved it incrementally and with more millstones. They also "engaged in product development in-between stages" (Garud and Karnøe, 2003: 285). In Denmark, initial units were supplied to both individuals and co-operatives. This meant there were plenty of applications, applied in a breadth of operating conditions. Beneficially, this "created multiple learning opportunities" (Garud and Karnøe, 2003: 288). As a consequence, it was conducive to the "scale-up to the larger turbines now being deployed by utilities" (Garud and Karnøe, 2003: 288).

In the US, enthusiasm towards the "dispersed market" was muted (Garud and Karnøe, 2003: 288). Focus was instead on the "centralized "wind farm" concept" that had originated in California (Garud and Karnøe, 2003: 288). Unfortunately for "US producers", this constrained the number of "interaction points" from which they might otherwise have been able to learn -and with that- improve the product (Garud and Karnøe, 2003: 288). Garud and Karnøe (2003) further explain how the two nations' trajectories differed on the testing and research front.

Citing Risø (1988), they note that "the DWTS [Danish Wind Turbine Test Station] was established in 1978 to service the emerging wind turbine industry" (Garud and Karnøe, 2003: 282). The convergence of different skillsets, and "extensive interactions between turbine firms and DWTS personnel" was beneficial to Denmark's approach (Garud and Karnøe, 2003: 290). The US had a similar organisation for "small-scale wind turbines": the Social Energy Research Institute (SERI), and latterly the National Renewable Energy Laboratory (NREL) (Garud and Karnøe, 2003: 283). Regrettably however, NREL did not achieve the same close-knit relations with stakeholders and so industry input was limited. In addition, the preoccupation with "fundamental scientific

principles” produced outputs “that were too theoretical” (Garud and Karnøe, 2003: 291). The aspiration for a “high-tech design may have led to critical delays in NREL’s inputs to the emerging path” (Garud and Karnøe, 2003: 291).

Contrasts continue to the regulatory environment. Regulation in Denmark served in a “steering” capacity, e.g. cautiously moderating growth of the wind turbine marketplace (Garud and Karnøe, 2003: 291). In the US, their initiatives were less successful. Decisions by the Reagan government ultimately ceased the “California wind energy gold rush” (Garud and Karnøe, 2003: 294). For Garud and Karnøe (2003: 278), the manifold differences between the two national approaches help understand “how one group of actors deploying modest resources” -the Danes- were able to “prevail over another deploying far superior resources” -i.e. the US. Of interest to the present study, the bricolage strategy was more successful than the one to have eyed so much more. The theoretical significance of intentional supporting influence, e.g. from regulatory bodies, is also duly noted.

More recently, Mateus and Sarkar (2024) have conducted their own systematic literature review of “bricolage-focused research”. As part of their methodology, they considered papers’ abstracts and disregarded those that did not centre on bricolage, or which referred to it in a way that was unconnected to entrepreneurship (Mateus and Sarkar, 2024). They offer many value reflections, pertinent among which is that “most scholars in bricolage research engaged in empirical research (90%) and frequently did not support their findings with a robust and coherent theoretical lens” (Mateus and Sarkar, 2024: 848). The present study, by contrast, benefits from employing activity theory (Chapter 2; Section 5.5, Chapter 5).

3.3.3 Summary: Bricolage in entrepreneurship

Although entrepreneurship research is somewhat distant from the present setting i.e. IT provision in UK academia, findings nevertheless offer valuable theoretical insight. Before transitioning to the next discipline, a number of these are summarised. The review conveys understanding of the character of bricolage per se, and -just as critically- how and why it may relate to the concept of congruence. Responsibly, it is recognised firstly that bricolage may not always show.

One noted entrepreneur was resolute in approaching matters “the right way” (Baker and Nelson, 2005: 340). By implication, this comment perhaps imparts the impression that bricolage -and/or other “way[s]”- are *not* “right” i.e. somehow inferior (Baker and Nelson, 2005: 340). Where it does occur, scholars associate it with an absence or otherwise lack of resource(s).

Expressions of bricolage can apparently reflect on those executing. Findings indicate as important, a bricoleur's attitude and enthusiasm towards approaching all kinds of tasks, as well as their competence and relevant knowledge. Engagement may even involve breaking the rules. Evidence illustrates how bricolage can be undertaken individually or collectively, or at least receive input from other(s).

Bricolage can manifest in different ways, and levels of engagement can vary. Overarching approaches e.g., include "serial", "parallel" (Baker and Nelson, 2003) or "selective" (Baker and Nelson, 2005: 343). In entrepreneurship research, the term "bricolage capabilities" has even been adopted to denote how "firms may differ systematically in their ability to apply bricolage skilfully" (Baker and Nelson, 2005: 357). Noteworthy developments and variations of the bricolage concept come from this body of literature.

The finding of a "dependence on pre-existing contact networks as the means at hand", for example, informed the notion of "*network bricolage*" (Baker et al., 2003: 265) [italics added]. At different points in the review, moreover, improvisation was found to feature (improvisation is discussed next, in Chapter 4). The effects of bricolage are also reported to vary. For attributable employee(s), maintenance of a bricolage product can be constraining (Baker and Nelson 2003). Entrepreneurs and their customers meanwhile, may benefit (Baker and Nelson 2005). At the company level, bricolage can "promote firm growth" (Baker and Nelson, 2003). Telling of tangible change, it can enable the provision of new services (Baker and Nelson, 2005).

Beyond the negative/positive distinction, it is more relevant to the present study that bricolage can allow companies to just "survive and function with a bare minimum of conventional resources" (e.g. "selective bricolage" in Baker and Nelson, 2005: 348). That is, to simply carry on irrespective. This insight from the entrepreneurship literature seems to corroborate the prospect -interpreted from Karanasios and Allen (2014, reviewed in Chapter 2)- that bricolage can intentionally influence congruence.

Like when considering the congruence literature, reviewing research in entrepreneurship reveals where theoretical understanding appears less thorough. A standout observation is that resource(s) employed in bricolage may reside with and/or belong to other(s) -and that "persuasive tactics" can assist (Domenico et al., 2010: 696). But the possibility remains, that permission is difficult or impossible to obtain -and that the bricolage effort is inhibited or altogether thwarted as a result.

Startling intrigue, the efficacy or success of bricolage can therefore not be guaranteed. But from the close reading of extant works, it is felt that the literature reflects limited theoretical

understanding of the nature of obstacle(s) or challenge(s) bricoleur(s) may encounter in practice. It is also kept in mind from Mateus and Sarkar (2024: 848), that researchers undertaking empirical work often “did not support their findings with a robust and coherent theoretical lens”. As the review progresses, it becomes clear entrepreneurs are not unique in exercising strategies marked by bricolage.

3.4 Academic research

3.4.1 Introduction

Bricolage is also of interest to those concerned with academic research. In turn, Section 3.4.2 appraises: Denzin and Lincoln's (2000) discussion of qualitative researchers as bricoleurs; Kincheloe's (2001: 679) regard for bricolage as a "research orientation" and “interdisciplinary approach” [italics omitted], which he latterly adds to (Kincheloe, 2005); Klag and Langley's (2013: 149) “conceptual leaping”; and Boxenbaum and Rouleau's (2011: 272) notion of “new knowledge products as bricolage”. Section 3.4.3 summarises.

3.4.2 Pertinent literature

To begin, Denzin and Lincoln (2000) reflect on the identify of qualitative researchers. They acknowledge how those in this line of work may be viewed in a number of different ways, for example as a scientist. According to Denzin and Lincoln (2000) however, these individuals may alternatively be regarded as bricoleurs, actively engaging in bricolage as they carry out academic research. One kind they identify are the “methodological bricoleurs” (Denzin and Lincoln, 2000: 6) [italics omitted]. Such scholars are apparently conscious of -and capable of applying- an extensive assortment of methods. These appear to comprise his or her repertoire.

Another is the “theoretical bricoleur” (Denzin and Lincoln, 2000: 6) [italics omitted]. Cognisant of disparate paradigms e.g. Marxism or feminism, these bricoleurs are able to draw widely when a contemporary task commands it. But Denzin and Lincoln (2000) recognise potential difficulty in amalgamating bits and pieces from different paradigms, given their respective rooting in differing epistemologies, ontologies and methodologies. An easier task for such bricoleurs is to gain benefit from embracing disparate “perspectives” (Denzin and Lincoln, 2000: 6), i.e. points of view.

“Interpretive bricoleur[s]” moreover, are conscious of how they themselves -and those studied- may influence the research (Denzin and Lincoln, 2000: 6). Then there is the “narrative bricoleur” (Denzin and Lincoln, 2000: 6) [italics omitted]. These individuals recognise firstly that scientists

tell stories; they are further alert to how these owe a lot to the paradigm from which the scientist works. Finally, so-called “political bricoleur[s]” equate science to power; they recognise the potential “political implications” (Denzin and Lincoln, 2000: 6) [italics omitted].

Kincheloe’s (2001) conceptual discussion follows the work of Denzin and Lincoln (2000). After Denzin and Lincoln (2000), he identifies bricolage as a “research orientation” and an “interdisciplinary approach” (Kincheloe, 2001: 679) [italics omitted]. In the domain of qualitative academic research, he argues “bricolage avoids both the superficiality of methodological breadth and the parochialism of unidisciplinary approaches” (Kincheloe, 2001: 679) [italics omitted]. Acknowledging interdisciplinarity to be difficult to define, Kincheloe (2001: 685) suggests it “generally refers to a process where disciplinary boundaries are crossed and the analytical frames of more than one discipline are employed”. This contrasts with researchers opting to work from a single discipline.

Bricoleur/researchers are aware e.g., of the “discursive strictures of [any] one disciplinary approach” (Kincheloe, 2001: 682). Bricoleurs with an interdisciplinary outlook welcome wide understanding of disparate disciplines. Vitally, the character “interdisciplinarity may take is shaped by the object of inquiry”; “the context in which the research takes place” influences “the nature of the deep interdisciplinarity employed” (Kincheloe, 2001: 685). From the “use of different methodological and interpretive perspectives”, a “synergy” can result (Kincheloe, 2001: 686).

Kincheloe (2001: 686) illustrates with an historian, versed both in “historiographical methods” and hermeneutics. What results from the merger is “something new” (Kincheloe, 2001: 686). The “synergized bricoleur” is more likely to “produce frame-shattering research” than those adhering to the “prearranged procedures of a monological way of seeing” (Kincheloe, 2001: 686). Kincheloe (2001) takes the dropping of disciplinary walls as evidence that this form of bricolage is already in motion.

Kincheloe (2005) expands on a number of these points and incorporates complimentary ideas. He again refers to Denzin and Lincoln in identifying “their concept of bricolage” as a “multimethod mode of research” (Kincheloe, 2005: 323). According to Kincheloe (2005: 323), “bricoleurs move beyond the blinds of particular disciplines and peer through a conceptual window to a new world of research and knowledge production”. For Kincheloe (2005: 324), “bricolage exists out of respect for the complexity of the lived world”; it is apparently “grounded on an epistemology of complexity”.

Apparently including himself as a bricoleur, he advances “we actively construct our research methods from the tools at hand rather than passively receiving the “correct”, universally applicable methodologies” (Kincheloe, 2005: 324). Swerving problems with “monological knowledge”, “multiple perspectives” are sought (Kincheloe, 2005: 326-327). Kincheloe (2005: 327) continues to argue that this kind of bricolage holds *both* an “epistemological and ontological assumption”: such “domains” as “the physical, the cultural, the psychological, and the educational consist of the interplay of a wide variety of entities—thus the complexity and the need for multiple ways of seeing”.

For bricolage, this “reality” is “ever changing” (Kincheloe, 2005: 327). What he terms “ontological complexity” in fact “undermines traditional notions of triangulation” (Kincheloe, 2005: 333). Kincheloe (2005) finds visualisation helpful. Researchers witness a river: constantly in motion, the “contents of the water are never the same”[;] different perspectives in the “web of reality”, mean “no portrait of social phenomenon is ever exactly the same as another” (Kincheloe, 2005: 333). Matters of “design and methods... cannot be separated” from this understanding of “reality”; “ontology and epistemology are inextricably linked in ways that shape the task of the researcher” (Kincheloe, 2005: 334).

This regard for complexity warrants “deep interdisciplinarity” (Kincheloe, 2005: 334). Citing Denzin and Lincoln (2000, above) moreover, Kincheloe (2005: 335) notes how “bricoleurs understand there are numerous dimensions to the bricolage”: “methodological”, “theoretical”, “interpretive”, “political” and “narrative”. Recognising the epistemological bases of different disciplines, bricoleurs select from “their conceptual and methodological toolkits, depending on the nature of the research context and the phenomenon” (Kincheloe, 2005: 340).

Bricoleur/researchers focus on the “liminal zones where disciplines collide”, and “in the deep interdisciplinarity” can “learn to engage in a form of boundary work” (Kincheloe, 2001: 689). This “involves establishing diverse networks and conferences where synergistic interactions can take place” (Kincheloe, 2001: 689). Pertinently then, it represents a way of conscientiously supporting bricolage. But Kincheloe (2001: 690) cautions that “personal interaction” is rather “a need”. This catalyses curiosity into contemplating what might happen if this is unmet. Yet where bricolage is successful, rewards can be reaped: Kincheloe (2005: 346) posits that “bricoleurs seek to cultivate a higher form of researcher creativity that leads them... to produce concepts and insights about the social world that previously did not exist”.

A positive prospect of bricolage is again portrayed by Klag and Langley’s (2013: 149) work on the “conceptual leaping” experienced by academics. They “define a ‘conceptual leap’ in the context

of qualitative research as a consciously realized and abstract theoretical idea in an empirical study that may or may not make its way to a theoretical contribution in its final form” (Klag and Langley, 2013: 150). Their understanding is informed by reviewing related literature. Klag and Langley (2013: 151) isolate a trend (e.g. Agar, 2010; Locke et al., 2008; Van Maanen et al., 2007) to cite “abduction” (originally Pierce, 1958) “as inherent to discovery-based research”. Their review reveals “the conceptual leap” to be premised on “abductive reasoning” (Klag and Langley, 2013: 151).

Typically, more than one leap contributes to an “ongoing process” with “dialectical qualities” (Klag and Langley, 2013: 151). They offer a model integrating four pairs of “dialectic tensions encircling the conceptual leap” (Klag and Langley, 2013: 152) [italics omitted]. These are “between deliberation and serendipity ... engagement and detachment ... knowing and not knowing, and... self-expression and social connection” (Klag and Langley, 2013: 152). From their reading, Klag and Langley (2013: 149) contend that “conceptual leaping is best portrayed as a form of bricolage, drawing resources from the different poles of the four dialectics”.

The first opposing pair is deliberation and serendipity. Klag and Langley (2013: 152) accept Weick’s (1989: 522) argument that superior theory comes from a “theorizing process characterized by a greater number of diverse conjectures”, rather than fewer similar ones. They reference attempts to promote “heuristics for stimulating creativity in the social sciences” (e.g. Abbot, 2004; Wicker, 1985; McGuire, 1997; cited by Klag and Langley, 2013: 152).

Klag and Langley’s (2013: 154) review nevertheless reveals a “significant role for serendipity”. They cite Fine and Deegan (1996) as having postulated “that ‘theory never develops out of thin air...’”; instead it owes to ideas familiar to the researcher (Klag and Langley, 2013: 154). They imply it is from a “pre-existing internal radar” that “important serendipitous stimuli first have to be noticed and then somehow linked with one’s research in order to be construed as findings” (Klag and Langley, 2013: 154).

The second pair pertains to engagement with –or detachment from- the data. Klag and Langley (2013: 155) note Locke’s (2007) mention of “the ‘rational control’ and ‘irrational free play’ dimensions of discovery”. Although the former involves “deep engagement” with the data, their review also indicates the importance of detachment (Klag and Langley, 2013: 155). According to Klag and Langley (2013: 156), “close engagement” is prerequisite to any conceptual leap.

The third pair concerns how knowledgeable and/or experienced a scholar is. Intuitively, “experience” and such “may offer resources for insight” (Klag and Langley, 2013: 157). But simultaneously, Klag and Langley (2013) recognise how preconceived ideas may inhibit a

researcher's capacity to come up with something original. They reason "creative thinking can benefit from both diverse knowledge resources *and* openness to surprise, doubt and uncertainty" (Klag and Langley, 2013: 158) [italics added].

The final contradictory pair is self-expression and social connection. Data are "interpreted first and foremost" by the focal researcher (Klag and Langley, 2013: 159). But the ideas must chime with peers, and "this may mean that their distinctive individuality will need to be adapted to fit into a broader context" (Klag and Langley, 2013: 160). For Klag and Langley (2013: 160), the "opposite pole of the dialectic: social connection" remains important.

Rather than favouring one extreme in each of the aforementioned pairs, conceptual leaping sees scholars "bridging across these tensions over time" (Klag and Langley, 2013: 161). More exactly, Klag and Langley (2013: 161) argue the "abductive process is constructed through the synthesis of opposites". Pertinently and as hinted at above, this is alleged to play out as a kind of bricolage. Klag and Langley (2013: 161) construe "conceptual leaping" as "a 'do-it-yourself' process of 'cobbling together' that one undertakes with the tools at hand". Apparently, "the bricoleur is able to engage in multiple, diverse tasks and does not limit each to the tools available for the project at hand" (Klag and Langley, 2013: 161). Rather, they choose from a "broader toolbox" comprising "many items collected over time (e.g. ideas, theories, methods, life experiences, skills, social connections" (Klag and Langley, 2013: 161).

"Key tools" are "verbal and written communication", permitting the bricoleur to steer "across and around the dialectic tensions" (Klag and Langley, 2013: 161). For Klag and Langley (2013: 150-1), arriving at "conceptual insight beyond the data themselves" calls for "one, and very likely more" of these "conceptual leaps". Notably, the concept of bricolage captures how this productive process unfolds. Klag and Langley's (2013) contribution is complemented by Boxenbaum and Rouleau (2011), whose work similarly sees the significance of bricolage to new theory.

With respect to "organizational theories", they isolate "empirical material, theoretical concepts, and metaphors" as the "most important" components (Boxenbaum and Rouleau, 2011: 274). Vitally however, both the "conception" and subsequent "presentation" of "new theories" is influenced by "epistemic scripts" (Boxenbaum and Rouleau, 2011: 278). These "implicit, cognitive templates... underpin our collective understandings of how new academic knowledge is produced" (Boxenbaum and Rouleau, 2011: 272). In their assessment of "contemporary organizational theory", Boxenbaum and Rouleau (2011: 278) suggest bricolage qualifies as one

of three in currency; the others are “evolution” and “differentiation”. Each is unpacked below, although more than one may be employed.

Scholars adhering to the evolution script are particularly knowledgeable of past work. In essence, their approach is to cautiously extend or otherwise augment prior understanding. Moreover and when subsequently promoting the work to peers, these scholars “present new knowledge claims as being continuous with previous knowledge”, i.e. a next logical step (Boxenbaum and Rouleau, 2011: 279). The revolution script differs substantially. Those assuming it deliberately disengage from extant work. Instead, they “actively seek to generate knowledge that is *dis*continuous with existing knowledge”; this is reflected in how they subsequently portray the work to others (Boxenbaum and Rouleau, 2011: 280) [*italics added*].

As emphasised, the most notable script is that which can be understood as bricolage. Citing Bryant and Lasky (2007), Boxenbaum and Rouleau (2011: 281) suggest “the script of bricolage invites scholars to produce new knowledge through improvisation rather than through adherence to a specific theory, method, or paradigm”. On the basis of “contextual factors... practical value, and their potential for generating novel insights”, the bricoleur combines “different knowledge elements that are readily available” (Boxenbaum and Rouleau, 2011: 281). Curiously however, this script “is not sufficiently legitimate” for “the academic presentation of new organizational theories” (Boxenbaum and Rouleau, 2011: 282).

As such, these scholars may rely on bricolage when devising new theory but later claim to have assumed one of the other scripts when publicly portraying their work. For Boxenbaum and Rouleau (2011: 282), this points to a “decoupling” of the “conception and [corresponding] presentation of new knowledge”. They substantiate this position by scrutinising seminal works from the academic area of organisational institutionalism.

In all, Boxenbaum and Rouleau (2011) illuminate the clear role of bricolage in academic research. Specifically and although this script is “particularly prevalent in the conception of new organizational theories”, it “is almost absent from the presentation of them” (Boxenbaum and Rouleau, 2011: 292) [*italics omitted*]. It is disheartening that some in the scholarly community view it unfavourably. At this point and before turning to review further literature, important insights are summarised.

3.4.3 Summary: Bricolage in academic research

The outgoing works have offered a handful of theoretical insights of interest to the present study. In the first instance, these pertain to bricolage per se. Additionally and although the studies do

not cite the CHAT concept of congruence explicitly, some association between the two can be read from the review. Select points are now summarised before transitioning to the next body of literature.

Most immediately and in keeping with the original conception of bricolage (Lévi-Strauss, 1972), scholars acting as bricoleurs are argued to pick resources in respect of their current research undertaking (e.g. Kincheloe, 2005). In the context and conduct of academic research, the character and variety of these are striking. Options include methods, theory (e.g. Denzin and Lincoln, 2000), and/or concepts (e.g. Boxenbaum and Rouleau, 2011). In the research domain, engaging in bricolage can involve transcending the boundaries of the native -and more familiar- academic discipline (e.g. Kincheloe, 2001). But as with entrepreneurs epitomising bricoleurs (Section 3.3, above), the ability to do so requires wider cognisance of what is available.

Fortunately however, it may be possible to support scholarly bricolage ambitions (e.g. Kincheloe, 2001). Kincheloe (2001: 689) for example, emphasises the idea of “establishing diverse networks and conferences where synergistic interactions can take place”. At the same time however, the “need” for “personal interaction” is affirmatively acknowledged (Kincheloe, 2001: 690). By itself, this spurs speculation regarding what could eventuate in circumstances where such is lacking or altogether absent. In general, however, this body of literature illuminates only limited insight relating to what might inhibit or altogether prevent pursuit of bricolage by academic researchers. With echoes of the entrepreneurship literature however, it is abundantly clear that some in the academic community perceive bricolage as substandard; as shown, such is the case that its exercise may even be cloaked (e.g. Boxenbaum and Rouleau, 2011). This is unfortunate in light of its palpable positives.

Kincheloe (2001: 681) for example, argues that academic bricoleurs uniquely “understand the necessity of new forms of rigor in the research process”. Elsewhere, Klag and Langley (2013) stressed its significance to “conceptual leaps”. Boxenbaum and Rouleau (2011: 292) meanwhile, illuminated its role in the “conception” -if not the “presentation”- of “new organisational theories” [italics omitted]. For academics undertaking formal research then, the concept of bricolage is demonstrably useful in capturing the particulars of their conduct. In different ways, it can explain how ongoing scholarly practice proceeds. In CHAT terms, it can reasonably be interpreted as intentional means by which the ultimate object of academic activity can be continually achieved. That is, its congruence.

3.5 Emergencies

3.5.1 Introduction

Bricolage can also be important in emergencies. In order, Section 3.5.2 looks at: Weick's (1993) reassessment of the Mann Gulch fire incident; Bechky and Okhuysen's (2011) study of a US SWAT team and film crew; work on the information sharing of different UK incident response agencies, by Mishra et al. (2011b); and another article in which Mishra et al. (2011a: 1) advocate activity theory as a framework to examine "information practices" in emergencies. Section 3.5.3 summarises.

3.5.2 Pertinent literature

The opening study foregrounding bricolage in emergency response is Weick's (1993) reinterpretation of the Mann Gulch fire incident. Originally detailed by Norman Maclean (1992), Weick (1993: 628) documents what he sees as the "interactive disintegration of role structure and sensemaking in a minimal organization". He is interested in asking "Why do organizations unravel?" and also, "how can organizations be made more resilient?" (Weick, 1993: 628).

Providing background, Weick (1993: 628) recites how a firefighting group of "smokejumpers" was tasked with neutralising a forest fire. Unfortunately for the responding group, a number of problems were encountered. Firstly and because of turbulence, they were forced to depart the aeroplane at 2,000 feet, rather than the customary 1,200. Further and because at least one parachute did not open as expected, the radio it carried was rendered worthless on impact.

Once on the ground, the fire approached rapidly. When it began closing on them, the leader (referred to as Dodge, the foreman and Wag) abruptly instructed the group to discard their equipment. In another move, and "to everyone's astonishment, he lit a fire in front of them and ordered them to lie down in the area it had burned" (Weick, 1993: 629). The foreman/leader intended for an "escape fire" to establish an area of ash that the group could lie in and therefore survive (Weick, 1993: 629). After cognising Bruner's (1983: 183) conception of "creativity", Weick (1993: 639) recognises the potential significance that "Dodge was an experienced woodsman, with lots of hands-on experience".

In Weick's (1993: 639) assessment, he was a bricoleur insofar as he had utilised resources available to hand at the time. Unfortunately the group failed to grasp his logic, and instead chose to run. Although the bricolage effort per se appears to have worked as intended -i.e. a fire was indeed started- it did not have the envisaged effect of saving the smokejumpers' lives. Tragically,

those men ultimately died. According to Weick (1993: 634), the catastrophe overall can be attributed to a more fundamental, “interrelated collapse of sensemaking and structure” (Weick, 1993: 634).

Beginning with sensemaking, the smokejumpers and “spotters on the aircraft” initially perceived it to be a “10:00 fire”; this meant it was expected to be put out by 10am the following day (Weick, 1993: 635). But they lacked an accurate sense of the situation faced. Weick (1993: 635) advances that “people rationalized this image until it was too late. And because they did, less and less of what they saw made sense”. With respect to the deterioration of structure, Weick (1993: 636) cites their “role system”. At one point, the foreman instructed the second in command to lead the others to a particular place. But this only caused confusion: “the spaces between members widened appreciably”, meaning “there is now no one at the end of the line repeating orders as a check on the accuracy with which they are understood” (Weick, 1993: 636).

Appraising events -the escape fire detail in particular- “allows us to move from a discussion of what went wrong at Mann Gulch, to a discussion of what makes organizations more resilient” (Weick, 1993: 638). Pertinently, he promotes bricolage and improvisation. On the former, he suggests that “because they [bricoleurs] routinely act in chaotic conditions and pull order out of them”, they “remain creative under pressure” (Weick, 1993: 639). He also advises that “when situations unravel, this is simply normal natural trouble for bricoleurs, and they proceed with whatever materials are at hand” (Weick, 1993: 639).

Continuing, he asserts: “If improvisation were given more attention in the job description of a crew person, that person’s receptiveness to and generation of role improvisations might be enhanced. As a result, when one organizational order collapses, a substitute might be invented immediately. Swift replacement of a traditional order with an improvised order would forestall the paralysis that can follow a command to “drop your tools.”” (Weick, 1993: 640). More broadly, and “to point the way to safety in the face of surprise, leaders today need to develop resilient groups that are capable of four things” (Weick, 1996: 145). The list notably includes improvisation.

Discussion of Bechky and Okhuysen’s (2011) work follows fluidly. Overlooking academic interest in surprises, they recognise “surprises can... differ in their consequences for organization members”; “cosmology events” like Mann Gulch (citing Weick, 1993) are equated to the “most negative” in this respect (Bechky and Okhuysen, 2011: 239). Thankfully, “most organizations face unexpected events of the less catastrophic variety”, i.e. are comparably mild (Bechky and Okhuysen, 2011: 639).

Nevertheless and whether intrinsic or extrinsic in origin, an organisation's "members... *need* to respond in ways that enable their work to continue" (Bechky and Okhuysen, 2011: 239-240) [italics added]. This resonates with the CHAT concept of congruence (Chapter 2). In their qualitative study, Bechky and Okhuysen (2011: 239) set out to understand how organisations "develop" such invaluable "responses to unexpected events". Data are drawn from two other studies (Bechky, 2006; Okhuysen, 2005) of a US "SWAT team" and "film production crews" (Bechky and Okhuysen, 2011: 240).

At the SWAT (Special Weapons And Tactics) team, Bechky and Okhuysen (2011: 242) engaged officers in semi-structured interviewing and observed "briefing" and "training sessions". Informal conversations with officers took place, and all of this was triangulated by acquisition of documentation, e.g. the "Manual for SWAT" (Bechky and Okhuysen, 2011: 242). Data from film production sets comprised participant observations of "how crew members' daily activities contributed to their responses to surprises" (Bechky and Okhuysen, 2011: 242). Documentation, e.g. "archival material", was also amassed (Bechky and Okhuysen, 2011: 242). Film crew were interviewed on an informal basis, and "unstructured interviews" occurred with other key personnel, e.g. "production managers" (Bechky and Okhuysen, 2011: 242).

Bechky and Okhuysen (2011: 244) "combined the two independently collected data sets to develop a comparative analysis of responses to surprise". Referring to Strauss and Corbin's Grounded Theory (1990), analysis proceeded inductively (Bechky and Okhuysen, 2011: 244). The empirically informed theoretical contribution constitutes a number of interconnected layers, which are now carefully explicated and related.

Most immediately and citing past works (Baker and Nelson, 2005; Garud and Karnøe, 2003, reviewed in Section 3.3, above), Bechky and Okhuysen (2011: 245) employ the expression "organizational bricolage" to account for the finding that "making do with the materials at hand and returning to the task quickly were the central characteristics of these responses". That is, "rather than novelty" (Bechky and Okhuysen, 2011: 245). Specifically, they allege it "took three main forms" (Bechky and Okhuysen, 2011: 246).

"Role shifting" was evidenced in both settings (Bechky and Okhuysen, 2011: 246) [italics omitted]. Job roles were sometimes unexpectedly unfilled; in these instances, others would step in spontaneously and carry out the work. On a film set, a "camera operator" failed to show and so the role was carried out by another crew member (Bechky and Okhuysen, 2011: 246). Crucially, it was "the camera crew's overlapping task knowledge [that] enabled members to shift roles and continue" (Bechky and Okhuysen, 2011: 246).

Surprises could also disturb the “expected flow of the work”; at SWAT teams, this resulted in “reorganizing routines” (Bechky and Okhuysen, 2011: 246) [italics omitted]. In one episode, an officer’s shot missed the suspect. The “situation became much more threatening”, with concern for the hostages (Bechky and Okhuysen, 2011: 246). Rather than attempting to communicate with him as intended, they went straight in. For Bechky and Okhuysen (2011: 246), the SWAT team switched to a different and “well-rehearsed routine for entry from their repertoire, changing their goal and their actions”.

Differentially, film crew members addressed surprises by “reordering the work” (Bechky and Okhuysen, 2011: 248). Owing to “their knowledge of the work progression and how tasks fit together”, this meant “changing the sequence” (Bechky and Okhuysen, 2011: 248). When a “tow mechanism broke” it prevented filming of a specific car-towing scene (Bechky and Okhuysen, 2011: 245). Fortunately, it was possible to simply film an alternative scene until the problem was rectified.

These patterns of organisational bricolage drew on resources that were “not just material, but also social and cognitive” (Bechky and Okhuysen, 2011: 249). Indeed, the application of “physical resources” like “materials and people” was contingent on “shared understandings of the situation” (Bechky and Okhuysen, 2011: 249). Bechky and Okhuysen (2011: 258) distinguish the “sociocognitive resources on which organizational bricolage relies” as “common workflow expectations and shared task knowledge”. In brief, the former refers to “members’ knowledge of the course of subsequent action” (Bechky and Okhuysen, 2011: 250). The latter label denotes the “process knowledge, held by multiple group members, about how to complete activities or accomplish particular aspects of tasks” (Bechky and Okhuysen, 2011: 249).

Next, Bechky and Okhuysen (2011: 250) turn to the “processes enabling organizational bricolage”. “Similar processes” are unearthed from SWAT teams and film production settings (Bechky and Okhuysen, 2011: 249). Reporting three, Bechky and Okhuysen (2011: 250) emphasise how “organizations drafted agreement on the work, reinforced and elaborated task activities, and built cross-member expertise”. “These processes continually re-created the sociocognitive resources” and are “daily activities... [that] enabled bricolage” (Bechky and Okhuysen, 2011: 256).

“Drafting agreement” saw personnel “collectively preparing” and “provisionally agreeing to an approach” (Bechky and Okhuysen, 2011: 250) [italics omitted]. SWAT teams favoured “Permission briefing meetings” (Bechky and Okhuysen, 2011: 250). Understandably, “time pressure and potential danger” meant they were “often unable to interrupt their work” in situ.

Although production personnel also conversed prior to -and after- filming, “ad hoc meetings” assisted “continually” (Bechky and Okhuysen, 2011: 253).

In each context, sociocognitive resources also stemmed from “reinforcing and elaborating task activities”, i.e. “strengthening task knowledge and giving individuals additional detail about the work” (Bechky and Okhuysen, 2011: 254). Whilst “quick corrections and reinforcing” could occur “during [SWAT] missions”, the reasons above meant they mainly “elaborate[d]” afterwards (Bechky and Okhuysen, 2011: 254). Owing to “the pattern of work, film crews had more time to elaborate while executing their task” (Bechky and Okhuysen, 2011: 254).

Lastly, “processes for building cross-member expertise” were also apparent at each setting (Bechky and Okhuysen, 2011: 254). The SWAT team engaged in formal “cross-training”; Bechky and Okhuysen (2011: 255) recount a “junior officer” encouraged to experiment with a “rifle and scope”, so as to impart an appreciation for the work of his colleagues. With similar intentions, film production workers rotated positions. For Bechky and Okhuysen (2011: 256), “the way in which cross-member expertise was developed also helped create common work flow expectations”.

Throughout, differences are noted between the two settings. Bechky and Okhuysen (2011: 258) explain this with respect to “structural context”: it “shapes” both “the development of sociocognitive resources” and the “organizational bricolage”. The particular influences isolated, include “temporal flow of the tasks”, “continuity of membership, i.e. of the group”, and “consequences of events” (Bechky and Okhuysen, 2011: 258). Bechky and Okhuysen (2011) contribute several theoretical insights. Foremost and with clear relevance to the congruence concept (Chapter 2), they exhibit the kinds of bricolage capable of allowing continuity in the face of the unexpected. Different types of resource are foregrounded, moreover, as well understanding into both how these are established and sustained. Finally, the influence of structural context is also conveyed.

Contrasting with the proceeding studies reviewed in this section, Mishra et al. (2011b and a) make no explicit mention of bricolage. Nevertheless, and as was possible when closely reviewing work by Allen et al. (2013) and Karanasios and Allen (2014) (Chapter 2), its potential significance can be reasoned. Mishra et al. (2011b: 1) are interested in the information sharing of multiple agencies “when responding to a major incident”. Establishing background, they clarify that “emergency responders in the UK emergency services are categorized into Category 1 and 2” (Mishra et al., 2011b: 1, citing Secretariat, Civil Contingencies Act, 2004).

The former is further broken down: “operational”, “tactical” and “strategic” duties are allocated to “bronze”, “silver” and “gold” personnel respectively (Mishra et al., 2011b: 1). Attention is delimited to Category 1, silver operatives.

The study assumes a qualitative approach. Mishra et al. (2011b: 2) carry out semi-structured interviewing, triangulated by observing “multi-agency training and exercises”. The “interview structure” is acknowledged to have been “designed using Activity Theory as a framework” (Mishra et al., 2011b: 2). “Critical Incident Technique method (Flanagan, 1954)” is also cited as having been “used to formulate the specific interview questions”; this entailed requesting interviewees recall “a recent emergency that they had handled” (Mishra et al., 2011b: 2). Activity theory further assisted in analysis.

Findings foreground “issues directly linked to information sharing”, and on “three dimensions”: the “social, technological and temporal” (Mishra et al., 2011b: 4). With respect to the social, they point to the potential “primacy of one agency” (Mishra et al., 2011b: 4) [italics omitted]. A “contradiction [can reside] between the subject (tactical commander) and the shared objective (outcome)”, in that well-informed agencies may withhold information from third party organisations (Mishra et al., 2011b: 4). In one instance, a police inspector “did not feel [it] necessary to contact and share information with the tactical commanders from other services” (Mishra et al., 2011b: 4). As a result, Mishra et al. (2011b: 4) suggest, “the latter were not able to make sense of what was happening”. From this, it may be read that this party had little choice but to make do with whatever information *was* at their disposal.

The same point applies to another of their socially oriented findings. As context, Mishra et al. (2011b: 4) detail how “information... made available to the tactical commanders is graded on importance and confidentiality”. According to one interviewee however, “commanders sometimes misclassify”, and his/her own organisation “tend to over classify” (Mishra et al., 2011b: 4). Problematically and as Mishra et al. (2011b: 4) explain, information identified as “very confidential” is “not shared with other agencies”. Such circumstances could -in effect- force some to make do with limited information, and without that available to others.

A further social problem pertains to the “reserved terms” and “shorthand” peculiar to each agency (Mishra et al., 2011b: 5). Although this aims to assist intra-organisational communication, it can inhibit multi-agency information sharing (Mishra et al., 2011b). For as long as this state of affairs remains, it represents something else with which responder(s) must seemingly make do. Yet, impediments to information sharing transcend the social realm (Mishra et al., 2011b). Under

“Technical Issues”, Mishra et al. (2011b: 5) illuminate “availability”, “familiarity”, “simplicity”, “reliability” and “interoperability” [italics omitted].

Although each inhibits “information sharing during multi-agency major incidents”, availability and reliability stand out (Mishra et al., 2011b: 1). With echoes of the potentially poor signal available to police mobile IS users (Karanasios and Allen, 2014, Chapter 2), there is little -if anything- suffering practitioner(s) can do to mitigate. Except perhaps, to make do. The last matter Mishra et al. (2011b: 6) delineate is the understandable “time factor”. One interviewee explains simply, that “in a tight time frame you haven’t got time for everybody to give you a full story” (Mishra et al., 2011b: 6) [italics omitted] It is not unreasonable to reckon that at times, responders may have to make do with what the same interviewee refers to as “concise information [, which] can be a little bit bare” (Mishra et al., 2011b: 6) [italics omitted].

The empirical work undertaken by Mishra et al. (2011b) contains various relevant ideas. Many are reflected by another of their studies. In this latter contribution, centred on “information *practices* in the context of Emergency Management” in the UK, Mishra et al. (2011a: 1) include additional theoretical insights [italics added]. They also place perceivably more emphasis on the utility of CHAT when applied as a framework. Mishra et al. (2011a) make use of the same or similar data as before (Mishra et al., 2011b).

Focus is again on the silver level, these operatives clarified as “fully responsible for all the management of [sic] given emergency” (Mishra et al., 2011a: 2). They carry out semi-structured interviewing, with CHAT assisting development of research questions and CIT (Flanagan, 1954) used to “underpin the interviewing” (Mishra et al., 2011a: 2). “Multi-agency training and exercises” undertaken by Category 1 and 2 personnel are also observed (Mishra et al., 2011a: 2). Findings foreground “information practice issues of [sic] response phase” (Mishra et al., 2011a: 2).

Technological concerns again relate to “reliability” and “difficulty” associating system use. Employing CHAT, Mishra et al. (2011a) interpret this as a contradiction residing between the silver subject and the prescribed technological tool(s). As indicated above, the study also introduces new theoretical insights. Mishra et al. (2011a) direct attention to a felt contradiction between the silver subject -and bronze personnel occupying the community. For silver subjects, bronze provide “the main source of information” (Mishra et al., 2011a: 6-7). The bronze however, “may not have the same level of understanding as that of a Silver Commander”, and this “makes it difficult for the latter to get the desired information” (Mishra et al., 2011a: 6-7).

Another contradiction conditioning the subject-community relation concerns the silver subject and control room staff. Control room staff record incidents. But they are “not trained commanders”, and entries are recorded “as... interpreted by that individual which may not represent the actual facts” (Mishra et al., 2011a: 7). The “information made available to the Silver Commander may not be as accurate as it should be”, with one interviewed silver operative suggesting “you may not find that it is as complete as you would wish” (Mishra et al., 2011a: 7) [italics omitted].

These findings are of particular interest. Clearly poor quality and/or any shortage of information can pose problems to silver responders. But during emergencies, there is likely little -if anything- that suffering practitioner(s) can do to mitigate. As a result and although not much more can be reasoned from this aspect of the study, it is suggested that silver level operatives may have to make do and continue as best as possible irrespective.

A last contradiction catching present attention is reported to reside between silver responders and the rules. Mishra et al. (2011a: 6) explain that according to protocol, silver level police officers are not to enter a building “even if someone is trapped”; rather, they should hold back until the fire service arrive. But despite being aware of this, one interviewee explains: “if fire services are not there and somebody is trapped, police officer goes in” (Mishra et al., 2011a: 6) [italics omitted]. Such a decision and/or course of action as executed by the police officer(s) in the cited circumstances, therefore transcend(s) pre-established planning or the otherwise preconceived arrangement.

This is reminiscent of the paramedic response in the study by Allen et al., (2013) (Chapter 2), a detail interpreted as indicating improvisation. As prospective means by which activity/practice can be made or influenced to continue, the concept of improvisation is considered in Chapter 4. In all, the works by Mishra et al. (2011b and a) offer theoretical insights pertinent to the present study. Whilst neither refers explicitly to bricolage nor improvisation, the respective role(s) of these concepts can be reasoned from close readings: in emergencies, they are seemingly significant to continuity. Before progressing to review further academic literature, important ideas from above are summarised.

3.5.3 Summary: Bricolage in emergencies

Carefully consulting the outgoing selection of works endows several theoretical insights valuable to the present study. Principally, these pertain to bricolage itself. Complimenting this, is provisional perspective on its relationship with the CHAT concept of congruence (Chapter 2).

Before progressing to appraise further academic literature, the most notable of ideas are briefly reiterated. In the most elementary sense, bricolage is shown to be significant in -and to- emergencies. Empirical evidence portrays it in different situations, from fighting a perilous fire (Weick, 1993) -to dealing with a precarious hostage situation (Bechky and Okhuysen, 2011).

Bechky and Okhuysen (2011: 245) refer to “the emergence of organizational bricolage in response to surprises”: a theoretical association also enabling them to explain its appearance in non-emergency settings, namely film sets. During an emergency, bricolage can be an individual endeavour, e.g. the foreman’s “escape fire” at Mann Gulch (Weick, 1993: 629). But it can also command collective compliance, such as when a SWAT team quickly selected a different “routine for entry from their repertoire” (Bechky and Okhuysen, 2011: 246).

Following findings from studies of entrepreneurship (Section 3.3) and academic research (Section 3.4) then, it is evident bricolage in an emergency may invoke non-material resource(s). Like in those literatures, the matter of a bricoleur’s past experience and/or knowledge is again contemplated (e.g. by Weick, 1993). Similarly, there is sympathy for the suggestion (e.g. Kincheloe, 2001 with respect to academic research, Section 3.4) that bricolage may be conscientiously supported. In particular, Bechky and Okhuysen (2011: 250) are acknowledged for eliciting “processes enabling organizational bricolage”. The significance of bricolage in the context of emergencies is forthcoming.

Bechky and Okhuysen (2011: 240) argue “organizational bricolage allowed team members to continue their work without interruption”. For Weick (1993: 638), “improvisation and bricolage” serve as “sources of resilience”, Reconciled with CHAT vocabulary (Chapter 2), bricolage appears to characterise means by which congruence can be intentionally instilled into inherently contradictory activity. Similar sentiments are rationalised by carefully contemplating studies not explicitly citing bricolage. Specifically, those focusing on silver level operatives (Mishra et al. 2011b and a). Relayed by Mishra et al. (2011b), an interviewee conceded: “in a tight time frame you haven’t got time for everybody to give you a full story about everything” [italics omitted]. From this example and others (above), it is reasoned that responders may have little or no option but to continue working towards their object regardless, by making do with the resource(s) available.

The literature emphasising bricolage in emergencies, moreover, conveys a sorry sense that its efficacy is no guarantee. Although the foreman in Weick’s (1993) Mann Gulch account *did* manage to light a fire with the resource(s) available, the firefighting group largely failed to

understand its utility and refused to go along. The catastrophe is ascribed to a more fundamental, “interrelated collapse of sensemaking and structure” (Weick, 1993: 634). Weick’s (1993) work an exception, there remains limited theoretical understanding of the kinds of situational and/or contextual factor(s) capable of challenging and/or compromising the effectiveness of bricolage.

3.6 Information Technology (IT) & Information Systems (IS)

3.6.1 Introduction

Academic interest in bricolage extends to studies of IT & IS. Successively, Section 3.6.2 considers: Ciborra’s (1994) scrutiny of well-known Strategic Information System (SIS) developments; Lanzara’s (1999: 331) illuminating assessment of “designing systems in action”; Wynn’s (1996) closely related chapter, which concentrates on bricolage in software development; and Ciborra’s (1996a) case study at a Swiss pharmaceutical company. Section 3.6.3 summarises.

3.6.2 Pertinent literature

Serving as a reasonable starting point, Ciborra (1994) points to the prevalence of bricolage across a number of well-known Strategic Information System (SIS) developments. For him, these illuminate the differential between on the one hand, the organisation’s “ideal plans”, and on the other what he terms “the realities of implementation” (Ciborra, 1994: 10). Of the exemplars, two are elaborated below. One he discusses is an ordering system, Economist, belonging to McKesson. Contrary to popular belief, the system came into being owing to one unit’s amalgamation of pre-existing and readily accessible systems. From Ciborra’s (1994: 11) perspective, this “tinkering and serendipity” amounted to a kind of bricolage¹.

Another he features is Minitel, a French Videotex facility permitting households access to information. To begin with, the systems were given away free of charge, and actually a number of commentators attribute its success to this detail. But for Ciborra (1994), there is more of interest. Although the device was capable of email functionality, France Telecom never marketed it on that basis. A hack resulted in media interest however, and the same move was widely imitated by a community of eager users.

¹ Thank you to Dr Matthew Jones, whom in an informal discussion at Leeds University made the general observation that Claudio Ciborra speaks of bricolage in a slightly different way, or something to a similar effect.

Citing Marchland (1987), Ciborra (1994: 13) acknowledges how Minitel came to be used for email; this notably contradicted the provider's initial intention. The bricolage had both unforeseen and collateral effects. Minitel devices ended up supporting a marketplace service for small companies. An increase in user traffic strained France Telecom's network infrastructure, which saw them subsequently augment it in accordance.

Ciborra (1994: 13) argues SIS "are not fully designed top-down or introduced in one shot" following management orders. Rather, "they are tried out through prototyping and tinkering" (Ciborra, 1994: 13). Bricolage "encourages tinkering by people close to the operational level", and involves "combining and applying known tools and routines at hand to solve new problems" (Ciborra, 1994: 16). Indeed as Minitel portrays in particular, it was users themselves whose bricolage was conducive to innovation.

For big innovations to eventuate from bricolage however, they must receive appropriate levels of support and the necessary resources (Ciborra, 1994). The development of SIS can be aided by "incremental learning" (Ciborra, 1994: 19). For example, it is posited that this type of tinkering may be intentionally encouraged within an organisation; management however, must be conscious of -and alert to- any potentially fruitful ideas. Additionally or instead, companies may engage in the notion of "*radical* learning and innovation" (Ciborra, 1994: 20) [italics added]. Albeit paradoxical, Ciborra (1994) suggests organisations perhaps ought to be prepared for failure, given what might be learned from it: in particular, the propensity for innovation.

Elsewhere, Ciborra's (1994) theoretical thinking is evidently accepted by Lanzara (1999). Lanzara (1999: 334) argues "design and change processes in organizational and professional settings" alike, proceed "in ways that remarkably differ from the orderly, structured paths that most current theories and methods tend to assume". Attention is on "designing in action" (Lanzara, 1999: 332). This is a "practical, situated, context-sensitive mode of design that feeds on the dynamic tension between the requirements of change and stability" (Lanzara, 1999: 332).

Its products are distinguished as "transient constructs and persistent structures" (Lanzara, 1999: 332). In the "design process", the former denote "dynamic carriers of knowledge and effective vehicles for sensemaking" (Lanzara, 1999: 331). Although "unfinished and makeshift[,...] they may occasionally coalesce", becoming the latter (Lanzara, 1999: 331). Persistent structures are "more stable", yet are themselves "continuously reconfigured by a never ending activity of bricolage" (Lanzara, 1999: 331) [italics omitted].

Lanzara (1999: 331) makes use of "online-observation and tracking of design processes". Based on his "own research experience as an observer and reflective interventionist", a number of

“short stories” pertain to “systems development projects in educational, institutional and professional settings” (Lanzara, 1999: 335). Lanzara (1999: 341) is eager to emphasise their “focus on practice”, evidencing “what people actually do”.

One that stands out concerns the collaborative development of music education software for a “major academic institution” (Lanzara, 1999: 335). Developers would oscillate between the incumbent solution “at-hand” -and novel capabilities “made available” by technological progress (Lanzara, 1999: 336). Lanzara (1999: 336) advances that “they seem to be tacitly guided by what they already know about the old system and its operations”, such that the present “design is *dependent* on the old system’s features in much deeper ways than they are aware of” [italics added].

The acting “project leader” -the recipient “musician and development psychologist”- was unclear on her own wishes (Lanzara, 1999: 335). As such, the programmer/designer offered her “for instances”; these conveyed his own comprehension of the requirements (Lanzara, 1999: 336). Theoretically, they “are a sort of transient constructs that allow the musician to make ongoing practical experiments and discover what she likes” (Lanzara, 1999: 335) [italics omitted]. The “for instances” Lanzara (1999: 337) refers to, “are made, dissembled and reconstructed in an endless process”. Although many are discarded, “bits and pieces of them are re-used, recombined, and given new meanings as component parts of further transient constructs” (Lanzara, 1999: 337).

The collaborative effort sees a convergence of “two distant worlds”, namely music and computer science (Lanzara, 1999: 337). Each “comprise[s] different repertoires of relevant objects, familiar work tools, consolidated skills, cognitive mappings, implicit frameworks and criteria for design, and even a different sense of beauty” (Lanzara, 1999: 337). The “two partners” -or “designers”- often suffer communication issue(s) (Lanzara, 1999: 337). Yet, it is “as they gradually merge their different domains of experience and practical knowledge”, “*through... their conversation and in spite of their mutual misunderstandings, or perhaps just because of them*”, that the end product develops (Lanzara, 1999: 337) [italics in original].

Pertinently, “their way of designing resembles a kind of bricolage” [italics omitted] (Lanzara, 1999: 337). Lanzara (1999) perceives them to “paste together a few components into “something”, see how it looks like [sic], play with it, check if it works, evaluate, modify, or reject” (Lanzara, 1999: 337). In that they are not certain “what the final configuration is going to be”, the practice “is not directed to any specific solution or configuration in particular, nor at solving

pre-fixed problems, or at fixing specs" (Lanzara, 1999: 337). Having recited the stories, Lanzara (1999) expands on his theoretical explanation.

The design process is argued to unfold by "moving from one [transient] construct to the next, new features and relations are "liberated" and rearranged in different configurations, while previous ones are kept or wiped out" (Lanzara, 1999: 341-2). Transient constructs allegedly "assure some provisional order and meaning" (Lanzara, 1999: 342). Albeit "indirectly", they assist in "establish[ing] some direction in time and some inter-temporal depth" (Lanzara, 1999: 342). From this perspective, "continuous rechunking and regrouping of components, features, and events lead to chains of revisions, and to revisions of revisions" (Lanzara, 1999: 342). Lanzara (1999: 344) argues "transient constructs are continuously reshuffled, recombined, and reworked along a main stream of sense, and in the long term these ongoing processes of recombination and restructuring tend to generate stability".

More precisely, those "that showed successful are rehearsed and re-used over and over again, and finally stabilized"; differentially, "unstable components are assembled into hybrids that perhaps do not look very elegant but "make do"" (Lanzara, 1999: 342). What results "are larger, loosely connected structures" (Lanzara, 1999: 342-3). Resonating with ideas in the CHAT literature (Chapter 2), they "carry history and tradition, bringing continuity and connectedness" (Lanzara, 1999: 343).

Lanzara (1999: 343) nevertheless downplays any firm "distinction between transient constructs and persistent structures". Even the latter are susceptible and "subject to continuous bricolage and local restructuring" (Lanzara, 1999: 343) [italics omitted]. Rather than "represent[ing] a conclusive state", they "are further manipulable: new features and components can always be accommodated or hooked onto them" (Lanzara, 1999: 343). It patterns an "ever evolving process of "shifting and drifting" or "redesigning"" (Lanzara, 1999: 343). Summarily, "designing in action" is a form of "systems development based on bricolage" (Lanzara, 1999: 346) [italics omitted].

Lanzara (1999) further rationalises its frequent such manifestation. Owing to what he terms "the present stage of functional and structural complexity", he suggests "*no system* can be designed and implemented from scratch" (Lanzara, 1999: 346) [italics omitted]. This contention concurs concisely with that of Ciborra (1994) (above). Rather and in reality, "designers start building up with materials they have at hand" (Lanzara, 1999: 346). The design process is marked significantly by "transforming and reshaping what is already in use, or creatively rearranging components" (Lanzara, 1999: 346). Moreover and concretising the re-combination aspect of

bricolage, Lanzara (1999: 346) recognises as “convenient” the “strategy... of convert[ing] old components and structures to new functions and uses”.

The products of bricolage “can be partially reworked without much investment effort”, and financial outlays are “recoverable” (Lanzara, 1999: 346). Among other points, Lanzara (1999: 346) argues that in the event of “depletion, obsolescence or low performance”, a revamp would not require everything to be disregarded. Bricolage accommodates “deliberate human intervention and unplanned interaction”, and aptly negotiates “dilemmas of change and stability, innovation and conservation” (Lanzara, 1999: 347).

With further theoretical relevance, he argues “experimenting with transient constructs... allows for some variability and improvisation” whilst avoiding “possible disruptions” stemming from “excessive instability and radical change” (Lanzara, 1999: 347). Simultaneously and although enabling “some order and reliability”, it does not stifle prospective “system improvement and innovation” (Lanzara, 1999: 347). One more familiar theme is alluded to by Lanzara (1999). In particular, that viewed from a “diffused engineering ideology[,] bricolage is usually associated with second-best solutions, maladaptation, imperfection, inefficiency, incompleteness, [and] slowness” (Lanzara, 1999: 347) [italics omitted]. Similar was sensed in e.g. the entrepreneurship (Section 3.3) and academic research (Section 3.4) literatures. Defending, Lanzara (1999: 347) reasons how “in many design situations it is the only thing we can reasonably do when we are engaged in action”. This in turn, chimes with the inferences made from select emergency response studies (Section 3.5).

Continuing, Wynn (1996) is similarly conscious of the role bricolage plays in software development. Informed by interviews with relevant personnel during a development period, her case study examined its presence within a health insurance company seeking to streamline its workflow. Intended for use by the Enrolment department, the new solution sought to ensure the accuracy of new applications before they were passed to underwriters for assessment. A peculiarity of the organisation relates to its structure.

In particular, its IS department was split twofold: one group was tasked with maintaining legacy systems, and a distinct unit was authorised to progressively pursue technical options to address the transforming demands of the industry. The latter was in essence, licensed by the organisation to experiment with different application configurations. Apparently acting as bricoleurs, this group came up with the solution. Among other details, Wynn (1996) draws attention to a period in which a programmer was drafted to work among target users

themselves. It meant any resulting prototype(s) more accurately reflected their requirements; moreover, any issue(s) could be immediately ironed out.

This echoes the story of music education software, selected from those recited by Lanzara (1999) (above). It reinforces the relevance of both interim product(s), and of a close user-developer relationship to ongoing software development. At the insurance company, the positioning of the programmer was deliberate: a department head instructed her on the move. "Support [evidently ran] from above and below" (Wynn, 1996: 227). This reflects how decisions can be made within an organisation, to encourage and/or support bricolage. Wynn further (1996) commends the programmer personally: working among users was novel, and so her ability to change working environments so fluidly was beneficial.

The matter of organisational support for bricolage is again evidenced in work by Ciborra (1996a). His case study, informed by interviewing, identifies as much at the Swiss pharmaceutical company, Hoffman-La Roche. As industry background, increasing interest in biotechnology caused companies to scramble for the competence necessary to compete. This was typically achieved by way of partnerships. Fittingly, groupware aids communication both within and between organisations (Ciborra, 1996a).

Hoffman-La Roche took to establishing so-called "Global Team Rooms" (GTR), high-tech provisions permitting members of its "International Project Teams" (IPT) to collaborate (Ciborra, 1996a: 101). Facilities such as videoconferencing, etc. were envisaged to aid decision-making and hence hasten drug development. Unfortunately, a scarcity meant different organisational groups all but fought over it. Yet curiously and because *their* work was so highly regarded, IPT access was privileged. After Weiser (1991), Ciborra (1996a) acknowledges how additional technologies were incrementally adopted and utilised by the GTRs.

From this observation, he comes to perceive the GTRs as having resulted from "*technological bricolage*" (Ciborra, 1996a: 111) [italics added]. In common with events surrounding Minitel (Ciborra, 1994, above), it subsequently became necessary for the organisation to augment its network infrastructure: something it had notably not planned for a priori. Although kept concise, the Hoffman-La Roche account remains insightful. Most immediately and in keeping with a now-familiar theme, it is apparent that conduct characterised as bricolage can be conscientiously supported from within an organisation; likewise, unexpected event(s) associated with bricolage are again in evidence. This assortment of works endows valuable understanding of bricolage in respect of IS and IT, and standout points are now summarised.

3.6.3 Summary: Bricolage in IT & IS

As with the proceeding areas of academic literature, studies of IT and IS foreground fitting theoretical insight. In the immediate, this relates to bricolage per se, i.e. its nature or character. Theoretically thin areas can also be isolated. In addition, the careful appraisal allows for inferences into its association with the CHAT concept of congruence (Chapter 2). Pertinent ideas are summarised below, before transitioning to reflect more generally on the bricolage literature at large. Extant IT and IS studies exhibit encouraging interest in bricolage.

Comprehension of the concept attracts initial attention. Ciborra (1994: 11) for example, argues it “encourages tinkering by people close to the operational level”, understanding it to involve “combining and applying known tools and routines at hand to solve new problems”. His assessment of Minitel (Ciborra, 1994) exemplifies how conduct amounting to bricolage can be undertaken by user(s), specifically non-staff. Lanzara (1999: 346) meanwhile, designates “designing in action as a style of systems development based on bricolage” [italics omitted]. His accompanying recollection of music education software development, moreover, portrays its potentially collaborative character (Lanzara, 1999).

Relatedly, scholars interested in IT and/or IS seem to find some agreement when theoretically rationalising the presence of bricolage in practice. In respect of Strategic Information Systems (SIS), Ciborra (1994: 13) firmly rejects that they are “fully designed top-down or introduced in one shot”. Concurring, Lanzara (1999: 346) is acknowledged for asserting that “*no system* can be designed and implemented from scratch” (Lanzara, 1999: 346) [italics omitted]. From the outgoing review of IT and IS research, it is clear that intentional engagement in bricolage serves -significantly- to make up for as much.

Works also offer theoretical understanding into the effects/outcomes of bricolage. These can fall exterior to planning (e.g. Ciborra, 1994; 1996a). Additionally and although a digital “distinction” is avoided, both the shorter and longer term are accommodated conceptually by “transient constructs and persistent structures” respectively (Lanzara, 1999: 343). In general and as conveyed by previous literature, bricolage can apparently be supported. As previously however, there is little -if any- regard for inhibiting factors.

Nevertheless, it is possible to link bricolage and congruence. Lanzara’s (1999: 346) work on “designing in action” lends most. Herein, so-called “persistent structures” are “continuously reconfigured” in what he refers to as a “never ending activity of bricolage” (Lanzara, 1999: 331) [italics omitted]. Bricolage is associated with “systems development” insofar as it is “based on

bricolage” (Lanzara, 1999: 346). In some sense then, bricolage characterises how this particular practice proceeds and/or continues. It can perhaps be considered therefore, that bricolage contributes towards congruence (Chapter 2).

3.7 On reflection: The bricolage literature

Perusing past works on bricolage has endowed an assortment of insights relevant to the present study. It is now sensible to reflect. Readers are reminded of the wide and long-spanning academic interest in bricolage, and a qualitative methodological approach is emphasised as evidently effectual. A less understood aspect in the literature is also isolated. Apparent association between bricolage -and congruence and improvisation- is then underscored before summarising and concluding the chapter (Section 3.8).

Since its original formulation by French anthropologist Lévi-Strauss (1972), there has been broad interest in bricolage spanning a number of academic areas. It is discussed -and shown to manifest- across a breadth of settings and circumstances. Yet the review reveals nuances in understanding, and also advances or developments in theoretical thinking. The review structure allows these to be accurately attributed, both to research area and specific scholar(s).

In keeping with their worth generally (Ravitch and Riggan, 2012), the literature review also serves a sense of how bricolage has been studied beforehand. Rather than approaching the concept quantitatively, the studies considered overwhelmingly assumed a qualitative angle. Given the wealth and standard of the reported theoretical insights above, the suitability of a qualitative, interpretive design is indicated (Chapter 5). From their own recent systematic review of studies pertaining to entrepreneurship, Mateus and Sarkar (2024: 848) highlighted that “most scholars in bricolage research engaged in empirical research... and frequently did not support their findings with a robust and coherent theoretical lens”. The present study transcends these insofar as it employs activity theory (Chapter 2; Section 5.5, Chapter 5).

Like when exploring the CHAT tradition and its concept of congruence (Chapter 2), the attentive assessment exposes where comprehension is limited. Although exceptions are certainly in evidence (e.g. Weick, 1993), there is interpreted to be relatively little regard for situational and/or contextual factors capable of inhibiting or altogether eclipsing the effectiveness of bricolage. That is, things influencing or mediating the success of bricolage in practice. Beyond bricolage alone -and although none of the studies refer to congruence- it was possible to identify apparent association. Among other observations, bricolage characterises much of academic

research (e.g. Boxenbaum and Rouleau, 2011; Klag and Langley, 2013) and IS development (Lanzara, 1999): each ongoing and continual practices.

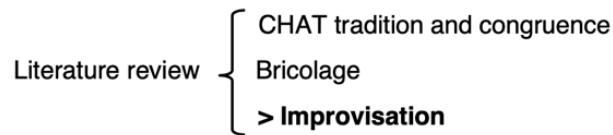
Further and from careful reasoning, connections were even inferred from works with no explicit interest in *either* bricolage or congruence (Mishra et al., 2011a and b). Similarly and whilst the outgoing review chapter dealt with bricolage by itself, improvisation did at times feature. Perhaps most pertinently, Weick (1993: 638) commits to the contention that both “improvisation and bricolage” are “sources of resilience”. Of the same kind, this seems to suggest. Below, the present chapter (Chapter 3) is suitably summarised and concluded, before transitioning to critically review past academic literature relating to the cognate concept of improvisation (Chapter 4).

3.8 Summary and conclusion

As established, the study seeks to ascertain how and why congruence (Allen et al., 2013) may be worked towards deliberately. Attention is directed to the constituent, stabilising, goal-driven action(s) of subject(s) or communities. Whereas RQ 1 is framed broadly enough to facilitate intentional behaviour generally, RQ 2 queries the role(s) of improvisation and bricolage specifically. This -the second of three literature review instalments- appraised academic literature associated with bricolage.

To begin, Section 3.2 characterised and clarified the concept. Research from a range of areas was then explored. In turn, these were: entrepreneurship (3.3); academic research (3.4); emergencies (3.5); and Information Technology (IT) & Information Systems (IS) (3.6). Standout theoretical insights from each were summarised. Following this, it was reasonable to reflect more generally (Section 3.7). Next, the last of three literature chapters (Chapter 4) reviews works relating to improvisation.

4 Literature review: Improvisation



4.1 Introduction

Stemming from close scrutiny of existing scholarship (Allen et al., 2013), improvisation attracted the interest of the present study. In accordance with the graphic (above), the third literature review instalment assesses past academic works relevant to improvisation. Section 4.2 initially characterises and clarifies the concept; it then becomes possible to further contemplate how improvisation and bricolage connect (Section 4.3). Following this, past research interest in a diversity of areas is explored. In order, its constituent sections cover: the arts (Section 4.4); Crises, emergencies and extreme events (Section 4.5); New Product Development (NPD) (Section 4.6); and Information Technology (IT) & Information Systems (IS) (Section 4.7). Summaries end each of these, and comprehension develops progressively.

This culminates with a more general reflection on the improvisation literature in Section 4.8. This briefly recounts the concept's history, its character and perceivable development. Appropriate methodological choices -as indicated by the works reviewed- are also foregrounded. Readers are reminded of an undesirably undeveloped aspect of the existing literature. Apparent associations with the concepts of congruence (Chapter 2) and bricolage (Chapter 3) are underlined. As with the CHAT concept of congruence (Section 2.5, Chapter 2), Section 4.9 goes on to discern what is/are interpreted as to be outstanding theoretical gap(s)/deficit(s) in the reviewed literature relating to bricolage *and* improvisation. In turn, this is shown to have informed the third of three research questions (RQ 3). Before transitioning to explicate methodological matters, Section 4.10 suitably summarises and concludes.

4.2 Characterising and clarifying the concept

The improvisation label stems from “proviso”, denoting prior “stipulation” (Weick, 1998: 544). The addition of an “im” prefix indicates the “opposite”: nothing is calculated a priori (Weick, 1998: 544) [*italics omitted*]. Moorman and Miner (1998a: 1) equate improvisation to “a convergence of composition and execution”; for them, “the narrower the time gap between composing and performing (or planning and implementation), the more that act is improvisational”. Accepting it as “an intriguing process”, Ciborra (1999b: 78) similarly suggests improvisation “is situated performance where thinking and action emerge simultaneously and on the spur of the moment”.

Miner et al. (2001: 314) go further, arguing that “improvisation requires material or substantive convergence”. They therefore insist on defining it as “the deliberate and substantive fusion of the design and execution of a novel production” (Miner et al., 2001: 314). As “purposeful human behavior”, improvisation is “intentional but extemporaneous” (Ciborra, 1999b: 78). Further apparent contradictions in its character, see it “simultaneously rational and unpredictable; planned but emergent; purposeful but opaque; effective but irreflexive; discernible after the fact, but spontaneous in its manifestation” (Ciborra, 1999a: 137).

Looking at music and organisations, Weick (1998: 544) identifies “improvisation deals with the unforeseen, it works without a prior stipulation, it works with the unexpected”. It contrasts with “strategic planning” (Ciborra, 1999a: 141), wherein “thinking and doing” are distanced (Mintzberg, 1994: 107). On its part, the latter suffers a number of “fallacies” (Mintzberg, 1994: 110). Although a planned approach prudently contemplates, it naively assumes future events can be foreseen; in actuality, Mintzberg (1994: 110) asserts, “the forecasting of discontinuities ... is virtually impossible”. This leads him to query the adequacy of strategic planning alone, arguing instead for flexibility.

Likewise, Crossan et al. (1996: 21) suggest “improvisation can be harnessed as a managerial technique for coping with the new reality of rapidly changing business environments”. Without overlooking the utility of “planning tools” outright, Crossan et al. (1996: 23) affirm “they are not enough”. That planning and improvisation are quite different, is clear. Whilst beyond the current scope, it is noted that improvisation also differs from innovation (Moorman and Miner, 1998a). Notwithstanding, Moorman and Miner (1998a: 4) argue “all improvisation, by definition, involves some degree of innovation because improvisation involves the creation of action outside current plans and routines”.

4.3 Connecting improvisation and bricolage

For present purposes, connecting improvisation and bricolage is more pressing. Apparent association was alluded to when reflecting on contributions relating to the concept of bricolage (Section 3.7, Chapter 3). In shifting to extant academic interest in the concept of improvisation, a familiar sentiment of similarity and/or closeness can be sensed. Most immediately and as already acknowledged, the two are often discussed together in scholarly works. From their reading of academic literature, Cunha et al. (1999: 302) define improvisation as “the conception of action as it unfolds, drawing on available material, cognitive, affective and social resources”.

“Organizational improvisation” moreover, inserts the clause: “by an organization and/or its members” (Cunha et al., 1999: 302) [italics omitted]. According to Cunha et al. (1999: 302), they are accounting for the “inseparability of... improvisation... and bricolage” [italics omitted]. In their own critical assessment, “the separate treatment that the concepts of improvisation and bricolage seem to be receiving from the literature is only apparent” (Cunha et al., 1999: 302) [italics omitted]. Startlingly, they draw attention to how in fact “some authors... use these concepts interchangeably, as synonyms” (Cunha et al., 1999: 302). Cunha et al. (1999: 313) regard bricolage to be “an integral part of the improvisation construct”.

From their perspective, “bricolage and improvisation are two lenses that can be used to look upon a single phenomenon” (Cunha et al., 1999: 308). Optimistically, “descriptive” -and potentially “explanatory” benefit- owes to “the two being brought together” (Cunha et al., 1999: 308). As established when reviewing the CHAT tradition and its concept of congruence (Chapter 2), the present study examines both bricolage and improvisation. At this point, past academic interest in improvisation is expounded.

4.4 Early interest: The arts

4.4.1 Introduction

To begin, academic interest in improvisation is recognised in the arts (e.g. Crossan et al., 1996; Weick, 1998; Kamoche and Cunha, 2001; Cunha et al., 1999; Berliner, 1994; Pressing, 1984; Mirvis, 1998; Crossan, 1998). Section 4.4.2 affords an intuitive and accessible introduction to many of the theoretical ideas attracting intrigue elsewhere. The broader relevance and applicability of improvisation to contemporary contexts also becomes clear. Section 4.4.3 summarises before advancing.

4.4.2 Pertinent literature

Much scholarly work on improvisation is written in relation to the arts, particularly jazz music (e.g. Crossan et al., 1996; Weick, 1998). In this domain, improvisation “entails composing and performing contemporaneously” (Kamoche and Cunha, 2001: 735). It is plausible to suppose these musicians invent “all or part of a [given] composition” on the spot (Ciborra, 1999a: 138). This remark seems to imply that instances of improvisation are not necessarily the same, but that they can differ. Indeed from their own review of the literature, Cunha et al. (1999: 310) elucidate how “improvisation is usually presented as a phenomenon that can be observed in varying degrees and forms”.

From Weick's (1998) work, they identify a conceptualisation which proposes a "four-level hierarchy" (Cunha et al., 1999: 310). Originally the brainchild of musician Lee Konitz, the division discerns how artists can adjust melodies to "varying degrees" (Berliner, 1994: 67). His "continuum [spans] from interpretation to [outright] improvisation" (Berliner, 1994: 67). Artists make modest changes during interpretation, whereas "embellishment" marks more moderate adjustments (Berliner, 1994: 69). At the penultimate level, "variation" entails "transfiguring the melody more substantially" still (Berliner, 1994: 70). Lastly, "the highest level of intensity" i.e. improvisation, involves heavily "transforming the melody" (Berliner, 1994: 70).

Elsewhere, Pressing (1984: 346) conceives "a continuum of possibilities between the extreme hypothetical limits of 'pure' improvisation and 'pure' composition". "Central to improvisation [, he notes,] is the notion of the 'referent'": the "underlying formal scheme or guiding image specific to a given piece, used by the improviser to facilitate the generation and editing of improvised behaviour on an intermediate time scale" (Pressing, 1984: 346). If absent, "or if it is devised in real-time, we speak of 'free' or 'absolute' improvisation" (Pressing, 1984: 346). Although these two takes differ on the details, both distance improvised efforts from the original or standard issue.

Moreover, there seems to be some consensus in the literature as to the foundations or antecedents of improvisation. Crossan et al. (1996: 28) reject that improvising musicians just "play notes randomly". Rather, they refer to "a rigorous method of learning the skill of improvising, requiring the initial development of the primary music skills" (Crossan et al. 1996: 28). Through practice, the musician develops a "personal "portfolio" for performance" (Crossan et al. 1996: 28). Additionally, Crossan et al. (1996: 28) highlight how "listening to other jazz performers as they improvise, as well as participating in jazz bands, also expands each musician's *repertoire*" [italics added]. Although advocating that "improvisation can be learned", they carefully caution it "must be grounded in a traditional skill base" (Crossan et al. 1996: 28).

This use of the term "repertoire" attracts attention, although in relation to improvisation, Crossan et al. (1996: 28) are not alone in applying it. Mirvis (1998: 587) exercises the same. In the present study, it is recognisable from the foregoing review of the bricolage literature (Chapter 3). In common, the repertoire referred to here appears to represent some kind of 'turn to' facility; its contents accumulate and are latterly drawn on when and/or where felt appropriate.

Berliner (1994) offers another, compatible explanation of how and/or why improvisation comes about. Again in relation to jazz, he notes "novices develop a storehouse of music from recordings

and from demonstrations" (Berliner, 1994: 64). What he closely terms "the repertoires... enable them to perform jazz at a fundamental level" (Berliner, 1994: 64). Of particular intrigue is his further suggestion, that the "repertoires... enable them to... prove themselves worthy of the assistance of experienced musicians" (Berliner, 1994: 64).

Perusing the literature, it is apparent that the relevance of improvisation extends way beyond the arts (e.g. Crossan et al. 1996; Mirvis, 1998; Weick, 1998). On his part, Ciborra (1999b: 80) contends that "improvisation belongs *fully* to ... everyday economic behavior" [italics added]. Converging, Weick (1998: 549) acknowledges it "occurs in settings as disparate as psychotherapy, medical diagnosis, and combat". In one article alluding to a wide variety of domains, Mirvis (1998: 587) argues "would be improvisers can up their odds by "practicing" with paradoxes and thereby prepare themselves, tactically and emotionally, to improvise when the stakes are raised". Among the "sorts of paradoxes" discerned, is so-called "rehearsed spontaneity" (Mirvis, 1998: 587).

To illustrate, he makes liberal reference to sports, as well as to the military. Like "performing arts", sports favour a "form of practice" involving "repetition" (Mirvis, 1998: 587). But herein, "top performers sometimes improvise" (Mirvis, 1998: 587). He cites Dennis Rodman -a basketball player- as engaging a weightlifting plan more appropriate for "contortionists"; the player also scours footage for opponent teams' weaknesses (Mirvis, 1998: 587). For Mirvis (1998: 587), "Rodman... has combined study and experience with practiced flexibility and elbowing", to his benefit.

"The point", Mirvis (1998: 587) clarifies, "is that you can't make something out of nothing". Elaborating, he reasons that "unless the performer has the move, step, or gesture in his or her repertoire, it is not likely to be evoked in the thrill or thrall of the moment" (Mirvis, 1998: 587). The "dress rehearsal" is also illuminated as allowing "potential improvisers the chance to "try out," say, a flying kick-on-goal" -or indeed other "actions that may need to be evoked spontaneously during an actual game, recital, or show" (Mirvis, 1998: 587).

Referring to "collective rehearsals", the benefits are seen to carry beyond the individual (Mirvis, 1998: 587). According to Mirvis (1998: 587), they can "enable a team or troupe to test its prearranged repertoire". In general, he recognises how "regular practice in dealing with the tension between following a prearranged plan versus adjusting to the exigencies of the moment helps individuals and groups get comfortable with the notion of improvising and gives them

comparatively low risk experience doing so" (Mirvis, 1998: 587). For Mirvis (1998), there is clear corporate applicability.

In a similar vein, Crossan et al. (1996: 30) perceive wider prospect in "improvisation exercises" contrived "for theatre training". To "management groups", they can offer a foundation "for team training" (Crossan et al., 1996: 30). Their application augments "skills" associated with "areas" such as "environment", "strategy", "organization members", and "organizational culture" (Crossan et al., 1996: 30). Beyond individuals, they "can enhance...group practice and performance" (Crossan et al., 1996: 34). But like musicians, these improvising "individuals must be highly trained"; only then are they able to "adapt the technique to management practice" (Crossan et al., 1996: 28).

In the "organizational setting", prerequisite "process skill" are "listening, coaching, and time management", whereas essential "substantive skills" align with the "trade" (Crossan et al., 1996: 28). Crucially, an improvising group "will only be effective if the individual[s]... have good basic management and technical skills" (Crossan et al., 1996: 28). Further, Crossan et al. (1996: 32) emphasise that "all improvisational activities need [what they term] a positive ambiance or culture". More palpably, they posit that "to improvise in real time, requires an environment that does not punish mistakes or criticize what might superficially look like foolishness" (Crossan et al., 1996: 32). Relatedly and from their reading of the literature, Cunha et al. (1999: 336) also note "necessary conditions for improvisation" and "influencing factors".

These concerns chime with insights in the literature relating to bricolage (Chapter 3). Regarding emergencies (Chapter 3, Section 3.5), Bechky and Okhuysen (2011: 250) expounded "processes enabling organizational bricolage"; elsewhere, the area of IT and IS (Section 3.6) reflected how bricolage was in essence supported by an organisation (Wynn, 1996). With respect to improvisation, Crossan et al. (1996: 33) advise businesses "create the necessary culture of commitment, risk taking, and innovation".

In a later article, Crossan (1998) makes complimentary points. "Improvisation exercises" are stressed as something in which "individuals can engage" to improve "their capacity to improvise" (Crossan, 1998: 594). "Workshops", moreover, are portrayed as "a very practical means to introduce and experience improvisation" (Crossan, 1998: 598). But vitally, reconciling "the art of improvisation with the practice of management" calls e.g. for "the expertise of improvisers to facilitate the exercises" (Crossan, 1998: 598).

Crossan (1998: 597) again alludes to “culture” and “environment”: each “needs to be able to tolerate mishaps for improvisation to work”. Although “audiences of improvisation are tolerant of some”, an absence, such as when an aeroplane departs, “may not be conducive” (Crossan, 1998: 598). Notwithstanding, “skills of improvisation in crisis” are emphasised as essential “even in these types of contexts”; an Apollo 13 incident illustrates how “lives were dependent upon their ability to improvise” (Crossan, 1998: 598).

Back on Earth, Weick (1998: 552) gives “good reasons why the idea of improvisation may have limited relevance for organizations”. One is that whilst a jazz performer seeks to supply “something that comes out differently than it did before... organisations typically” strive for “reliable performance” -and the resulting, “standardized” output (Weick, 1998: 552) [italics omitted]. Albeit, academic interest in improvisation extends far. Further areas are reviewed once insights from the arts are summarised.

4.4.3 Summary: Improvisation in the arts

The outgoing section provided a brief -but nonetheless illuminating review of improvisation- as understood in the first of four academic areas explored: the arts. Although this domain is distant from the present study, the selection of literature endowed valuable understanding; before progressing, prominent theoretical insights are summarised. These pertain to the nature of improvisation per se, as well as to apparent linkages with the concepts of bricolage and congruence. An opening point is that improvisation is clearly regarded as significant in the context of music performance -particularly jazz- and to theatre alike.

This established, arguably the most foundational idea found in this body of literature is the assumption that individual instances of improvisation can differ. Alternative conceptions even account for the differences differently, although those cited from Pressing (1984) and Berliner (1994) are perceptibly proximate. Crucially and on the basis that “no improviser... can avoid the use of previously learned material, and no re-creative performer can avoid small variations”, Pressing (1984: 346) reasons that neither “‘pure’ improvisation” nor “‘pure’ composition”, can be reached in reality. There seems to be consensus in the literature, that improvised episodes either do -or at least tend to- work from something precursory.

Towards explaining associated ideas, similar-sounding concepts are in no short supply. Whereas a “referent” relates to “a given piece” (Pressing, 1984: 346), “novices [also] develop a storehouse of music from recordings and from demonstrations” (Berliner, 1994: 64). The continuously growing “repertoires” are credited with permitting “them to perform jazz at a fundamental level”

(Berliner, 1994: 64). With seemingly the same or close meaning, others have employed the near-indistinguishable term “repertoire” (Crossan et al., 1996: 28; Mirvis, 1998: 587).

In the context of the present study, the *repertoire* label is notably recognisable from the review of literature attending to the concept of bricolage (Chapter 3). When referred to in respect of improvisation, it again denotes a cumulatively developed facility. Rather than presenting spontaneously, its containing contents increase and improve progressively through exposure and practice (Crossan et al., 1996). The repertoire is subsequently turned to, when improvising.

Closely related is that “improvisation can [itself] be learned” (Crossan et al., 1996: 28). From theatre, specialist “exercises” can be “used to develop the capacity to improvise” (Crossan, 1998: 593). This contended “capacity to improvise” (Crossan, 1998: 593) resonates with the notion of “bricolage capabilities” (Baker and Nelson, 2005: 357), cited in entrepreneurship (Section 3.3). Pertinent at present, such a capacity to improvise has been considered with respect to both individuals and groups (Crossan, 1998). For those in the arts boasting the capacity or capability, improvisation characterises much of ongoing performance.

This observation is analogous to insights foregrounded previously in the bricolage literature. Specifically, that bricolage captures a lot of what typifies academic research (Section 3.4) and IS development (Section 3.6). Likewise, improvisation in the arts accounts -at least somewhat- for how the activity continues. Theoretically, it appears to represent intentional means of instilling congruence. In summary, the above assortment of arts-related literature affords a gentle and palpable introduction to various theoretical ideas tied to the concept of improvisation. Underscored throughout, the relevance and applicability of improvisation carry more widely (e.g. Ciborra, 1999; Crossan et al. 1996; Mirvis, 1998; Weick, 1998). At this point, attention turns to appraise academic works on improvisation in crises, emergencies and extreme events.

4.5 Crises, emergencies and extreme events

4.5.1 Introduction

As emphasised, intrigue in improvisation transcends the arts. It can also feature in crises, emergencies and extreme events. In order, Section 4.5.2 consults: Garreau and Adrot’s (2009) and Adrot’s (2011) studies of the 2003 French heat wave; an examination of Latin American firefighters by Monares et al. (2011); Mendonca’s (2007: 952) research on the 2001 “World Trade Center” (WTC) atrocity; and Adrot and Mourmant’s (2009) ideas for assisting improvisation technologically. Section 4.5.3 summarises.

4.5.2 Pertinent literature

In the first study to be reviewed, Garreau and Adrot (2009) examined how practitioners improvised whilst a crisis was unfolding. This, they refer to as “crisis improvisation” (Garreau and Adrot, 2009: 2) [italics omitted]. Assessing extant literature, they convey concern at the lack of understanding around “how individual improvisation becomes collective and coherent” (Garreau and Adrot, 2009: 1) [italics omitted]. Nevertheless, significance is seen in the concept of sense (e.g. Weick, 1993).

Opting to appraise the 2003 French heat wave, they undertake a “retrospective analysis of the response from the national health network in Paris” (Garreau and Adrot, 2009: 1-2). As background, they clarify that “northern areas” of the county are not ordinarily disposed to such temperatures, and so what was faced was “unknown and threatening” (Garreau and Adrot, 2009: 2). Tragically, hyperthermia claimed thousands of lives. Health “units” were “overwhelmed” by patient numbers, and saw “unexpected shortages” e.g. of medication, ice, water, air-conditioning, and also personnel like nurses (Garreau and Adrot, 2009: 5). Attention centres on “Ile-de-France”, an especially “chaotic” area (Garreau and Adrot, 2009: 5-9). Here, hyperthermia was even less understood than elsewhere. Exacerbating matters, it coincided with a common holiday period, which meant fewer practitioners were available.

The case study is informed by interviews with practitioners, e.g. medical staff and management. Documentation like archival materials, research papers and news publications triangulate. Analysis is described as “interpretive” and “abductive”, with Garreau and Adrot (2009: 6) paying particular attention to Garreau (2009). Following Garreau (2009: 6), they think of “sense as the way people grasp the reality of a situation through cognitive elements, aims and affects”; Garreau and Adrot (2009: 6) mobilise this three-fold “sense framework to try to interpret the data”.

To briefly delineate its interconnected constituents, “cognition includes both beliefs and knowledge” (Garreau and Adrot, 2009: 3). Further, “affects refer to emotion and physical sensation” (Garreau and Adrot, 2009: 4). Lastly, “aims” equate to “actors’ purpose and the particular state they intend to attain”; they can be “individual” or collective” (Garreau and Adrot, 2009: 4). Findings suggest “sense plays a support role” in “three key processes necessary for crisis response” (Garreau and Adrot, 2009: 6). These are “detection, mobilization, [and] response” (Garreau and Adrot, 2009: 6).

Foremost, detection enabled practitioners to sense the crisis and issue “alerts, which mentally prepared them to improvise” (Garreau and Adrot, 2009: 7). Practitioners readily cognised “patients suffering”, but could not grasp why (Garreau and Adrot, 2009: 8). They “felt their very aim - taking care of patients - was questioned” (Garreau and Adrot, 2009: 7). Also, bodily senses exposed them to the extraordinary temperatures. Garreau and Adrot (2009: 7) note those detecting “may get mobilized to respond... or not”.

The sensemaking elements again contributed to *mobilization*. Practitioners were “shocked” to see the ill-matched premises and patient count; heightened alertness to their “mission”, moreover, saw them “multiply efforts and make do, in spite of local conflicts and misunderstandings” (Garreau and Adrot, 2009: 8). The sense of helping to combat a larger, nationwide issue “also enabled people to make do” (Garreau and Adrot, 2009: 9). The aspects of sense again featured in response. This stage accounts for “how individually mobilized actors react”, and it notably nests improvisation (Garreau and Adrot, 2009: 7). Intriguingly, “crisis and improvisation were most of the time taboo subjects”; “some managers” felt such disclosures would reflect negatively (Garreau and Adrot, 2009: 6).

Nevertheless, Garreau and Adrot (2009: 6) suggest “interviewees admitted at some point they had no choice other than improvisation”. Drinking water was scarce or otherwise “too hot”, and in one instance a director improvised by driving to a local shop to source some (Garreau and Adrot, 2009: 9). But Garreau and Adrot (2009: 9) explain that the tiring temperatures spurred practitioners towards speed and efficiency, even influencing “more convenient patterns of action”. The temperatures, together with time constraints and “required flexibility”, saw nurses attach wheels to air-conditioning units to enhance their mobility (Garreau and Adrot, 2009: 9).

Interestingly, Garreau and Adrot (2009: 10) also observe that “knowledge and good sense” were instrumental in addressing the crisis generally and the “lack of equipment”. Stemming from the shortage of air-conditioning, nurses submerged bed sheets in water, and used them to cover windows. The apparent idea was to lower the room temperature, in spite of the conditions outside. This tactic was not “taught in nurses’ school” (Garreau and Adrot, 2009: 10).

Improvisation is also attributed to “ideas association and cognitive reframing” (Garreau and Adrot, 2009: 10). In one illustration, improvising practitioners appropriated “painting hooks” as “hydrating solution hooks” (Garreau and Adrot, 2009: 10). For Garreau and Adrot (2009: 10), the exposure to fatalities “also made sense for efficiency and enriched professional aims”. It concretised their sense of worth, and was conducive to improvisation (Garreau and Adrot, 2009).

Recognising their work thus far focuses on the improvisation of individuals, Garreau and Adrot (2009) offer insights explaining theoretically how it came to be collective. A further “three mechanisms” are foregrounded (Garreau and Adrot, 2009: 11). These are argued to have allowed the aforementioned individuals “either to lead others to make sense of the situation”, i.e. to detect it as a crisis -or- “to mobilize them” in correspondence with the crisis-aligned “mission” (Garreau and Adrot, 2009: 11).

Firstly and through “informal discussion”, improvising practitioners conveyed “new ways of doing”, and as such, raised “mobilization” (Garreau and Adrot, 2009: 11). Secondly, just “witnessing” improvised efforts encouraged the “imitation” mechanism (Garreau and Adrot, 2009: 11). Lastly, bodies such as the Assistance Publique afforded “formal direction” via mediums like email and fax (Garreau and Adrot, 2009: 12). Garreau and Adrot (2009: 12) argue these three “enabled [the] collective improvisation to be coherent”.

Adrot (2011) looks back to the events of the 2003 French heat wave again in a later article. Whilst keeping the concern with improvisation, this subsequent study delves deeper into the application and significance of Information and Communication Technologies (ICT) in particular. More exactly, she seeks to shed theoretical light on how “users benefit (or not) from ICT when they interact to improvise collectively in crisis response” (Adrot, 2011: 2) [italics omitted].

A qualitative case study is supported by a variety of collection methods. Data is sourced from public hearings already undertaken by “two investigation commissions”, interviews with responding practitioners, and from relevant internal and external documentation (Adrot, 2011: 4). The “approach” (citing Corbin and Strauss, 1990; Orlikowski, 1996; Orlikowski and Hofman, 1997) and “methodology” (citing Strauss and Corbin, 2008) adhere to Grounded Theory (Adrot, 2011: 4).

Oscillating between the collected data and pre-existing theory, Adrot (2011: 1) discerns a “dispassionate communicative genre”, exhibited by “administrative actors” employing fax and email [italics omitted]. Following Orlikowski and Yates (1994), a “communicative genre” is recognised as a “repertoire of communicative practices and strategies that are associated with specific social codes and communication media” (Adrot, 2011: 5). Adrot (2011: 2) contends that “crisis responders’ participation in the ongoing improvisation *depended* on their communicative genres” [italics added].

Most generally, the newly unearthed genre was detrimental to “organizational improvisation” (Adrot, 2011: 1). It manifested variously, but for brevity only some ways are recited. One form it

took was “process narration”: the proclivity of practitioners, to curb the content of email correspondence to “ongoing processes and data” (Adrot, 2011: 5). The preoccupation with “reporting” meant “opportunities for improvisation were hardly discussed” at all (Adrot, 2011: 5). Another way in which the dispassionate communicative genre played out, is designated “data hunting” (Adrot, 2011: 5). This label corresponds with how practitioners persistently sought to obtain hard death count data. According to Adrot (2011: 5), this came at the expense of “discussing about the ongoing improvisation”. It also stopped practitioners “fuelling reflection with opinions and emotions, which [in turn] prevented expertise leadership from emerging” (Adrot, 2011: 6).

Exhibiting the dispassionate genre, email users were also “protecting from disapprobation” (Adrot, 2011: 6). Conscious of its inherent “transparency”, it served strategically as “proof of their responsiveness”; excessive “forwarding” however, largely displaced meaningful “discussion” (Adrot, 2011: 6). Appreciating the “traceability” of email and apparently so as to “prevent criticism”, the email users actually “avoided mentioning controversial content, which limited discursive exchanges about the widespread bricolage and improvisation practices” (Adrot, 2011: 6).

Clearly then, practitioners improvised nevertheless; they “developed new communication practices and strategies in relation to fax use” (Adrot, 2011: 7). The communication of “emotions and opinions” encouraged improvisation, whilst at the same time advocating “deviation from established uses of resources” (Adrot, 2011: 7). According to Adrot (2011: 8), this represented a theoretical departure or shift “from the usual dispassionate communicative genre to interact with improvisers”.

In one exemplar, a director from the AP-HP -the Assistance Publique-Hôpitaux de Paris- faxed “guidelines to hospitals”, legitimising intervention close to that commanded by the formal “White Plan” (Adrot, 2011: 7). “Enacting” as much “unofficially” and without the appropriate permissions, Adrot (2011: 7) points to deviation “from the rules that health care and civil protection organizations usually abide by”. The same fax candidly conveyed his own raw feelings on the state of affairs.

Nevertheless, fax users “could improvise over the dispassionate communicative genre” by adding detail with pens; reflecting on its materiality, Adrot (2011: 8) argues the method “facilitated the transformation of the dispassionate communicative genre into a more fervent way of interacting”. With the concept of communicative genres, the work distinguishes how different

technologies affected improvisation in an organisational crisis (Adrot, 2011). This is relevant to the present study, set in the context of IT provision.

In related research, Monares et al. (2011) illuminate improvisation among Latin American firefighters. Likely volunteers, “they have minimal support from governmental agencies” (Monares et al., 2011: 1255). At present, those party to response rely on radio technology to converse. Information is understandably essential, and “taking control of an urban emergency requires [it to be] quick and accurate” (Monares et al., 2011: 1255). But whilst radio brings “several benefits”, it is also a “limitation” (Monares et al., 2011: 1255, citing Carver and Turoff, 2007; Schöning et al., 2009; Turoff, 2002).

One issue is its inability to handle digital files; another constraint stems from the shortage of available channels. Anything beyond just three emergencies at the same time means sharing the main channel, which slows the exchange of information (Monares et al., 2011). Consequently, this can “force incident commanders (and also other firemen in the field) to improvise” (Monares et al., 2011: 1256). Given the situation, “they are not able to wait for additional information or for the channel to become available” (Monares et al., 2011: 1256). Backup channels exist, but even *their* “use... is a bit chaotic” (Monares et al., 2011: 1256). Curiously and in spite of a prescribed “protocol”, “urgent events typically push the firemen to break these rules” (Monares et al., 2011: 1256).

Monares et al. (2011: 1257) overview the “urban emergency response process”, beginning when a command centre takes receipt of an emergency call. At this point, they allocate fire truck(s). The first “officer” to the scene inherits the “incident commander (IC)” role, which involves informing the command centre of “crisis features” i.e. its particulars (Monares et al., 2011: 1257). Command-based practitioners then relay to approaching firefighters. Still, the firefighters must communicate with the IC for direction and information regarding how to respond. But each can be difficult to pinpoint: the radio channels may be exhausted, and even when located, the IC may be preoccupied. The IC “becomes a bottleneck”, and so “many... in the field have to improvise their response actions, sometimes with little supporting information or none at all” (Monares et al., 2011: 1257).

Monares et al. (2011: 1256) thus propose a technical solution, “Mobile Map”. Billed as a “mobile collaborative tool”, this software is envisaged for use alongside the antiquated radios (Monares et al., 2011: 1256). Its specification is extensive, e.g. it places the firefighter on a map, and identifies the whereabouts of fire response vehicles. “All functionality” gives access to “shared

information on-demand” (Monares et al., 2011: 1261). This resultantly “reduces the [existing] need of using the radio channels” (Monares et al., 2011: 1261).

Additionally and although “improvisation will be *always* present in emergency scenarios”, the prompt and high-quality information can inform improved decision-making on the ground (Monares et al., 2011: 1261) [italics added]. Beyond this, the organisation can gather valuable data for longer-term learning (Monares et al., 2011). The researchers tested the solution, and latterly involved actual firefighters responding to “typical emergencies” in Santiago in Chile (Monares et al., 2011: 1264). Following ten such events, Monares et al. (2011: 1264) elicited “users’ opinion” via focus group.

They also performed what they refer to as a “comparative study on fireman interactions with and without” the application (Monares et al., 2011: 1264). Findings are optimistic, indicating e.g. that drivers, as well as their assistants and those at command, perceived Mobile Map to lessen the time to reach the site. Pertinently, firefighters “felt more confident when they had to improvise an action, because they had additional supporting information” (Monares et al., 2011: 1265). The “interactions analysis” moreover, reflected “potential to reduce the radio channels [sic] usage” (Monares et al., 2011: 1265) [italics omitted].

Mendonça (2007: 952) expresses alike interest in improvisation in “extreme events” e.g. “natural or technological disasters”. Vital to responsive efforts, are “flexibility and an ability to improvise” (Mendonça, 2007: 953). Alluding to bricolage (Chapter 3), he also appreciates that the accompanying “risk and time constraint contribute to the need for response personnel to “make do” with resources that are or can be made available in time” (Mendonça, 2007: 953). “Events for which” a prepared response protocol is absent, “create the need for the responding organization to develop and deploy new procedures in real-time” (Mendonça, 2007: 954).

Fortunately, improvisation can attend to “unplanned-for contingencies” (Mendonça, 2007: 954). Improvisation “and preparedness [are perceived to] go hand in hand”: improvisation affords valuable “flexibility”, whereas being prepared promotes “clarity and efficiency” (Mendonça, 2007: 954). From literature in the arts (Section 4.4), Mendonça (2007: 954) goes on to foreground the notion of “referent” (citing Sarath, 1996; Pressing, 1988; 1998) [italics omitted]. In the context of “emergency response”, this could take the shape of a “standard operating procedure or a routine learned from experience” (Mendonça, 2007: 955). The referent represents a foundation “for a new course of action”, where events are “unplanned-for” (Mendonça, 2007: 955).

He also recognises “researchers have suggested that different *realizations* may arise from the same referent” (e.g. Berliner, 1994, cited by Mendonça, 2007: 955) [italics in original]. For jazz musicians, he clarifies, “a realization... is that which is played based on the referent” (Mendonça, 2007: 955). Referencing Rashbaum (2001), Mendonça (2007: 955) explains that when reacting to emergencies, the equivalent “realization may be a set of actions that follow a modified standard operating procedure”. In these scenarios, improvisation is a “two-stage process” (Mendonça, 2007: 955, citing Mendonça et al., 2001). Foremost, it is perceived that no protocols are applicable -or rather- that implementing a suitable one is impossible (Mendonça, 2007: 955). Of theoretical interest, Mendonça (2007: 955) disclaims: “no improvisation or planned-for procedure is guaranteed to have a desirable outcome”. The subsequent stage is designated to “the real-time development and deployment of new procedures” (Mendonça, 2007: 955).

Yet echoing the arts literature (Section 4.4), “improvisation may *range*[,] from substitution to the construction of new procedures” (Mendonça, 2007: 955) [italic added]. “Substitution... [signifies how] the responding organization “mixes and matches” existing procedures and/or the materiel [sic]” they utilise (Mendonça, 2007: 955). This is close to the conduct of a SWAT team, which responsively switched routine (Bechky and Okhuysen, 2011, Chapter 3). “The other end of the spectrum”, i.e. construction, sees “the organization... develop new procedures and possibly find new materiel [sic]” (Mendonça, 2007: 955).

From existing work, Mendonça (2007: 956-957, citing Stuart and Bostrom, 2002) recites attributes of “extreme events... important for decision making”. The six comprise “rarity”, “uncertainty”, “high and broad consequences”, “complexity”, “time pressure”, and “multiple decision makers”; they are also significant to “decision support” (Mendonça, 2007: 956-957). Mendonça (2007: 957) mobilises them to arrive at “a preliminary set of opportunities for designers of decision support systems” (DSS).

For example and in acknowledging “time pressure forces a convergence of planning and execution”, (Moorman and Miner, 1998b, cited by Mendonça, 2007: 957), the system could shorten “search time by supporting divergent and convergent thinking” [italics omitted]. “Support [for] information seeking” could address inherent “uncertainty” (Mendonça, 2007: 957) [italics omitted]. “Support [for] collaboration, negotiation and data sharing” moreover, could accommodate “multiple decision makers” (Mendonça, 2007: 957).

Mendonça (2007) progresses by employing empirical evidence pertaining to the 2001 World Trade Center (WTC) terrorist attack in New York City (NYC). He starts by isolating “cognitive-level

issues... in responding to extreme events”, whilst voicing heightened interest in any “impact[ing] interdependent critical infrastructures” (Mendonça, 2007: 953). From this, he proffers “requirements and challenges for computer-based systems intended to support cognition in extreme event decision making” (XEDM) (Mendonça, 2007: 953).

He initially found news publications on incidents resulting from 9/11. Specifically, those seen by the U.S. government as entailing critical infrastructures (Mendonça, 2007: 958, citing President’s Commission on Critical Infrastructure Protection). Contact was made with people from “responding organizations”, the sample comprising “public and private” (Mendonça, 2007: 958). Data came from around 30 interviews, and in some cases internal and external documentation. Crediting Hoffman et al. (1998) and Klein et al. (1989), he assumed the “critical decision method” (CDM) so as “to elicit knowledge from study participants” (Mendonça, 2007: 958). This, he notes, is an adaptation of Flanagan’s (1954) critical incident technique (CIT).

Participants also returned questionnaires, one relating to “professional training and background” (Mendonça, 2007: 958). Based on studies by Miner et al. (2001) and Moorman and Miner (1998b), another sensed “organizational improvisation, organizational memory and the evaluation of the response” (Mendonça, 2007: 958). Mendonça (2007) centres on the case of a telecommunication facility -and how its personnel addressed a power outage. Evidence is supplied “primarily” by the organisation’s “senior network operations manager”; it comprises an interview and documentation, e.g. “after-action reports” (Mendonça, 2007: 959). In that the impeded infrastructure supported vital services, its return to power was urgent. “Time pressure” stemmed from governmental and “company culture” (Mendonça, 2007: 960).

Ordinarily, they would draw on generators to provide charge to batteries and the assembly of machines. But the basement housing them was flooded, and debris also interfered. Ultimately, “standard operating procedure” was ruled out (Mendonça, 2007: 960). Rather -and as part of their response- they decided in a “split-second” to attach alternative, mobile generators; it was also necessary “to clean the environment and equipment” beforehand, to avoid “additional failures” (Mendonça, 2007: 960).

Mendonça (2007: 960-961) speculates that “the standard procedure... would likely have been to connect via the basement hookups”. But the pollution “made this procedure unexecutable”, and so they instead linked the generators straight to each benefiting level (Mendonça, 2007: 961). Questionnaire responses indicated that “standard approaches and procedures were not available but that prior knowledge and skills were highly relevant”, and “that the response was

highly improvised” (Mendonça, 2007: 961). Mendonça (2007: 963) understands “the new procedure” as a “realization of the referent”, in that “it entailed the modification of an existing procedure and the use of unplanned-for materiel [sic]”.

More precisely, “two materiel [sic] substitutions” are identified: the mobile generators rather than those prescribed, and makeshift electrical interfaces instead of those in the basement (Mendonça, 2007: 963). Changes to the building risers further represented “procedural modifications” (Mendonça, 2007: 963). Mendonça (2007: 963) posits that “a procedure was also added” inasmuch as “the cleaning crew was called in to clean the building environment”. In this respect, the improvised response to the extreme event comprised multiple actions and was collaborative in character. Although eventually successful, it was less than straightforward.

Ultimately, Mendonça (2007: 964) specifies “requirements for extreme event decision support systems”. Such systems must be able to discern “unplanned-for contingencies”, and “retrieve or infer a [suitable] referent” (Mendonça, 2007: 964). They must further produce “one or more new procedures... derived from this”, which “can be executed in a timely fashion” (Mendonça, 2007: 964). They should ideally “communicate and collaborate with human decision makers”, i.e. those involved in response, and even “reason about interdependent physical systems and the models that represent them” (Mendonça, 2007: 964).

In keeping with Mendonça (2007), Adrot and Mourmant (2009: 1276) isolate improvisation as “a core dimension of crisis response”. They seek to better comprehend the cognition underpinning “improvisation in crisis response”, and to establish “IT requirements and IT artifacts” to aid it (Adrot and Mourmant, 2009: 1277). Inspired by Beach’s (1998) Image Theory, they propose “a new approach” (Adrot and Mourmant, 2009: 1277). Adrot and Mourmant (2009: 1277) argue organisational crises call for “quick and innovative response[s]”, regardless of “time and emotional pressure”.

Improvisation can assist in addressing “complexity”, and also “to figure innovative responses to crisis in a short delay” (Adrot and Mourmant, 2009: 1276). For Adrot and Mourmant (2009: 1277), it “compliments Business Continuity Planning (BCP)”. Following Mendonça and Wallace (2007), they regard improvisation as a “two steps [sic] process”: respectively, these involve “bringing up and developing new ideas”, and selecting “the most adequate” from “emerging solutions” (Adrot and Mourmant, 2009: 1278). “Idea development” then, is internal to improvisation (Adrot and Mourmant, 2009: 1278).

From their reading of past literature, moreover, they acknowledge this has been accounted for in different ways. Pertinent to the present study, Cunha (1999) has cited bricolage, whilst Ciborra (1996) has talked about tinkering (Adrot and Mourmant, 2009: 1278) (Chapter 3). These have been drawn on “to define how actors elaborate new ideas” (Adrot and Mourmant, 2009: 1278). Influenced by Mendonça (2007, above), Adrot and Mourmant (2009: 1278) leverage existing academic literature on crises and improvisation to inform “design” or “tool requirements”. A “user-friendly and intuitive interface” (Graphical User Interface, GUI) is necessary to accommodate “emotional and time pressure” (Adrot and Mourmant, 2009: 1278).

The tool should also facilitate the “two-step cognitive process that requires support to creativity and selection” (Adrot and Mourmant, 2009: 1278). Adrot and Mourmant (2009: 1278) contend creativity can be bolstered by complimenting “existing knowledge” with “other [i.e. additional] sources”. “Graphical representation and manipulation of ideas as objects” can help with selection, meanwhile (Adrot and Mourmant, 2009: 1278). They also encourage regular use of the tool - even exterior to crises- “as crisis is not predictable” (Adrot and Mourmant, 2009: 1278).

Adrot and Mourmant (2009: 1278) go on to assert how “idea selection corresponds to the screening process described by image theory”. Citing Niederman et al. (2007) and Joseph et al. (2007), they recognise image theory as an “influential decision-making theory that has been used in the IS field” (Adrot and Mourmant, 2009: 1279). It has a number of “main mechanisms” (Adrot and Mourmant, 2009: 1279), but their full exposition is beyond the present scope. Suffice to suggest, aspects of image theory are also worked into “design requirements” of the proposed system (Adrot and Mourmant, 2009: 1280). In essence, its intrinsic “screening process” enables “users to access to select the appropriate solution amongst multiple candidates” (Adrot and Mourmant, 2009: 1280).

To identify and present them to users, they integrate ideas of ontology and semantic distance. Ontology “has been defined as an index of formalized notions that are interrelated to each other’s semantically” (Adrot and Mourmant, 2009: 1281). The advocated “artifact” brings together “the users’ ontology”, notably “internal and specific” -and the “external ontology”, which is “general”; this “opens a new window on new semantics so as to bring up new ideas for improvisation” (Adrot and Mourmant, 2009: 1281). To appraise connectedness, they employ semantic distance.

Adrot and Mourmant (2009: 1282) define more “design requirements”. They suggest the system should display “hypernyms and hyponyms for each part of the descriptions of the crisis” (Adrot

and Mourmant, 2009: 1282). New “keywords” show on the basis of semantic distance; the system should cater for changes to the semantic distance, as desired and/or appropriate (Adrot and Mourmant, 2009: 1282). Its workings are illustrated effectively by a hypothetical example. A user would initially use the system to input a description, including details of the crisis. The system considers this when consulting ontologies for connected keywords. Relevant images are looked for online and displayed onscreen. Adrot and Mourmant (2009: 1283) explain that “elements are... automatically linked to one another”, and are manipulable.

The user is able to “select” or “reject” the “constituents” (Adrot and Mourmant, 2009: 1283). The idea is that “one or several images (combination of different constituents) emerge and lead to one or several solutions” (Adrot and Mourmant, 2009: 1283). These can either be “saved” or deployed immediately (Adrot and Mourmant, 2009: 1283). Although just “a prototype has been developed and tested” at present, Adrot and Mourmant (2009: 1283) have encouraging intentions to test, evaluate, and ultimately improve it.

4.5.3 Summary: Improvisation in crises, emergencies and extreme events

The preceding pick of past works imparts relevant theoretical insight. Most immediately, this regards improvisation in crises (Garreau and Adrot, 2009; Adrot, 2011), emergencies (Monares et al., 2011) and extreme events (Mendonça, 2007). Additionally, and although congruence (Chapter 2) receives no explicit mention, a connection can be inferred. Salient ideas are now summarised before looking to further academic literature.

Foremost, the review illuminates the significance of improvisation to crises, emergencies and extreme events. The 2003 French heat wave -a crisis- witnessed both individual and collective improvisation (Garreau and Adrot, 2009). Its exercise also extends collectively among Latin firefighters responding to emergencies (Monares et al., 2011). Likewise and in the aftermath of 9/11 -an extreme event- the largely improvised response received input from multiple parties (Mendonça, 2007).

Exact explanations for the emergence of improvisation can vary. Not least it seems, because of idiosyncratic differences between belonging episodes. In the main however, the reasons relayed are similar: a shortage or inadequacy of resources, e.g. water (Garreau and Adrot, 2009), or of radio channels and/or information (Monares et al., 2011). Time pressure and/or urgency can contribute (Monares et al., 2011), and it has shown when “standard approaches and procedures were not available” (Mendonça, 2007: 961).

There is a continuation of the idea from the arts literature (Section 4.4), that improvised efforts are not entirely baseless. Rather, instances of improvisation are again argued to work from a “referent” (Mendonça, 2007: 954, citing Sarath, 1996; Pressing, 1988; 1998) [italics omitted]. In “emergency response”, it just assumes a different form, e.g. a “standard operating procedure or a routine learned from experience”, adapted as necessary (Mendonça, 2007: 955).

Further, familiar ideas are found in this body of literature. In the 2003 French heat wave study, the co-presence of improvisation and bricolage is abundantly clear (Adrot, 2011). Behaviour of both kinds was acknowledged as “widespread”, and similarly significant to the healthcare response (Adrot, 2011: 6). In a certain sense, this corroborates Weick’s (1993: 638) claim that “improvisation *and* bricolage” are “sources of resilience” [italics added] (Chapter 3). Staff using email in the French heat wave nevertheless kept away from “mentioning” what was felt to be “controversial content” (Adrot, 2011: 6). This in turn, limited dialogue pertaining to the two.

This detail is to some extent analogous to one in the bricolage literature (Chapter 3, Section 3.4). In particular, that the “epistemic script of bricolage” -often adhered to by scholars- lacks legitimacy: a perception which sees it concealed in public presentations (Boxenbaum and Rouleau, 2011: 282). More optimistically, what stands out from works in this area, is the strong academic appetite to assist practitioner(s) technically. Monares et al. (2011: 1256) convey a considered “mobile collaborative tool”, whilst Mendonça (2007: 964) specifies “requirements for extreme event decision support systems”. On their part, Adrot and Mourmant (2009: 1277) identify “IT requirements and IT artifacts” aiming to aid “improvisation in crisis response”. But the aim is not to eliminate improvised efforts outright; “improvisation [indeed,] will be *always* present in emergency scenarios” (Monares et al., 2011: 1261) [italics added].

From this body of past research, it is clear improvisation is important in crises, emergencies and extreme events. Somewhat or fully, the concept captures individual or collective efforts to continue or resume practice. Reintroducing CHAT vocabulary (Chapter 2), improvised action(s) are read as intentional means by which the Object is worked towards; in short, improvisation is interpreted to promote the congruence of inherently contradictory activity. Next, attention advances to further academic literature.

4.6 New Product Development (NPD)

4.6.1 Introduction

Improvisation is also relevant to NPD. In turn, Section 4.6.2 reviews: Pavlou and El Sawy's (2010: 443) idea of "improvisational capabilities"; Eisenhardt and Tabrizi's (1995: 84) comparison of a "compression model" with an improvisation-reliant "experiential" alternative; Moorman and Miner's (1998a: 1) conceived "convergence of planning and execution"; their latter work on "organizational improvisation" (Moorman and Miner, 1998b: 698); a link between organisational improvisation and learning (Miner et al., 2001: 304); improvisation in respect of "NPD teams" (Magni et al., 2013: 1009); Brown and Eisenhardt's (1997: 1) study of "the art of continuous change"; and Kamoche and Cunha's (2011: 733) work on "minimal structures". Section 4.6.3 summarises.

4.6.2 Pertinent literature

Although discernibly distant from the outgoing domain, the opening study shares a similar interest in improvisation against a backdrop of "environmental turbulence" (Pavlou and El Sawy, 2010: 443). This denotes "general conditions of unpredictability because of changes in customer needs, new technologies, and strategic moves by aggressive competitors" (D'Aveni, 1994, cited by Pavlou and El Sawy, 2010: 446). In NPD, this is "prevalent" (Pavlou and El Sawy, 2010: 446). From Holsapple and Jin (2007), Pavlou and El Sawy (2010: 444) note how environmental turbulence may be construed as "waves" or "storms". Whereas waves are "roughly predictable in their pattern", storms "are rapid, have a strong impact, and occur unexpectedly" (Holsapple and Jin, 2007, cited by Pavlou and El Sawy, 2010: 444).

They go on to recognise "dynamic capabilities" (Teece et al., 1997; Eisenhardt and Martin, 2000; Teece, 2007, cited by Pavlou and El Sawy, 2010: 444). These signify "specific capabilities" which see organisations turn "existing operational capabilities into new ones", more optimally paired with the environment (Teece et al., 1997; Eisenhardt and Martin, 2000; Teece, 2007, cited by Pavlou and El Sawy, 2010: 444). Yet whilst "best suited" to waves, "they may not be appropriate... in stormy environments with unpredictable change" (Pavlou and El Sawy, 2010: 444, citing Winter, 2003). They "may not [even] be possible to exercise in unexpected events, [e.g.] as they require prior planning" (Pavlou and El Sawy, 2010: 444).

Pavlou and El Sawy (2010: 444) thus posit "improvisational capabilities... for reconfiguration in turbulence", i.e. "the ability to spontaneously reconfigure existing resources to build new

operational capabilities to address urgent, unpredictable, and novel environmental situations". These are appropriate in storms, where "procedures offer little or no guidance, and spontaneity in identifying novel configurations is preferred" (Pavlou and El Sawy, 2010: 444). They are "collective" in character (Pavlou and El Sawy, 2010: 444-5).

Moreover, "improvisational capabilities can be enhanced with appropriate IT" (Pavlou and El Sawy, 2010: 456). Pavlou and El Sawy, (2010: 445) consider the "IT-leveraging capability" of three NPD IT solutions: "project and resource management systems" (PRMS), "organizational management systems" (OMS), and "cooperative work systems" (CWS). Past works influenced a number of interrelated hypotheses, and inspired measures worked into their data collection instrument. Pavlou and El Sawy (2010: 458) carried out "two studies" in all, drawing on members of US NPD management. Participants identified "a[n] NPD work unit they were managing" in the survey supplied (Pavlou and El Sawy, 2010: 459). The partial least square method (PLS) was subsequently employed in analysing the quantitative data.

The study offers a number of findings, most immediately indicating an "empirical distinction" between improvisational and dynamic capabilities (Pavlou and El Sawy, 2010: 464). Via reconfiguration of operational capabilities, each represents "unique complimentary means for building a competitive advantage" (Pavlou and El Sawy, 2010: 464). In heightened turbulence, the "competitive role of dynamic capabilities" declines; it "gives way" to its improvisational counterpart (Pavlou and El Sawy, 2010: 465). Far from "failure of planning or a liability", improvisational capabilities are regarded as "an asset and a [figurative] "third hand" (Pavlou and El Sawy, 2010: 465).

In turbulent environments, findings further reveal a "differential effect of the effective use of [the] three IT systems on improvisational and dynamic capabilities" (Pavlou and El Sawy, 2010: 465). Especially in turbulence, "IT-leveraging capability" is "more... positively associated with improvisational capabilities" if functionality allows resource management (PRMS) and collaboration (CWS) (Pavlou and El Sawy, 2010: 443). Citing Mendonça (2007), Pavlou and El Sawy (2010) argue they add to works which aim to assist improvisation with IT (Section 4.7).

Like Pavlou and El Sawy (2010), Eisenhardt and Tabrizi (1995) have an interest in improvisation in product development. They look at "rapid adaptive processes", seeing "product innovation as a crucial adaptive process" (Eisenhardt and Tabrizi, 1995: 86). From different streams of past literature, they establish and test "two theoretical models" (Eisenhardt and Tabrizi, 1995: 86). These are the "compression" and "experiential" model[s] (Eisenhardt and Tabrizi, 1995: 84).

Although each of the corresponding “*strategies* accelerate product development”, there remain differences (Eisenhardt and Tabrizi, 1995: 88) [italics added].

Foremost, the “compression strategy” assumes “development is a predictable or certain process... that can be planned out as a series of discrete steps” (Eisenhardt and Tabrizi, 1995: 88). The logic holds that by reducing the time these take, the “process” overall can be “compressed” (Eisenhardt and Tabrizi, 1995: 88). Products are thus developed quicker. Differentially, the “experiential strategy” assumes development walks a “very uncertain path through foggy and shifting markets and technologies” (Eisenhardt and Tabrizi, 1995: 88). From this premise, “the key” to quick development lies in swiftly erecting “intuition and flexible options in order to learn quickly about and shift with uncertain environments” (Eisenhardt and Tabrizi, 1995: 91). It remains crucial to “create structure and motivate pace” (Eisenhardt and Tabrizi, 1995: 91, citing George, 1980 and Weick, 1993).

Eisenhardt and Tabrizi (1995: 86) set forth a number of hypotheses relating to the strategies, and these were then reconciled with data from what is recognised as a “fast-paced, global computer industry”. The sample comprises 36 European, US and Asian companies, mirroring the industry’s de facto makeup. They take to examining at the “product development project” level (Eisenhardt and Tabrizi, 1995: 95). Each company provided data on two such projects: one “major” and one “medium-sized development” (Eisenhardt and Tabrizi, 1995: 95). The “sample of projects” i.e. product categories, again matched the “composition of the industry” (Eisenhardt and Tabrizi, 1995: 96).

Personnel including management and manufacturing staff completed a comprehensive instrument. Researchers latterly “gather[ed] qualitative and observational data” (Eisenhardt and Tabrizi, 1995: 97). Eisenhardt and Tabrizi (1995) proceeded to perform quantitative analysis. Results relating to the compression strategy were particularly interesting. Their “overall regression” was found to be statistically significant (Eisenhardt and Tabrizi, 1995: 101). But against what was hypothesised, efforts to plan in advance, raised participation of suppliers, and the use of CAD software (Computer-Aided Design) all acted to the detriment of quick development, i.e. in fact slowing it.

With respect to the experiential strategy, “the overall model” was again shown to be “significant” (Eisenhardt and Tabrizi, 1995: 102). More specifically, increased “design iterations” and time spent on testing, and shorter timeframes between “milestones”, are linked to quicker product development (Eisenhardt and Tabrizi, 1995: 102). Eisenhardt and Tabrizi (1995: 102) also

associate it with “whether the [respective] project manager reported to the SBU [(Strategic Business Unit)] manager”.

The study foregrounds how “fast product development emerges as more uncertain than predictable, more experiential than planned, and more iterative than linear” (Eisenhardt and Tabrizi, 1995: 104). Of the two strategies, the experiential option is “more germane to unpredictable projects” (Eisenhardt and Tabrizi, 1995: 106). Relevant to the present research, improvisation is identified alongside “real-time interaction” and “flexibility”, as “essential” to it (Eisenhardt and Tabrizi, 1995: 107).

In related work, Moorman and Miner (1998a: 1) cognise common sentiment among marketing scholars: that planning of a “marketing strategy” should take place before its motioning. Querying as much, they contend that the two can unfold in close proximity or even at the same time. “Such a convergence of composition and execution” is submitted as improvisation by definition, with smaller intervals indicating more in its way (Moorman and Miner, 1998a: 1). Remaining in NPD, Moorman and Miner (1998a: 4) take to examining “organizational improvisation”, i.e. that attributed to “groups, departments, or whole organizations” [italics omitted].

Informed by relevant literature, they present what they refer to as “arguments about the incidence and effectiveness of improvisation in organizations” (Moorman and Miner, 1998a: 5). Ultimately, they advance an assortment of hypotheses which comprise a conceptual framework. The longitudinal study draws on data from two “midsized” companies, noted as having established “product development processes” (Moorman and Miner, 1998a: 9). “SeeFoods” is a food company, whereas “FastTrack” develops electronic instruments (Moorman and Miner, 1998a: 9). Moorman and Miner (1998a: 9) concentrated on a solitary development at each, and by sitting in on meetings, researchers were able to pinpoint “action events” i.e. “discrete activities undertaken by a new product development unit”.

To lessen their sample, they “randomly selected” just two per meeting, (Moorman and Miner, 1998a: 9-10). In the following week, participants filled in an instrument, scoring the focal “action”, and other “activities” that happened beforehand and simultaneously; after around four weeks, those participants filed a further assessment of the corresponding action’s “short-term impact” (Moorman and Miner, 1998a: 10). “Team leaders” are regarded “key informants” (Moorman and Miner, 1998a: 10). A hundred questionnaire responses were received. Moorman

and Miner (1998a: 12) then subjected their hypotheses to “three distinct model testing approaches” (Moorman and Miner, 1998a: 12).

In the most elementary sense, data demonstrate “organizational improvisation” was at play (Moorman and Miner, 1998a: 12). Following the earlier hypothesising, results are organised by “the incidence” and “effectiveness of improvisation” (Moorman and Miner, 1998a: 12) [italics omitted]. Findings are acknowledged to be varied. As hypothesised, “environmental turbulence” is foregrounded as a “positive predictor of the level of improvisation” (Moorman and Miner, 1998a: 12). Yet contrary to hypothesised, “real time information-flows” were not found to significantly promote its occurrence (Moorman and Miner, 1998a: 12). As anticipated however, “organizational memory” is negatively associated with the “level of improvisation” (Moorman and Miner, 1998a: 12).

Heightened turbulence in the environment, moreover, was found to favour the effect of improvisation on “design effectiveness”; in calmer environments, improvisation instead acted to its detriment (Moorman and Miner, 1998a: 12). Findings further indicate that information flows positively mediated the relation between improvisation -and “design” and “market effectiveness” (Moorman and Miner, 1998a: 12). But contrary to hypothesised, this did not carry e.g. to cost and time efficiency (Moorman and Miner, 1998a: 12).

On its part, organisational memory did elevate the effect of improvisation on these and more, e.g. “team learning” (Moorman and Miner, 1998a: 13). The same extended to “design effectiveness”, but not “market effectiveness” (Moorman and Miner, 1998a: 13). These findings are of particular intrigue: whilst “[organisational] memory reduces the likelihood of improvisation” happening in the first place, it also appears to raise its “effectiveness” once underway (Moorman and Miner, 1998a: 15).

For Moorman and Miner (1998a: 15), this reflects why “improvisation... involves trade-offs and potential synergies for marketing organizations”. Rather than a “free good” bringing “effective outcomes in *all* conditions”, they reinforce that it “must be directed explicitly”, and that all it involves be comprehended and overseen with care (Moorman and Miner, 1998a: 15) [italics added]. Organisational improvisation -particularly of a “collective” kind- is of interest in a further article (Moorman and Miner, 1998b: 704).

In keeping with their previous work, Moorman and Miner (1998b: 706) presume the direct relationship between improvisation and “organizational outcomes” is “neutral”. They instead

contend its “effectiveness” is contingent on “the processing of stored knowledge”: “organizational memory” (Moorman and Miner, 1998b: 706) [italics omitted]. More precisely, on “procedural memory” i.e. “skill or action knowledge” and on “declarative memory” i.e. “fact knowledge” (Moorman and Miner, 1998b: 706).

Foremost, they present propositions pertaining to their differential mediating effects on coherence, speed and novelty (Moorman and Miner, 1998b: 709-713). Heightened procedural memory, for example, is proposed to promote the chances of coherent and timely “action”, but also to reduce its novelty (Moorman and Miner, 1998b: 709) [italics omitted]. In support of the last outcome, Moorman and Miner (1998b: 710) recall how firefighters at Mann Gulch “were unwilling to “drop their packs and tools” to “run faster” to escape catastrophic death” (citing Weick, 1996: 1).

Regarding declarative memory, raised levels are reckoned to lift the chances of “coherent” and “novel action” (Moorman and Miner, 1998b: 710-711) [italics omitted]. Simultaneously however, the same is suggested to influence “action that proceeds at a slower pace” (Moorman and Miner, 1998b: 711-712) [italics omitted]. Citing Singley and Anderson (1989: 220), Moorman and Miner (1998b: 71) rationalise this by noting how “vast amounts” of “potentially relevant” declarative memory produces “problems of search”. In that these memory types counteract “one another’s weaknesses”, they can be considered “complementary competencies” (Moorman and Miner, 1998b: 712). Moorman and Miner (1998b) anticipate that the two together will perhaps be most conducive to improvisation characterised by all three outcomes.

They further propose that instances of improvisation “can serve as unplanned experiments that generate changes” to the memory (Moorman and Miner, 1998b: 714) [italics omitted]. They lastly entertain the idea that via practice, “an effective improviser” can “acquire... a general skill or competency in improvisation itself” (Moorman and Miner, 1998b: 714). More exactly, they propose that raised “organizational improvisation” will promote the probability that the “organization” comes to “develop a higher-order organizational competency in improvisation over the long run” (Moorman and Miner, 1998b: 715) [italics omitted].

In all, the article contributes a well-considered and informed array of propositions. Whilst the study is liberal in this regard, Moorman and Miner (1998b) stop shy of attempting any formal testing. Responsibly, it should also be recalled that their related reasoning was previously shown to falter (Moorman and Miner, 1998a). Credit where due, however: they do valuably discuss

viable ways in which future research efforts could proceed. As becomes apparent, the outgoing class of criticism cannot be claimed of the next study looked at (Miner et al., 2001).

Miner et al. (2001: 304) acknowledge emphasised academic attention on the idea that “organizational memory” -itself the “result of prior learning”- “shapes the skillful and fruitful improvisation of novel performances”. There is identifiably less understanding of “how improvisation affects learning” (Miner et al., 2001: 304). Ultimately, they “conclude that improvisation can fruitfully be seen as a special type of short-term or real-time learning” (Miner et al., 2001: 306).

Miner et al. (2001) undertook a longitudinal study of two companies, pseudonymised as before (Moorman and Miner, 1998a). FastTrack is involved in “technology products”, and Seafoods, food (Miner et al., 2001: 306). At each, they sat in at around “50 product development meetings” (Miner et al., 2001: 306). They observed “team meetings” for a single “project at each site”, and interviewed pertinent personnel (Miner et al., 2001: 307). They also leverage archival material.

Manifesting three ways, “direct outcomes” of improvisation are labelled “improvisational productions” (Miner et al., 2001: 309). “New behaviors” i.e. “behavioral productions”, saw “teams” improvise “processes” i.e. “sequences of behavior” (Miner et al., 2001: 309). As an example, Seafoods personnel were meant to visit outlets offering alike products. On one occasion however, they went to shops stocking different products, but which boasted comparable packaging. For Miner et al. (2001: 310), this was a “new activity”.

“Physical structures” or “artifactual productions”, moreover, tell of how “teams... actually created new physical structures without prior design” (Miner et al., 2001: 310). In one exemplar, FastTrack personnel spontaneously devised a novel circuit board capable of interfacing with wiring which had unexpectedly failed to satisfy requirements. Common to the two companies, improvisation could lastly manifest as “new interpretive frameworks” i.e. “interpretive productions” (Miner et al., 2001: 309). In one illustration, FastTrack personnel appreciated that the performance of a certain component would vary. Options were discussed, and an engineer proposed that colleagues inform him of any well-performing part, such that he could then contact the customer and offer it to them. Via the “interpretive improvisation”, FastTrack “transformed” an issue that could have otherwise jeopardised the customer company’s assessment of its product quality (Miner et al., 2001: 312).

Ensuing from scrupulous study, Miner et al. (2001: 313) tender a revised definition of improvisation and reassess its association with “related constructs”. From their findings, they foreground the apparent “inseparability” of “design” and “action” (Miner et al., 2001: 313-314). Improvisation they insist, “requires material or substantive convergence”; it is taken to denote “the deliberate and substantive fusion of the design and execution of a novel production” (Miner et al., 2001: 314). In further elaboration, Miner et al. (2001: 315) contend “improvisation... can be conceived of as a special form of short-term learning”. What is advanced to unfold, is that “real-time experience informs novel action *at the same time* that the action is being taken (during the act)” (Miner et al., 2001: 316) [italics added]. A “contemporaneous quality” is thus argued to set it apart from other kinds of learning -for which past experience is crucial to “changed behavior or knowledge” (Miner et al., 2001: 316).

Miner et al. (2001: 316) further sought to understand what influenced “the specific designs or composition” in the instances of improvisation unearthed. Ultimately, they appropriated the notion of “referents” from relevant past research (Pressing, 1984, cited by Miner et al., 2001: 316) (Section 4.4). At the sites sampled by their own study, “unexpected problems, temporal gaps, and unanticipated opportunities provided crucial referents that anchored and constrained the improvisational episodes” (Miner et al. 2001: 316).

Miner et al. (2001: 319) continue to consider improvisation more extensively, alongside “experimental learning” and “trial-and-error learning”. Characteristically, the improvisation was marked by high “issue and time” specificity; “knowledge creation”, moreover, was neither the “goal [n]or main focus” (Miner et al. 2001: 318). These qualities set it apart from the experimental learning also in evidence, which Miner et al. (2001: 318) sum up as “controlled situations” culminating in “new knowledge”.

In their assessment, improvisation differed in respect of its “long-term influence on organizational activities” (Miner et al. 2001: 319). Although they might have been meagre or even absent, the effects of “improvisational episodes” could equally endure (Miner et al. 2001: 320). That is, the “improvisational production or collateral insights generated during improvisation became a more permanent organizational feature” of either the project -or the company in general (Miner et al. 2001: 319).

Whilst not universally true, the “improvisational productions” could represent “grist for higher-level processes of long-term trial-and-error learning” (Miner et al. 2001: 320). To assist their explanation, Miner et al. (2011: 320) explicate the idea of “retention of an improvisational

production". They recognise it as "the degree to which the improvised production or collateral insights are made a permanent part of the organization's artifacts, processes, or knowledge" (Miner et al., 2011: 320, citing Miner, 1989; Van de Ven and Polley, 1992; Moorman and Miner, 1997; Argot, 1999).

Further, Miner et al. (2011: 320) concede improvisation could interfere with "long-term learning and adaptation". As one case in point, a team at Seefoods turned its attention to sandwiches; detrimentally, this saw them suspend interest in certain salad products (Miner et al. 2001). The "action" is linked to "a loss of knowledge gained in prior research and prioritization" (Miner et al., 2011: 321). Fortunately, the companies had grown able to curb the "special risks" tied to "improvisational learning[,] and/or to facilitate fruitful higher-level improvisational learning" (Miner et al. 2001: 324).

As a matter of fact, each had established "several distinctive competencies" associated with "improvisation in different functional areas" (Miner et al. 2001: 324). One kind is identified as the "harvesting [of] valued improvisations" (Miner et al. 2001: 326). This captures how the companies "retained" their "improvisational productions", and latterly "replicated them" elsewhere (Miner et al. 2001: 326). The harvesting -of either "a procedure or an artifact"- was performed "selectively" (Miner et al. 2001: 326). According to Miner et al. (2001: 328), the aforementioned competencies were "developed... in very specific areas" and so are not considered "general". This finding is foregrounded as running contrary to Moorman and Miner's (1998b) earlier hypothesising. Interestingly and instead of the competencies occupying or resting with any given practitioner, they are understood to have "flowed from broader organizational routines, cultures, and collective capabilities" (Miner et al. 2001: 327).

In related research, Magni et al. (2013: 1009) also examine improvisation in "NPD teams" [italics omitted]. Identifying e.g. Bechky and Okhuysen's (2011) study (Chapter 3, Section 3.5), they note how work has considered as much among teams operating in close proximity. They instead study those that are "dispersed" (Magni et al., 2013: 1010). This is plainly relevant to the present study of IT provision in British universities, wherein the IT practitioner community tends to be distributed around a campus (Chapter 5).

Recounting a "recent perspective" (O'Leary and Cummings, 2007) Magni et al. (2013: 1011) transcend the 'either/or' outlook in considering the "degree" of dispersion [italics omitted]. They are sensitive to the "spatial" i.e. "physical distance between team members' locations", and their "arrangement... across physical sites", i.e. "configurational dispersion" (Magni et al., 2013: 1013) [italics omitted]. Crediting Wilson et al. (2008) with the observation that "distance can be

psychological”, they also account for “cognitive dispersion” (Magni et al., 2013: 1013) [italics omitted].

Hypotheses integrate “team improvisation”, “team performance” and “team dispersion” (Magni et al., 2013: 1014). These were operationalised by a “field study of software development teams” at two sizeable Italian technology consultancies, each comprising teams spread across cities (Magni et al., 2013: 1017). With measures influenced by past literature, 299 surveys were returned by “team members” and “leader[s]” associated with 71 teams (Magni et al., 2013: 1017). A number of findings are notable.

Contrary to hypothesised, none of the forms of dispersion impaired team performance. As predicted however, team improvisation did benefit it. This latter finding is emphasised in light of prior research, which took the view that “team improvisation is neither inherently bad nor inherently good” (e.g. Moorman and Miner, 1998a; Vera and Crossan, 2005, cited by Magni et al., 2013: 1021). Magni et al. (2013: 1022) point out that whereas extant work refers to “work teams”, they focus on “project teams”.

Findings further indicate that where a team is not so dispersed, improvisation benefits performance; inversely, its increase dilutes the same. Specifically, where there was modest spatial and configurational dispersion, team improvisation links positively to performance; at higher levels, team improvisation in fact affected performance negatively. In low cognitive dispersion, moreover, team improvisation promoted performance; raised levels revealed a “nonsignificant relationship” (Magni et al., 2013: 1021). Since heightened dispersion possibly sees team improvisation adversely impact team performance, “team improvisation is not necessarily a panacea for managing complex tasks” (Magni et al., 2013: 1021). Further “potential factors” could also mediate (Magni et al., 2013: 1022).

Remaining in NPD, Brown and Eisenhardt (1997) further recognise improvisation to feature significantly. Departing from the “traditional punctuated equilibrium view”, their interests lie in understanding “continuous change” within the “multiple-product innovation” setting (Brown and Eisenhardt, 1997: 2). They turn attention specifically to the IT industry, citing the “*extraordinary rate of change*” witnessed between 1993 and 1995 (Brown and Eisenhardt, 1997: 2) [italics added].

The multiple case study proceeds inductively, adhering to Grounded Theory principles. Six Strategic Business Units (SBU) are sampled from as many companies: half with “successful multiple-product-development portfolios” and half without (Brown and Eisenhardt, 1997: 4). Various methods were deployed. Management engaged in semi-structured interviewing and

completed questionnaires. Observation was possible, e.g. at meetings. A “financial questionnaire” was returned by a “finance-staff member”, and “secondary data” solicited (Brown and Eisenhardt, 1997: 5).

From their findings, Brown and Eisenhardt (1997: 2-3) foreground three ways “successful managers” stood out from those less so. Foremost and in the present, they fused “limited structure” -i.e. that pertaining to priorities and responsibilities- with “extensive interaction” and “freedom to improvise” (Brown and Eisenhardt, 1997: 2-3). At the companies with comparably inferior performance, priorities and responsibilities were instead vague, and inter-project communication was poor.

Managers of prospering companies, moreover, held the future in high regard: “they balanced between the rigidity of planning and the chaos of reacting” (Brown and Eisenhardt, 1997: 16-17). “Specific tactics” included “experimental products”, employing futurists, forming associations and attending meetings (Brown and Eisenhardt, 1997: 17). At two of the less successful companies, management naively “planned the future”; they merely “reacted” at the other (Brown and Eisenhardt, 1997: 19-20).

Lastly, the managers at successful companies oversaw the “transition between the present and the future” meticulously (Brown and Eisenhardt, 1997: 21). This was enabled by “predictable time intervals between successive projects[, and] choreographed transition procedures” (Brown and Eisenhardt, 1997: 21). Companies with poorer “product portfolios” exhibited “neither”, instead handling matters “haphazardly” (Brown and Eisenhardt, 1997: 23). For Brown and Eisenhardt (1997: 32), “these practices” comprise “a core capability” feeding the “frequent, relentless, and endemic change” linked to success.

In general, “continuously changing organizations” possess “three key properties” (Brown and Eisenhardt, 1997: 3). “Semisttructures” strike a “balance between order and disorder” (Brown and Eisenhardt, 1997: 3). “Links in time”, moreover, refer to sensitivity of “different time frames” (Brown and Eisenhardt, 1997: 3). They thus “create the direction, continuity, and tempo of change” (Brown and Eisenhardt, 1997: 30). Finally, “sequenced steps” are also stressed to be important (Brown and Eisenhardt, 1997: 3). As is apparent, the study signals the significance of improvisation both to companies -and their respective management- adept at continuous change. Yet in spite of its perceptibly positive presence, it is also clear improvisational behaviour is not exercised in isolation. More accurately, it contributes in a constituent capacity to a larger effort. Brown and Eisenhardt’s (1997) work is recognised by the final study reviewed in this section (Kamoche and Cunha, 2001).

As background, Kamoche and Cunha (2011) overview inadequacies in the extant NPD literature. Whereas “dominant NPD approaches” assume “high levels of structure” and are suited to “stable environments”, a contrasting “perspective” accepts “the uncertainty inherent in product development” and largely overlooks structure in favour of “flexibility” (Kamoche and Cunha, 2011: 733). For Kamoche and Cunha (2011: 736), the “sequential”, “compression” and “flexible model[s]” are each “becoming increasingly unsuitable for the rapidly changing environments of today”.

The sequential model assumes “major eventualities are predictable”, and so depends “on systematic planning” (Kamoche and Cunha, 2011: 739). The compression model can be considered a more recent “version”, and similarly supposes “development activities can be known” a priori; its “process” is “adapted” to the “fast-changing environment” (Kamoche and Cunha, 2011: 740). But fault is also found with the purely flexible: e.g., this manner of organising can be difficult to co-ordinate (Kamoche and Cunha, 2011: 739).

Following from these and related observations, Kamoche and Cunha (2011: 743) posit their own “improvisational approach”. To do this, they import insight from past literature on jazz improvisation (JI) (Section 4.4). With respect to structure, jazz works from “a set of consensual guidelines and agreements” *they* term “minimal structures” (Kamoche and Cunha, 2011: 744). “Jazz improvisers” indeed, are credited with “combining structure and flexibility” (Kamoche and Cunha, 2011: 734). Referring to the JI literature and also to Bastien and Hostager (1988), Kamoche and Cunha (2011: 745) suggest minimal structures incorporate both “social... and technical structures”.

Social structures are understood to mainly include “behavioural norms and communicative codes” (Kamoche and Cunha, 2011: 746, citing Bastien and Hostager, 1988). These may take the form of e.g. a chorus, and hand signalling, respectively. The technical structure encompasses e.g. the collection of individuals’ competencies. The same “social and technical dimensions” are applicable to NPD (Kamoche and Cunha, 2011: 752). In support of the social side, Kamoche and Cunha (2011: 752) point e.g. to the “clear-cut responsibilities” Brown and Eisenhardt (2007) found in prospering projects. On the technical front, they highlight e.g. “the specification of quality and performance standards in innovation”; at the same time however, they urge “allowable margins of error”, such that “experimentation” can occur (Kamoche and Cunha, 2011: 754).

Kamoche and Cunha (2011: 755) insist their offering finds “a balance between control/structure and flexibility/autonomy”. They envisage “minimal structures... might serve as a template for

improvisational activities” (Kamoche and Cunha, 2011: 758). It is noted nevertheless, that “many organizations may lack the capacity to be both flexible *and* structured”; a deficiency of suitable “training and reward strategies”, “teamwork” and “supportive culture”, moreover, are possible impediments (Kamoche and Cunha, 2011: 756) [italics in original].

4.6.3 Summary: Improvisation in NPD

The NPD literature lends lessons of theoretical worth to the present study; select points are now summarised in brief. Striking is the variety of analytical levels at which improvisation is evidenced. Beyond individuals, works document it in teams (Magni et al., 2013), projects (Eisenhardt and Tabrizi, 1995) and SBUs (Brown and Eisenhardt, 1997). “Organizational improvisation” accommodates the improvised conduct of “groups, departments, or whole organizations” (Moorman and Miner, 1998a: 4) [italics omitted].

The occurrence of improvisation is explained -at least to some extent- by the character of the NPD context. Pavlou and El Sawy (2010: 446) argue “environmental turbulence is prevalent in NPD”. Moorman and Miner (1998a: 12), moreover, found “environmental turbulence” to be a “positive predictor of the level of improvisation in new product actions”. For the teams studied by Miner et al. (2001: 316) certainly, improvisation served “to solve problems created by surprises in bringing a product to market”.

Improvisation in NPD can be non-material (e.g. Miner et al., 2001), akin to the abstract form bricolage can take in academic research (e.g. Kincheloe, 2005) (Section 3.4, Chapter 3). A further familiar idea is that like bricolage in entrepreneurship (e.g. Baker and Nelson, 2005) (Section 3.3, Chapter 3), improvisation in NPD is a competence (Moorman and Miner, 1998b). From studies of improvisation in crises, emergencies and extreme events (Section 4.5) moreover, enthusiasm towards IT assistance is evidently extended (e.g. Pavlou and El Sawy, 2010).

Furthermore, the NPD literature nests a welcome alertness to mediators of improvisation. Pertinent to the present study of often-distributed university IT practitioners, Magni et al. (2013) examined mediation by different kinds of dispersion. But on the whole, the improvisation literature was felt to offer only limited understanding of contextual and/or situational factors inhibiting or preventing the otherwise efficacy of improvisation. That is, which influence or mediate the effectiveness of improvisation in practice.

Lastly and before progressing, a close reading of the NPD literature imparts some idea of how improvisation may associate with the CHAT concept of congruence (Chapter 2). Perhaps the clearest indication can be read in Brown and Eisenhardt’s (1997: 1) study of “*continuous change*”

[italics added]. To “successful multiple-product innovation” -an apparently ongoing activity- improvisation was found to be important; notably however, it contributed together with other “practices” (Brown and Eisenhardt’s, 1997: 32).

4.7 Information Technology (IT) & Information Systems (IS)

4.7.1 Introduction

Academic intrigue in improvisation carries to IT & IS. Successively, Section 4.7.2 considers Ciborra’s (1999a: 137) thoughts on “smart or competent improvisation”; Njenga and Brown’s (2012) study of Information Systems Security (ISS); work by Magni et al. (2009: 104) on “how team-level processes affect individual improvisation in complex project domains”; Orlikowski’s (1996: 63) “Situated Change Perspective”; McGann and Lytinen’s (2008: 1) “dynamic model of ISE” (Information Systems Evolution); their “Improvisation Dynamics Model” (McGann and Lytinen, 2010: 1) [italics omitted]; and Heeks’ (2006: 125) look at “Health information systems” (HIS). Section 4.7.3 summarises.

4.7.2 Pertinent literature

In the opening work, Ciborra (1999a: 137) contributes a theoretical discussion on so-called “smart or competent improvisation”. This is differentiated from “acting extemporaneously for the sake of acting” -and equally, from the improvised efforts of a novice (Ciborra, 1999a: 137). Resonating with other research areas reviewed, e.g. the arts (Section 4.4) and NPD (Section 4.6), “the expert’s smart improvisation... turns out to be highly competent behaviour” (Ciborra, 1999a: 137). Ciborra (1999a: 137) expresses awareness of improvisation and its significance in “situations where routines do not work, i.e. in emergencies” (see Section 4.5 Crises, emergencies and extreme events, above, for a related review).

Yet improvisation is also acknowledged to be “ubiquitous and economically relevant” in what is referred to as “everyday life in economic institutions” like “markets and bureaucracies” (Ciborra, 1999a: 137-138). In fact, it perceivably “permeates structured decision-making” (Ciborra, 1999a: 143). Elaborating, Ciborra (1999a) cites several scholars. Among these is Schutz (1967), for whom “action” is executed in respect of a “project” (Ciborra, 1999a: 144). A project nests a future-focused “vision of the act as if already accomplished”, and the action’s “meaning” is apparently “constituted by the image of that project” (Ciborra, 1999a: 144). The “meaning embedded in... a project and its constituent elements” equate to Schutz’s (1967) “*in-order-to* motives of action” (Ciborra, 1999a: 144) [italics in original].

But following Garfinkel (1974), Ciborra (1999a: 144) recognises this to reflect only the “tip of the decision-making ‘iceberg’”. Lower down are the “actor’s past experiences”, said to be “selectively evoked” in alignment with the “existential circumstances valid at the moment of making the decision” (Ciborra, 1999a: 144). Termed the “*because-of* component of the action”, this “bundle of motives” notably “conveys the ultimate meaning” (Ciborra, 1999a: 144) [italics in original]. Whereas the “in-order-to project” accommodates the “actor’s explicit and conscious meaning in solving a problematic situation”, the “because-of motives are tacit and lie in the background” (Ciborra, 1999a: 144) [italics omitted].

These ideas offer understanding of “why ordinary decisions on markets and in hierarchies are de facto improvised”, irrespective of “rules and norms” (Ciborra, 1999: 144). The “improvised component” is “caché” i.e. hidden, “even in structured decision-making” (Ciborra, 1999: 144) [italics omitted]. Although the iceberg’s underneath endures, “we are [simply] not aware of its selective influences on our plans and projects at the moment of action” (Ciborra, 1999: 145). The “deep nature of decision-making” is apparently improvisational, contrasting with “the clean, rational world” portrayed by popular “business and IT models” (Ciborra, 1999: 145). After Garfinkel (1974), Ciborra (1999: 145) suggests “structured analysis and design methodologies assume... plans and decisions can be analysed and executed objectively”, and “deny” improvisation.

But this kind of “artificial world” is a mirage, and those accepting it encounter “surprises” (Ciborra, 1999: 145). “Gaps” i.e. discrepancies, can emerge “between artificial routines, programmes, and structures” -and “practicalities” associating their application: these inspire “impredictabilities” (Ciborra, 1999: 145). With crossover to bricolage in IT and IS (Chapter 3, Section 3.6), it is claimed the “only chance for such models to have an impact on the actual workflow is to be constantly *worked at*”; “by *fiddling around* and *bricolage*”, “competent members” can “fill the frequent gaps” (Ciborra, 1999: 146) [italics in original].

As a “practice”, improvisation is praised for its “important role in complex economic institutions” (Ciborra, 1999: 152). Rather than “trying to eradicate it [, e.g.] through automation”, Ciborra (1999: 152) advocates efforts to “support/enable it, albeit indirectly” i.e. by IS. This idea is already familiar from other areas of the improvisation literature reviewed above (Section 4.5 Crises, emergencies and extreme events and Section 4.6 New Product Development). Closely related to Ciborra’s (1999) work is that of Njenga and Brown (2012), in Information System Security (ISS).

Giving helpful background, they recognise that the “rational choice approach” currently prevails (Njenga and Brown 2012: 593). “Rational choice” per se is premised on “predictive capacity”, i.e. “what is presently known”; corresponding “conventional... methods” are noted to be “highly normative” in nature (Njenga and Brown 2012: 593). But unfortunately, such “frameworks” overlook “environmental surprises and uncertainties” (Njenga and Brown 2012: 592, citing Ciborra, 1996). Differentially, “improvisation” is an “approach” that *does* provide “a way of managing ISS incidents in both certain and uncertain environments” (Njenga and Brown 2012: 593). Expanding, Njenga and Brown (2012: 593) interpret Ciborra's (1999: 137) characterisation of smart improvisation to accommodate “rational choice and [equally,] emergent, adaptive behaviour”.

It thus chimes with Segars and Grover's (1999) “rational-adaptive approach” (Njenga and Brown 2012: 593). By research on “IS management”, this approach has been repeatedly recognised as optimal when facing “unpredictability and volatility” (Njenga and Brown 2012: 593, citing Grover and Segars, 2005). Disconcerted with a feeling that improvisation has been considered a “*laissez-faire* approach”, Njenga and Brown (2012: 593) set out to show and theoretically understand it in ISS [*italics in original*].

They conducted a case study of a South African multinational operating against numerous “rational normative frameworks”, namely the International Organization for Standardization/ International Electrotechnical Commission (ISO/IEC 17799), the Information Technology Infrastructure Library (ITIL), and Control Objectives for Information and Related Technologies (COBIT) (Njenga and Brown 2012: 595-6). Interview data were triangulated with observation and documentation. “Hermeneutical exegesis” assisted in analysis (Njenga and Brown 2012: 597).

Findings convey both individual and collective improvisation, although mainly the latter. In one episode, an employee required access to specific information, but owing to a technical administrative conflict was prevented. Seemingly on the “spur-of-the-moment”, an ISS practitioner made change(s) to the database, such that access was in fact possible (Njenga and Brown, 2012: 599). Njenga and Brown (2012: 600) refer to this finding as “quick-wittedness”.

At the company considered, it was policy to dispose of laptops when their warranties ran out. But because of resource constraints, the board advocated their ongoing usage; “the policy was tactically and creatively overridden collectively” (Njenga and Brown, 2012: 601). This exemplified “an extemporaneous way of coping with an unplanned for situation as it was arising” (Njenga

and Brown, 2012: 601). Although heightening "costs and risk", it "ensure[d] that work continued" (Njenga and Brown, 2012: 601).

Practitioners' "internalized knowledge" led to improvisation in some ISS-related activities (Njenga and Brown, 2012: 605). Referring again to Ciborra's (1999: 137) "smart improvisation", Njenga and Brown (2012: 605) argue "improvisation proved only effective provided the practitioners were skilled enough" [italics omitted]. Further and from analysing "enactments by ISS practitioners", they are able to advance a number of practical pointers (Njenga and Brown, 2012: 605). Smart improvisation is apt if e.g. "frameworks do not provide expected support" (Njenga and Brown, 2012: 605). "Enactments" -i.e. of improvisation- "occur within social contexts and cannot be separated from the environment" (Njenga and Brown, 2012: 605). Pertinent to the concept of congruence, moreover, it is also clarified that "enactments are seen to serve one useful purpose, and that is *continuity* of work regardless of the surrounding circumstances" (Njenga and Brown, 2012: 605) [italics added].

A further study by Magni et al. (2009) examines improvisation in the context of Information Systems Development (ISD). They begin by articulating concerns with past academic literature, e.g. that works tend to narrow in "on only one level of analysis at a time" (Magni et al., 2009: 1045). Aware of as much, they assess "the cross-level effects [i.e. influences] of team-level interaction processes on individual improvisation" i.e. that of comprising members (Magni et al., 2009: 1045) [italics omitted]. They are specifically interested in "the nature of interaction among [team] members;" after Hambrick (1994), they foreground "behavioral integration" and "cohesion" (Magni et al., 2009: 1045).

Whereas the former is a "more substantive and task-related interaction", the latter labels the "more social and affective" (Magni et al., 2009: 1046). Both are proposed to promote the improvisation of individual members (Magni et al., 2009, citing Hambrick, 1994 and Smith et al., 1994), with cohesion further hypothesised to reinforce the behavioural integration-individual improvisation link. They adopt and/or modify existing scales, including one from Vera and Crossan (2005) to capture the extent of "creative and spontaneous behaviours... [i.e.] the two facets of improvisation" (Magni et al., 2009: 1048). These were worked into a questionnaire, to collect data from four Italian firms engaged in ISD of business software.

The hypotheses were reconciled with responses from 138 "team leaders and members" associated with 38 such "projects", and analysis assumed Hierarchical Linear Modelling (HLM) (Magni et al., 2009: 1045). Findings indicate the positive influence of team behavioural

integration and cohesion on individual improvisation, and somewhat support the hypothesis that cohesion accentuates the team behavioural integration-individual improvisation relation. Their model accounts for “30% of the variance in individual improvisation” (Magni et al., 2009: 1049-1050). Whilst modest, Magni et al. (2009: 1050) reiterate that multi-level models are “required” for elevated comprehension of improvisation “within the organization”.

Heightened sensitivity to improvisation is of similar concern to Orlikowski (1996), whose empirical efforts assess the utilisation of recently introduced IT. Ultimately, she promotes a novel “perspective on organizational transformation” (Orlikowski, 1996: 63). Indeed, criticisms of existing “perspectives” serve as her starting point; these are premised on “the prior discourse of stability”, which for Orlikowski (1996: 63-64) makes them a bad match “to a world where[in] change is... a way of organizational life”.

“Punctuated equilibrium”, “technological imperative” and “planned change” are acknowledged to have impacted works on “technology-based organizational transformation” (Orlikowski, 1996: 64). But noting the “distinction between deliberate and emergent strategies” (Mintzberg, 1979, 1987, cited by Orlikowski, 1996: 65), Orlikowski (1996: 65) finds issue. Briefly, “deliberate change” denotes “the realization of a new pattern of organizing precisely as originally intended”; “emergent” equates to “the realization of a new pattern of organizing in the absence of explicit, a priori intentions” (Orlikowski, 1996: 65). Each of the three offerings overlook the latter (Orlikowski, 1996).

As such, Orlikowski (1996: 65) contends a perspective propounding change instead of stability would be “more appropriate”. In turn, she submits a “Situating Change Perspective”, which is “premised on the primacy of organizing practices in organizational change” (Orlikowski, 1996: 65). Whilst accepting “organizational transformation can be and often is... deliberate”, she encourages attention to “another kind” (Orlikowski, 1996: 65). Orlikowski (1996: 65) is concise and clear: this sort “is enacted more subtly, more slowly, and more smoothly, but no less significantly”.

It is “grounded”, she elaborates, “in the ongoing practices of organizational actors, and emerges out of their (tacit and not so tacit) accommodations to and experiments with the everyday contingencies, breakdowns, exceptions, opportunities, and unintended consequences that they encounter” (Orlikowski, 1996: 65). “Organizational transformation” is itself regarded “an ongoing improvisation” (Orlikowski, 1996: 65). Identifying influences (e.g. Giddens, 1984; Weick, 1993), Orlikowski, (1996: 66-67) argues her own “analysis laid the groundwork”.

Empirical work was undertaken at the “Customer Support Department” (CSD) of US-based software firm, “Zeta Corporation” (Orlikowski, 1996: 67). It had recently introduced “Incident Tracking Support System” (ITSS), a Lotus Notes-based facility for handling calls (Orlikowski, 1996: 68). Data were gathered in “two phases”: during pilot testing and two years after (Orlikowski, 1996: 68). Methods included observation, interviews and collection of documentation e.g. files created by “specialists” recording their effort(s) to aid callers, and which were also “accessible” by colleagues (Orlikowski, 1996: 71). Participants were e.g. “specialists” and management (Orlikowski, 1996: 68). Qualitative analysis ensued.

In Orlikowski’s (1996: 69) assessment, “organizing practices and structures... changed considerably” in the focal timeframe. Although “*enabled* by the technology” in question, the “transformation” in evidence “was not [straightforwardly] *caused* by it”; more accurately, it unfolded “through the ongoing, gradual, and reciprocal adjustments, accommodations, and improvisations enacted by the CSD members” (Orlikowski, 1996: 69) [italics added]. She comprehensively documents “five metamorphoses” (Orlikowski, 1996: 69).

Certain details stand out to the present study. For example, the ITSS newly enabled specialists to electronically note incident-related information whilst still on the telephone: a deliberate change. But the majority kept the former pen and paper method, attending to the system record afterwards: an emergent change. Rationale included poor typing ability, a grievance that the system’s design was at odds with how users actually conveyed information, and an awareness that the system and network could falter.

In relation to such contingencies, specialists’ reliance on paper represented an “improvised (manual) backup system”; prudent, it meant they could “continue working on their calls” regardless (Orlikowski, 1996: 73). Yet problematically, volumes requiring input to the system could accumulate, and their “lagged entry” is among “unanticipated outcomes” (Orlikowski, 1996: 72-73). Laudably, “most specialists improvised ways” to assist, e.g. committing to overtime: a further apparently emergent change (Orlikowski, 1996: 72-73). Orlikowski’s (1996) empirical examination is extensive, but for brevity only aspects felt most applicable to the present study are recounted.

Nevertheless, the chosen evidence aptly demonstrates analytical advantage in the new vis-à-vis existing change perspectives. In particular, it is able to attend to both deliberate *and* emergent kinds of change. Of most interest to the present research, however, is its theoretical sensitivity -

as showcased- to the presence and significance of improvisation. Rather than replacing the pre-existing perspectives, Orlikowski (1996: 67) introduces hers “as a complement”. She concedes that the “kinds of metamorphoses” presented are peculiar to “one unit (CSD) within one organization (Zeta)” (Orlikowski, 1996: 90). This responsibly recognised, the “*process of change*” i.e. of “ongoing local improvisations in response to deliberate and emergent variations in practice”, is presented as “potentially generalizable” (Orlikowski, 1996: 90) [*italics in original*].

Related is work on Information Systems Evolution (ISE) (McGann and Lytinen, 2008; 2010). In this context, scant studies explore “interactions” between IT and organisational change (McGann and Lytinen, 2008: 1) [*italics omitted*]. McGann and Lytinen (2008: 2) eagerly establish that ISE is “an iterative process of punctuated, transformative changes in organizations and its information systems that result from planned change actions by organizational implementers and incremental improvisations by users”.

They formalise two research questions. Against the backdrop of ISE, the first seeks to understand “how... changes in organizational routines and IT interact”; of particular interest to the present study, the second queries “how... users’ improvisations generate permanent changes in organizational routines and IT designs” (McGann and Lytinen, 2008: 2). The “dynamic model of ISE” they offer is influenced by affiliated theoretical ideas (McGann and Lytinen, 2008: 2). McGann and Lytinen (2008) initially identify interest in software and organisational change - and emphasise their connection. They further distinguish between “the traditional model of organizational change” (citing e.g. Hage, 1965; Hirschheim et al., 1995) and emergent change (citing e.g. Mintzberg, 1985; Morch, 1995; Orlikowski, 1996).

The latter perspective sees improvisation and bricolage build up “over time”, becoming “transformative socio-technical change” and fuelling ISE (McGann and Lytinen, 2008: 3). To their reckoning, Orlikowski (1996) did not explain “how user improvisations lead to concomitant changes in the IT designs, and thus become “reified” and institutionally transformative” (McGann and Lytinen, 2008: 3). As such, they collocate these perspectives, attributing ISE to “both improvised change and planned change”, whilst keeping alert to “the IT and organizational/process aspects” (McGann and Lytinen, 2008: 3) [*italics omitted*]. This gives “four change dimensions” (McGann and Lytinen, 2008: 3).

From existing literature, they also elucidate “two categories” or “types” of improvisation linked to IT (McGann and Lytinen, 2008: 4). “Workarounds” stem from “shortcomings or “functional gaps” in the existing IS”, i.e. if “[pre-]designed functionality” cannot attend to “current user

requirements”; differentially, “configured improvisations” occur where “[pre-] designed system tailorability” *is* able to accommodate novel needs (McGann and Lyytinen, 2008: 4) [italics omitted]. These address its “nature” (McGann and Lyytinen, 2008: 4).

Users’ “improvised changes” can additionally be understood in respect of their “target”, i.e. involving “an adjustment of a process” or “of the IT” (McGann and Lyytinen, 2008: 4) [italics omitted]. McGann and Lyytinen (2008: 4) are thus able to foreground as many as “four improvisation types”, each applicable to ISE. They lastly note that improvisation has been understood theoretically to occupy a scale or continuum (see Section 4.4 for a fuller discussion, above). They credit Weick (1998) with the “continuum” spanning “interpretation”, “embellishment”, “variation”, and outright “improvisation”, finding it offers a foundation from which to gauge “the scale of changes” throughout ISE (McGann and Lyytinen, 2008: 5). Orlikowski’s (1996) alternative “continuum” -ranging from “situated changes” to “metamorphoses”- is also acknowledged (McGann and Lyytinen, 2008: 5). McGann and Lyytinen (2008: 5) bring various ideas together to offer a “dynamic model for ISE”, encompassing four familiar-sounding, yet nuanced “stages”.

In “Ad Hoc Adjustment”, a user performs an “IT or process workaround, or a configured improvisation” if encountering “a new requirement”; the improvisation is “localized” and not “formal” (McGann and Lyytinen, 2008: 5). “Process Embellishment” accounts for how these alter “standard organizational routines”, whereas “IT Modification” addresses “ad hoc IT improvisation” impressing on “IT functionality” long-term (McGann and Lyytinen, 2008: 5). These can amass, provoking “metamorphosis”: a “deeper organizational transformation” portraying “punctuation” (McGann and Lyytinen, 2008: 7).

Whilst the “dynamic model of Information Systems Evolution” conveys “how minor user improvisations can grow into path-breaking organizational changes”, it contends these have to be “cultivated” via “an ongoing process of refinement, extension, and institutionalization” (McGann and Lyytinen, 2008: 6). McGann and Lyytinen (2008: 8) deploy it in a longitudinal, dual-case study of two manufacturers, “Big Brake Company” (BBC) and “Automotive Interior Manufacturer” (AIM). Each had introduced an “inter-organizational system” dubbed “XXX” (McGann and Lyytinen, 2008: 8).

McGann and Lyytinen (2008) use multiple methods. Gathering data “followed” users, management and other pertinent practitioners (McGann and Lyytinen, 2008: 8). Interviews and observations were triangulated (citing e.g. Yin, 1984) by assessing documentation. A brief

account from each company exhibits “ISE processes initiated by local improvisations”, and both exhaust all stages (McGann and Lyytinen, 2008: 9). Of the two, the “Material Tracking Process/Receiving Process ISE” trajectory at AIM proceeded at notable pace (McGann and Lyytinen, 2008: 11).

Before introducing XXX, AIM lacked any method of monitoring shipments and practitioners were unable to assess the accuracy of what arrived. Compounding matters, the respective “transaction” was input to the ERP “manually” -and as such, slowly (McGann and Lyytinen, 2008: 10). Some were not even recorded. This had a collateral and understandably adverse effect on other parts of the company, e.g. Accounts Payable (A/P) and “material planners”, as well as its suppliers (McGann and Lyytinen, 2008: 10-11).

Cognising a “crisis”, the “senior materials director” improvised a “tracking process” and “Material Discrepancy Log” (McGann and Lyytinen, 2008: 11). It was briefly an “ad hoc adjustment”, after which “modification” and embellishment” occurred together (McGann and Lyytinen, 2008: 11). This spawned a new software module and improved processes e.g. suppliers had to finish up by using the portal, instilling AIM with “instant visibility” (McGann and Lyytinen, 2008: 11). They also had to provide a “packing list”, to be scanned on arrival (McGann and Lyytinen, 2008: 11). At AIM, efficiency ensued.

The account unearths “how an improvisation... designed to meet an urgent need, can quickly escalate into a large-scale change” (McGann and Lyytinen, 2008: 11). “Metamorphoses” was fast (McGann and Lyytinen, 2008: 12). On reflection, McGann and Lyytinen (2008: 12) emphasise that whilst the “organizational routines”-“IT” relation of the “improvised change realm” is indeed crucial, “improvisations must “cross-over” to the planned change realm” if IS are to “evolve significantly and permanently”. For this, management must appreciate the worth of improvisation (McGann and Lyytinen, 2008).

In a further article, McGann and Lyytinen (2010) suggest scholars have overlooked extensive examination of factors influencing improvisation. Proceeding on this premise, they develop a “framework” that arranges assorted elements “into a dynamic model” (McGann and Lyytinen, 2010: 1). The “Improvisation Dynamics Model” is sensitive to the “frequency, type and evolution of improvisations during ISD” (McGann and Lyytinen, 2010: 1). The ambition appears to draw from the same two cases and empirical data articulated previously (McGann and Lyytinen, 2008) (above).

Foremost, McGann and Lyytinen (2010: 3) establish "what triggers user improvisation". Taking leads from previous work (Suchman, 1983; Strong, 1995), they characterise "improvisation triggers" as "an event encountered in IS use where information cannot be properly processed through existing IT functionality or process design, thus triggering improvisation" (McGann and Lyytinen, 2010: 3). Analysing their data, they foreground three kinds: "missed", "evolving" or "unmet requirements" (McGann and Lyytinen, 2010: 3). Individual or multiple triggers can provoke improvisation in this opening "step" of the "improvisation process" (McGann and Lyytinen, 2010: 9).

To elaborate, requirements might be missed because designers failed to accommodate it or them initially; in this sense, subsequent improvisation would owe to oversight(s) at another time and place. Alternatively, novel needs can evolve over time. Lastly, technical issue(s) etc. may translate to addressed requirements remaining unmet. McGann and Lyytinen (2010: 6) moreover, understand instances of improvisation to manifest as one of the same "four... types" explicated beforehand (McGann and Lyytinen, 2008) (above).

"Improvisation dynamics" are argued to be "impact[ed]" by different "contextual variables (CVs), with evidence pointing to a "User Level" and an "Organizational Level" (McGann and Lyytinen, 2010: 4). User level is further split into "manufacturer-user" and "supplier-user variables", these influencing the "type and frequency of improvisation" (McGann and Lyytinen, 2010: 4). To illustrate, heightened "technical skills" were found to "enable IT workarounds", whilst elevated "user enthusiasm" favoured the frequency of improvisation (McGann and Lyytinen, 2010: 4).

Instances advance via "one of the six paths" portrayed by the "improvisation evolution model" (McGann and Lyytinen, 2010: 9): a tweaked version of the "dynamic model for ISE" (McGann and Lyytinen, 2008: 5). The improvisation can stay at the user level, i.e. at "ad hoc adjustment"; alternatively, an "evolution trigger" can carry it to the "organizational level" (McGann and Lyytinen, 2010: 9). This confers "ownership and control from user to organization", where it also turns from "improvisation into a permanent change" (McGann and Lyytinen, 2010: 9).

The once-improvised episode can then plausibly progress to "IT modification or [all-out] metamorphoses" (McGann and Lyytinen, 2010: 9). Its "evolution" is influenced by the organisation-level CVs, with the identity of the "final stage" owing to their "impact and direction" (McGann and Lyytinen, 2010: 9). Ultimately and by building on their prior work (McGann and Lyytinen, 2008), McGann and Lyytinen (2010: 10) tender a temporally broader theoretical account of improvisation, spanning "initial inception to [possible] evolution into organizational

change". Like McGann and Lyytinen (2010), the final study was stimulated by discontent with existing literature.

In particular, Heeks (2006: 125) points to the typically positive portrayal of "health information systems (HIS)" in medical informatics. Instead, he contributes to a modest body examining "HIS failure" (Heeks, 2006: 126). Evidence and conceptual consideration of "HIS success and failure" remain frail (Heeks, 2006: 127). He thus promotes a model attributing as much to the difference in "design conceptions" and "current realities": the "design-reality gap" (Heeks, 2006: 128). Taking influence from past literature, he suggests "seven dimensions" (Heeks, 2006: 128-9). Proposed beforehand by Heeks et al. (1999), these comprise "Information", "Technology", "Processes", "Objectives and values", "Staffing and skills", "Management systems and structures", and "Other resources" (ITPOSMO) (Heeks, 2006: 129).

In each respect, the perceived "gap" can be identified and appraised; altogether, "ratings" i.e. scorings, may impart a "view of the likelihood of success or failure" (Heeks, 2006: 129). In one sense, the model can serve as a useful "evaluation tool" (Heeks, 2006: 135). To exemplify, Heeks (2006: 129, citing Guah, 1998) alludes to an account of a UK hospital which strove to implement "an expert system for computerised coloscopy". In general, he acknowledges its design was mostly the work of "technical staff", and that varied and "significant... gaps" are discernible (Heeks, 2006: 129). "Overall" these overwhelmed, and as a consequence the pilot went to waste (Heeks, 2006: 130).

The model can also be applied as a "risk assessment tool", invaluable to management and consultants (Heeks, 2006: 131). Heeks (2006: 131) illustrates its application in a "facilitated workshop" with "key stakeholders" at The University of Manchester. Its "intended output", or yield, was identification of "design-reality gaps" -equated to "risks"- capable of hindering the HIS initiative (Heeks, 2006: 132). Within an "overall risk management process", this paves the way to proactively alleviate the same (Heeks, 2006: 132).

Rather than being viewed as "static", Heeks (2006: 133) emphasises design and reality are "dynamic" i.e. changing. It follows that gap(s) change, and that efforts aimed at narrowing or eliminating them are ongoing (Heeks, 2006: 133). Referencing Mintzberg (1994), he raises regard for "emergent change... associated with local improvisations" (Heeks, 2006: 133). "Emergent changes can be envisaged as continuous reciprocating improvisations between design and reality"; for "success", these "seek accommodation and adaptation between" the poles (Heeks, 2006: 133, citing Orlikowski, 1996, and Heeks, 2005).

“Design-reality closure improvisations” might be facilitated by “methods, techniques, and roles and competencies” (Heeks, 2006: 133). Regarding method, “an iterative approach” can curb concurrent gaps and allow contemplation of improvisation (Heeks, 2006: 133). In terms of techniques, prototyping can pick up on gaps, but it also “legitimises the process of improvisation - of design-reality gap closure - within HIS development” (Heeks, 2006: 134). Lastly and relating to roles and competencies, “hybrids” (Earl, 1989, cited by Heeks, 2006: 134) of “developer and user” may benefit (Heeks, 2006: 134).

4.7.3 Summary: Improvisation in IT & IS

Following the other areas of academic interest (Sections 4.4-4.6), IS literature offers a plethora of theoretical insights. Studies reflect the significance of improvisation in e.g. ISS (Njenga and Brown, 2012), ISD (Magni et al., 2009) and ISE (McGann and Lyytinen, 2008). Further and whilst the CHAT concept of congruence (Chapter 2) does not feature formally, prospective interrelation can be inferred. Standout ideas are summarised below, before a timely reflection on the improvisation literature as a whole (Section 4.8).

Contributing scholars have sought with enthusiasm, to account for the occurrence of improvisation (e.g. Ciborra, 1999a; McGann and Lyytinen, 2010; Njenga and Brown 2012). Most relevant is that McGann and Lyytinen (2010: 3) linked the improvisation of IS users to “improvisation triggers” such as “missed”, “evolving” or “unmet requirements”. This relates to the present study of IT provision in academia, given both IT practitioners’ and the wider university population’s daily use of -even reliance on- IS (see Chapter 5. Methodology).

Like before (Section 4.5 Crises, emergencies and extreme events), this literature indicates improvisation can be undertaken individually (McGann and Lyytinen, 2008; Magni et al., 2009) and/or by collectives (e.g. Njenga and Brown, 2012). Episodes are acknowledged to possibly play out in different ways, e.g. with McGann and Lyytinen (2010: 6) delicately differentiating between the “nature” and “target of improvisation”. Some instances are also emphasised and evidenced as important to “organizational transformation” (Orlikowski, 1996: 63; McGann and Lyytinen, 2010: 6).

To some extent, this area is cognisant of factors influencing improvisation. McGann and Lyytinen (2010: 10) advance the ostensibly obvious -but in fact illuminating observation- that the “creation” and “evolution of the improvisation” subsequently, “are influenced by different sets of contextual variables”. Notwithstanding and as argued, the literature affords little insight into

situational and/or contextual factors capable of attenuating or altogether thwarting its effectiveness, i.e. influence(s)/mediator(s).

Finally and although none of the studies cite the CHAT concept of congruence (Chapter 2), an association is perceivable. When conferring “principles important for promoting smart improvisation in ISS practice”, Njenga and Brown (2012: 605) assert: “enactments are seen to serve one useful purpose, and that is continuity of work regardless of the surrounding circumstances”. Improvised action(s) can be interpreted as means by which the object of inherently contradictory activity is worked towards, i.e. assisting the activity’s congruence. Attention now turns to reflect on the improvisation literature overall.

4.8 On reflection: The improvisation literature

Extensively reviewing prior academic literature on improvisation reveals it to be replete with valuable insight. The opportunity is now taken to briefly reflect. Aspects reiterated include the concept’s history, character and development. Suitable methodological choices, as showcased by the studies reviewed, are also emphasised. Readers are further reminded of an aspect felt to be theoretically undeveloped. Perceivable connections to bricolage and congruence are also underscored.

In common with bricolage (Chapter 3), improvisation has long attracted scholarly interest. The review pinpointed initial interest to the arts (Section 4.4), after which select studies explored and evidenced its wider applicability (Sections 4.5-4.7). The concept has undergone modification, e.g. to its meaning (Miner et al., 2001), and the related notion of “referent” has been appropriated more broadly (Mendonça, 2007: 954, citing Sarath, 1996; Pressing, 1988; 1998) [*italics omitted*].

Understanding extends to the methodological. Although works have assessed improvisation using quantitative techniques (e.g. Pavlou and El Sawy, 2010; Magni et al., 2013), most are qualitative, additionally or instead. Crucially, Njenga and Brown (2012: 605) are recalled for asserting: “enactments by ISS security practitioners occur within social contexts and cannot be separated from the environment”. Concurring, the present study is conscientious of both when approaching IT practitioners (see Chapter 5. Methodology).

The literature also acknowledges improvisation is subject to influence (e.g. McGann and Lyytinen, 2010; Magni et al., 2013) -and that as with a “planned-for procedure”- a “desirable

outcome" is not "guaranteed" (Mendonça, 2007: 955). This accepted, it was repeatedly read that there is only modest appreciation of situational and/or contextual factors able to inhibit or altogether prevent its effectiveness. That is, things influencing or mediating the otherwise efficacy of improvisation in practice.

Although the outgoing chapter concentrated on improvisation, the concept of bricolage also appeared in the literature. As argued earlier with respect to bricolage (Chapter 3), the review similarly reflects the significance of improvisation to ongoing practice. In CHAT vocabulary, improvisation is interpreted as goal-driven action(s) assisting and ultimately contributing to the achievement of an activity's incumbent object. In short and from careful contemplation, it is read to represent intentional means towards congruence (Chapter 2).

4.9 Bricolage and improvisation: Discerning and addressing theoretical gap(s)/deficit(s)

Reviewing past academic literature relating to bricolage (Chapter 3) and improvisation (Chapter 4) has endowed an in-depth and comprehensive appreciation of each concept. Theoretical gap(s)/deficit(s) were also discerned. These final thesis reviews are an end product, reflecting more refined understanding(s)/interpretation(s) than the earlier transfer document (Goddard, 2015). Notwithstanding and even at an infant stage of the present research, the student researcher was intrigued by specific point(s)/detail(s)/aspect(s).

Although not exhaustive, the transfer document offered a number of critical observations of the academic literature, as then understood/interpreted:

“Whilst uncertainty is widely held to provoke improvisation and bricolage, less is known of its influence on ongoing efforts in situ.”

(Goddard, 2015: 4)

“studies attribute their [improvisation and bricolage] appearance to unease in the environmental context, as well as to uncertainty and unpredictability.”

(Goddard, 2015: 23-24)

“the review indicates that with respect to both improvisation and bricolage [sic], there is only a finite comprehension of potential situational factors that might represent aids or hindrances to ongoing efforts.”

(Goddard, 2015: 23)

“the literature indicated the need to consider contextual conditions capable of provoking and/or mediating both improvisation and bricolage efforts.”

(Goddard, 2015: 42)

The passages are suggestive of the student researcher's understanding(s)/interpretation(s) before, and/or at, and/or at approximately the time(s) the original RQs were formulated -and/or of how this/these understanding(s)/interpretation(s) influenced the formulation of original RQ 3. Improvisation and bricolage were attributed to “unease in the environmental context, ...uncertainty and unpredictability” (Goddard, 2015: 23-24). Yet, there was felt to be limited understanding of “aids or hindrances” (Goddard, 2015: 23).

This interpreted shortcoming identifiably influenced the third research (RQ 3) question, as originally formulated in the transfer document:

“3. How does uncertainty influence improvisation/bricolage efforts in practice?”

(Goddard, 2015: 4)

This was subsequently refined, to its final form:

RQ 3. What influences/mediates efforts towards congruence in practice?

Although the student researcher understood RQ 3 when formulating and refining it, conceptual clarity improved even afterwards. The decision was made for it to concentrate on *negative* influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice. Beyond the concepts of bricolage and/or improvisation, it extends to embrace negative influence(s)/mediator(s) on -i.e. challenge(s) to- any means towards congruence. That is, irrespective of conceptual character. In this way, its general framing follows RQ 1 (Section 2.5.3, Chapter 2).

Laterally and just as no past works in the CHAT tradition (Chapter 2) explicitly examine congruence with respect to bricolage or improvisation, neither the bricolage (Chapter 3) nor improvisation literatures (Chapter 4) formally consider the concept of congruence. From all angles then, means towards congruence, the candidate capacities of bricolage and/or improvisation, and negative influence(s)/mediator(s) i.e. challenge(s), remain unexplored. These theoretical gap(s)/deficit(s) is/are addressed by the present study.

4.10 Summary and conclusion

Established already (Chapter 2), the concept of improvisation came to occupy interest of the present study. This last literature review instalment critically considered pertinent past academic works. Section 4.2 began by characterising and clarifying the concept, after which it was sensible to contemplate how improvisation and bricolage link (Section 4.3). Following the theoretical opening, various works from a wide range of areas were explored. Ordered in the interest of legibility and flow, areas covered were: The Arts (4.4); Crises, Emergencies and Extreme Events (4.5); New Product Development (NPD) (4.6); and Information Technology (IT) & Information Systems (IS) (4.7). Summaries closed each, and understanding grew gradually.

A more general, overall reflection on the improvisation literature served to remind readers of a number of especially important observations (Section 4.8). Like with the CHAT concept of congruence (Section 2.5, Chapter 2), the extensive and attentive review permitted the possibility of discerning an apparently undeveloped aspect in the extant academic literature reviewed. Although emphasised consistently and throughout, Section 4.9 cemented it. This interpretation was shown to have fed into the third and final research question (RQ 3). Next, Chapter 5 turns to discuss all aspects of the present study's methodology.

5 Methodology

5.1 Introduction

This chapter addresses methodological matters. Section 5.2 firstly reiterates the present study's purpose and RQs. Establishing basic philosophy, Section 5.3 substantiates its underlying commitment to interpretivism. Practice theory is then explored by Section 5.4, with the present position clarified. Recognising activity theory as a practice theory, Section 5.5 consults CHAT-associated philosophy and identifies theoretical apparatus favouring it as a theoretical framework. Section 5.6 subsequently introduces Critical Incident technique (CIT) and characterises the critical incidents as interpreted.

Following this, Section 5.7 introduces the study's empirical setting as IT provision in UK academia. Sampling and the decision to target IT practitioners are explained in Section 5.8. Section 5.9 recites the active recruitment process; the resulting sample is presented in Section 5.10, alongside reflections on an apparent skew. Section 5.11 goes on to discuss data gathering, achieved by method of semi-structured interviewing (SSI). All aspects of the ensuing qualitative data analysis are then elucidated by Section 5.12. Lastly, Section 5.13 summarises and concludes.

5.2 Purpose and research questions (RQs)

This section reiterates the purpose and research questions (RQs).

Following on from the introduction (Chapter 1) and literature review (Chapters 2-4), the study seeks to elevate theoretical understanding of congruence -a relatively new and as yet undeveloped activity theory concept- by asking:

- RQ 1. How is congruence reached in practice?
- RQ 2. What role(s) do(es) bricolage and improvisation play towards this?
- RQ 3. What influences/mediates efforts towards congruence in practice?

5.3 Underlying philosophy

5.3.1 Introduction

This section attends to philosophy. Section 5.3.2 begins with brief background of philosophy in research; its general importance is grasped, as are the foundational ideas of ontology,

epistemology and axiology. In each of these respects, Section 5.3.3 then contrasts positivism - the prevailing philosophy of the "organization and management field" (Duberley et al., 2012: 19)- with interpretivism: "a critique" (Saunders et al., 2015: 151). It thus becomes possible to substantiate interpretivism (Section 5.3.4).

5.3.2 Philosophy in research

Those undertaking research are "developing knowledge" in a given domain (Saunders et al., 2015: 124). "Research philosophy" signals "a system of [applicable] beliefs and assumptions" (Saunders et al., 2015: 124). Knowingly or not, different kinds feature throughout research (Burrell and Morgan, 1979, cited by Saunders et al., 2015). A "credible research philosophy" comprises a "consistent set of assumptions"; this "underpin[s] methodological choice, research strategy[,],... data collection techniques and analysis procedures (Saunders et al., 2015: 124-125).

The present study is interpretive. But "no philosophy exists in a vacuum" (Collier, 1994: 70). Indeed, interpretivism is among the assortment of "major philosophies" Saunders et al. (2015: 135) identify in "business and management"; others are positivism, postmodernism, pragmatism and critical realism (Saunders et al., 2015). "Three [specific] types of research assumptions" - namely the notions of "ontology, epistemology and axiology"- enable "research philosophies" to be differentiated (Saunders et al., 2015: 127).

In short, ontology denotes "the study of being" (Crotty, 1998: 10) and refers to "the nature of reality and its characteristics" (Creswell, 2013: 20). Epistemology is taken as "the theory of knowledge" (Benton and Craib, 2011: 3), or otherwise "the *nature* of knowledge" (Tracy, 2012: 38) [*italics added*]. Axiology, meanwhile, accounts for "the extent and ways your own values influence your research process" (Saunders et al., 2015: 124). These foundational concepts are certainly helpful -perhaps even requisite- to substantiating the present study's philosophical stance.

5.3.3 Contrasting positivism with interpretivism

Whilst interpretivism is argued to be most suitable at present, Duberley et al. (2012: 19) perceive that actually positivism has largely prevailed over the "organizational and management field". Positivism represents the "philosophical stance of the natural scientist" (Saunders et al., 2015: 135). It recognises only "one true reality" -one which is "real, external, [and] independent" (Saunders et al., 2015: 136). This "already exists "out there" in the world and is [just] waiting to be discovered" (Tracy, 2012: 39).

Positivist researchers undertake research so as “to observe, measure, and predict empirical phenomena and build tangible, material knowledge” (Tracy, 2012: 39). Positivism “underlies the scientific method” and employs experimentation for the most part; where “not feasible”, surveys can substitute (Oates, 2006: 286). Work premised on positivism tests hypotheses, and “quantitative data analysis” is typically favoured (Oates, 2006: 286). Throughout their “value-free research”, the positivist observes an “objective stance” (Saunders et al., 2015: 136).

The rationale behind positivism is that by “applying the scientific methods to experiences and to [sic] empirical world”, “knowledge of the world” is arrived at (Eriksson and Kovalainen, 2008: 18). Positivist researchers “build tangible, material knowledge” (Tracy, 2012: 39). Epistemological emphasis is placed on “observable and measurable facts” and “numbers” (Saunders et al., 2015: 136). There is also an affirmative appetite to “produce law-like generalisations” that hold elsewhere (Saunders et al., 2015: 135).

Although positivism is appropriate for research examining the “natural world”, it is “less suited” to “the world of people” i.e. the social equivalent (Oates, 2006: 288). The present study buys into the basic, seemingly intuitive assumption that “people see the same thing in different ways” (Oates, 2006: 289). Positivism falls short in its regard for “the subjective nature of human thoughts and actions”, and in the “organizational and management field” certainly, unease with this paved the way for alternative “philosophical stances” (Duberley et al., 2012: 19).

Among these is the one assumed at present, interpretivism (Duberley et al., 2012). Interpretivism advanced as “a critique of positivism” and itself represents “a subjectivist philosophy”; it contends that in contrast to “physical phenomena”, humans “create meanings” (Saunders et al., 2015: 151). It perceives “social research” to carry a “special concern for uncovering the meaning associated with social activity” (Hammond and Wellington, 2013: 57). Interpretivist researchers examine “meanings” (Saunders et al., 2015: 140). “Interpretive studies”, such as the present study, examine “how the people perceive their world (individually or in groups) and try to understand phenomena through the meanings and values that the people assign to them” (Oates, 2006: 292).

“An interpretive point of view” is also called “constructivist or constructionist” (Tracy, 2012: 40). Reality does not just reside ““out there,”” to be “clearly explain[ed], describe[d], or translate[d] into a research report” (Tracy, 2012: 40). A “single objective reality” is disbelieved (Oates, 2006: 293-294). Regarding *its* ontology, reality is “complex” and “rich”, “socially constructed through

culture and language”, with “multiple meanings, interpretations, [and] realities” (Saunders et al., 2015: 136). It accepts disparate “groups or cultures” have different worldly perceptions (Oates, 2006: 292).

“Communication, interaction and practice” are vehicles via which “reality and knowledge” are each “constructed and reproduced” (Tracy, 2012: 40). Denying a “single version of ‘the truth’”, interpretivism insists on “multiple subjective realities”; anything recognised as “‘real’ or [as] ‘knowledge’” is considered “a construction of our minds, either individually or in a group” (Oates, 2006: 292). With respect to epistemology, the “focus” is “on narratives, stories, perceptions and interpretations” (Saunders et al., 2015: 136).

Researchers operating in the “interpretive paradigm” are plainly uninterested in the “artificial world of a laboratory”, as is typical of “most experiments” (Oates, 2006: 292-3). They instead examine “people in their natural settings”, with studies attempting to make sense of “people in their [own] worlds” (Oates, 2006: 293). The “challenge for the interpretive researcher”, as Saunders et al. (2015: 141) see it, is to “enter the social world of the research participants and understand that world from their point of view”.

The “ISS [interpretive social science] researcher” aspires to uncover “what is meaningful or relevant” to those studied, and to appreciate “how they experience everyday life” (Neuman, 2013: 104). S/he becomes thoroughly acquainted with those occupying a “particular social setting”, and strives to consider it “from the viewpoint of the people in it” (Neuman, 2013: 104). Ongoingings are assessed “from the perspectives of the participants”, and the researcher’s preconceptions are not imposed (Oates, 2006: 293). Gomm (2009: 178) associates interpretivism with “a wide range of qualitative approaches”. Indeed, some qualitatively inclined similarly argue “the social world must be interpreted from the perspective of the people being studied” (Bryman and Bell, 2011: 402).

Regarding the “role of values” i.e. the matter of “axiology”, positivism entails “value-free research”; correspondingly, the “researcher is detached, neutral and independent of what is researched” (Saunders et al., 2015: 136). By contrast, interpretivism refers to “value-bound research” and the “researcher interpretations are [considered] key to [the] contribution” (Saunders et al., 2015: 136). In fact, multiple “interpretations of the same data” may be “potentially meaningful” (Eriksson and Kovalainen, 2008: 20).

5.3.4 Interpretive stance

The outgoing sections enable the present study's interpretive stance to be substantiated over positivism. Given the purpose and RQs (Section 5.2), it would not be appropriate to "observe, measure, and predict empirical phenomena" as a positivist researcher would (Tracy, 2012: 39). There is no ambition for the "law-like generalisations" preoccupying positivism (Saunders et al., 2015: 135). Instead, and typical of "interpretive studies", it considers "how the people perceive their world" and attempts to "understand phenomena through the meanings and values that the people assign to them" (Oates, 2006: 292).

As regards ontology, the present study does not subscribe to the supposition of a solitary "objective reality" (Oates, 2006: 293-294). It rejects that there is only "one true reality" -one which is "real, external, [and] independent", as positivism assumes (Saunders et al., 2015: 136). Instead, the present study's ontological assumption is aligned with interpretivism: it acknowledges the "nature of reality or being" as "complex" and "rich", "socially constructed through culture and language", complete with "multiple meanings, interpretations, [and] realities" (Saunders et al., 2015: 136).

In relation to epistemology, the "observable and measurable facts" and "numbers" significant to positivism (Saunders et al., 2015: 136) would not provide adequate answers to the RQs (Section 5.2). Rather, and in keeping with interpretivism, the present study accepts the epistemological worth of e.g. "narratives, stories, perceptions and interpretations" (Saunders et al., 2015: 136). These indeed, are assumed to inform in an ontological sense e.g. of "the nature of reality and its characteristics" (Creswell, 2013: 20). The present study draws on the first-hand interpretive, subjective, qualitative insights of those intimately acquainted with practice: practitioners.

Where available, practitioners' insights inform of the interrelated concepts/phenomena queried by the RQs (Section 2.5.3, Chapter 2; Section 4.9, Chapter 4; Section 5.2). That is, how congruence is reached in practice i.e. means towards congruence (RQ 1), the role(s) of bricolage and/or improvisation i.e. their candidate capacities towards the same (RQ 2), and negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice (RQ 3). Where available, practitioners' insights assist in answering the RQs and therefore serve the study's purpose (Section 5.2). Inherent in the purpose and RQs is interest in the concepts/phenomena as they manifest in practice.

Where available, practitioners' first-hand, interpretive, subjective, qualitative insights inform the present study in related respects, expounded in subsequent sections. Most immediately and as perhaps already implied, informing of their own practice(s) and, where applicable, any other with which they are familiar (Section 5.4). In applying activity theory as a practice theory (Nicolini, 2013), the same insights are understood theoretically to inform of the activity/activities they partake in, and where applicable, any associated (Section 5.5). Some of the practitioners' insights, moreover, inform of critical incidents (5.6; 5.8).

Axiologically, the study is not "value-free" as per positivism (Saunders et al., 2015: 136). Rather, it is "value-bound" and the student "researcher[']s interpretations" are recognised as important -aligning again with interpretivism (Saunders et al., 2015: 136). Saunders et al. (2015: 128) contend that just "*choosing* one topic rather than another suggests that you think one of the topics is more important" [italics added]. Similar is suggested of the student researcher and present study. One value in particular, was inspired at least somewhat by the critical review of extant literature (Chapters 2-4).

Expressed simply, the student researcher values practice and practitioners. The student researcher stops consciously shy of arguing the level of practice is any "more important" (Saunders et al., 2015: 128) than another, e.g. the level of the organisation. Nevertheless, a closely held belief is that the ongoings of practice and work of practitioners are important enough to merit attention. To end the section, Saunders et al. (2015: 124-5) stress that "a consistent set of assumptions...underpin... your methodological choice, research strategy and data collection techniques and analysis procedures".

5.4 Practice theory

5.4.1 Introduction

This section addresses the concern for practice. Section 5.4.2 acknowledges extant academic interest; issues of terminology are isolated. Valuable clarity stems from the suggestion that practice can be considered three ways: as a "phenomenon", a "perspective" and a "philosophy" (Orlikowski, 2010) -with an "empirical", "theoretical" and "philosophical focus", respectively (Feldman and Orlikowski, 2011: 1240) (Section 5.4.3). The segmentation assists explanation of practice, as regards the present study (Section 5.4.4).

5.4.2 Practice in research

In the present study's purpose, RQs (Section 5.2) and interpretive philosophical stance (Section 5.3.4), there is inherent interest in practice. Alike academic intrigue is evident in e.g. management (Orlikowski, 2010) and organisation studies (Feldman and Orlikowski, 2011). But the same enthusiasm spurs a profusion of terminology capable of testing even the most attentive. No doubt among others, terms include: “practice theory”; “practice-centred theory”; “practice approach”; “practice account”; “practice-based view”; “practice perspective”; “practice lens”; “practice turn” and “practice idiom”.

Beyond the excess alone, scholars appear to employ multiple labels when referring to the same or similar (e.g. Orlikowski, 2010; Nicolini, 2013). Further, and where different scholars apply the same or similar labels, it is not always clear whether they indeed intend to impart the same or a similar meaning. This presents an obstacle to understanding the extant practice literature -and a hindrance to confident, trustable synthesis. Fortunately to the present study, Orlikowski (2010) hands a helpful way in.

5.4.3 Practice, three ways

From the management angle, she expands on “three modes of engaging practice in research”: as a “phenomenon”, a “perspective” and a “philosophy” (Orlikowski, 2010). Feldman and Orlikowski (2011: 1240) overlay on these, an “empirical”, “theoretical” and “philosophical focus”, respectively. They also note that one may be accentuated above the others. The three-fold segmentation serves a structure; other academic insights are integrated as accurately as possible (Sections 5.4.3.1-5.4.3.3). But given the outstanding prospect of ambiguity, a pinch of cautionary salt remains advisable.

5.4.3.1 A phenomenon: Empirical

When understood as a “phenomenon”, researchers seek to understand “what practitioners do ‘in practice’” (Orlikowski, 2010). They contrast “theory” and “practice”, i.e. “what researchers claim” and “what ‘actually happens’” (Orlikowski, 2010). Conscious of the “typically... large gap” separating “scientific knowledge” and “lived reality”, researchers focus heavily on “the empirical details of organizational life on the ground” (Orlikowski, 2010). Attention is on “everyday doings”, and incorporates “both the mundane and the novel” (Orlikowski, 2010).

Worlds apart from the “rational, orderly, homogenous and invariant phenomenon” commonly conveyed, works of this kind reveal “realities are rich with contingency, complexity, interdependence and emergence” (Orlikowski, 2010). An “empirical approach to practice” then,

addresses “the “what” of a practice lens”, i.e. “the everyday activity of organizing in both its routine and improvised forms” (Feldman and Orlikowski, 2011: 1240) [italics omitted]. These points are of relevance to the present study.

The present study aims to appreciate “what ‘actually happens’”, both daily and in challenging circumstances (Orlikowski, 2010). It adheres to Orlikowski’s (2010) “first mode”, studying “practice as a phenomenon”. Where available, practitioners’ interpretive, subjective, qualitative insights (Section 5.3.4) inform of the interrelated concepts/phenomena asked about by the RQs (Section 5.2); all are concerned with manifestations in practice. Pertinently, RQ 2 reflects explicit intrigue in improvisation. Where available, practitioners’ insights inform of their own practice(s) and, where applicable, any other with which they are familiar.

5.4.3.2 A perspective: Theoretical

Although practice can be legitimately examined in the absence of a “practice theory”, the study does utilise a particular “perspective” (Orlikowski, 2010). Applying Activity theory (Section 5.5), it adheres with Orlikowski’s (2010) “second mode”. Interestingly and whilst “practice theory has emerged as a potent challenger to prevalent ways of thinking about human life and sociality” (Schatzki et al., 2001), a foundational point is that “there is no unified practice approach” (Schatzki, 2001: 2), nor “theory” (Nicolini, 2013: 8). Nicolini (2013: 9) expounds “six different ways of theorizing practice”.

Helpfully, scholars clarify common concerns and/or underlying premises (e.g. Schatzki, 2001; Feldman and Orlikowski, 2011; Nicolini, 2013). One is the “general principal of consequentiality”: an acceptance that practitioners’ actions are significant in “producing the structural contours of social life” (Feldman and Orlikowski, 2011: 1241). Another is the “rejection of dualisms[,] and [instead] recognition of the inherent relationship between elements that have often been treated dichotomously” (Feldman and Orlikowski, 2011: 1241) [italics omitted].

Nicolini (2013: 2) notes that several scholars (Ortner, 1984; Schatzki, 2001; 2001; Reckwitz, 2002; Rouse, 2007) posit “a practice-based view of the social” gets past issues “left unsolved by other traditions”. These include the propensity to portray “the world in terms of... actor/system, social/material, body/mind, and theory/action” (Nicolini, 2013: 2). Related is the insisted “relationality of mutual constitution” (Feldman and Orlikowski, 2011: 1242) [italics omitted]. This implies a regard for agency is required to properly appreciate “social orders” such as structure; from the opposite angle, agency is “always already configured by structural conditions” (Feldman and Orlikowski, 2011: 1242).

Practices are “conceive[d] of... minimally, as arrays of activity” (Schatzki, 2001: 2). “Inherently relational”, practice theories perceive “the world as a seamless assemblage, nexus, or confederation of practices” (Nicolini, 2013: 3). Pursuing “practice as a perspective” entails “employing, to a greater or lesser extent, the conceptual scaffolding afforded by one or other practice theory” (Orlikowski, 2010) [italics omitted]. Attending to “the “how” of a practice lens”, the “theoretical approach” is to “explicitly” assume the “apparatus of practice theory” (Feldman and Orlikowski, 2011: 1241) [italics omitted]. Using others’ “theoretical ideas” calls for scholars to “engage with the [corresponding] core logic”, e.g. “how practices are produced, reinforced, and changed” (Feldman and Orlikowski, 2011: 1241). Clarified in Section 5.5, activity theory vocabulary is beneficial to the present study.

Generally, the “theoretical generalizations” that result from employing practice theory are “historically and contextually grounded” (Feldman and Orlikowski, 2011: 1249). This attracts attention because in the literature review (Chapter 2), alertness to the context and situation helped explain why paramedics intervened to encourage the activity’s continuity i.e. its congruence (Allen et al., 2013). Context was again significant to understanding bricolage (Chapter 3) and improvisation (Chapter 4). Regardless of exactly what the RQs return, the contextual sensitivity accommodated by practice theory is vital.

Whilst accepting contexts differ one to the next, the resulting “dynamics and relations” may aid apprehension elsewhere (Feldman and Orlikowski, 2011: 1249). Intent on elevating theoretical understanding of congruence -a relatively new and as yet undeveloped activity theory concept- the present study shares this optimism. Practice theory can also uncover opportunity for improvement (Feldman and Orlikowski, 2011: 1249). Although the study lacks any explicit interventionist ambition, practical insight is naturally valued.

5.4.3.3 A philosophy: Philosophical

Turning to Orlikowski’s (2010) “third mode”, practice is taken to be a philosophy. This utmost tier commands a “commitment to the ontological primacy of practice in social life” (Orlikowski, 2010). It assumes “social reality is fundamentally made up of practices” (Feldman and Orlikowski, 2011: 1241). Practices are “the primary building blocks of social reality”, so a concern for “everyday activity is critical”; this, in turn, attends to “the “why” of a practice lens” (Feldman and Orlikowski, 2011: 1241). Subscribing scholars “necessarily engage with practice through all three modes” (Orlikowski, 2010).

In Orlikowski’s (2010) mind at least, researchers operationalising a “practice perspective” (Section 5.4.3.2) “need *not* also take on board a practice ontology” [italics added]. Yet for Nicolini

(2013: 9), “practice theories are fundamentally ontological projects” inasmuch as “they attempt to provide a new vocabulary to describe the world and to populate [it]... with specific ‘units of analysis’” i.e. “practices”. Yet, exactly “how these units are defined... is internal to each of the [practice] theories” (Nicolini, 2013: 9).

5.4.4 Practice at present

Together with lending general insight into practice, the fleeting look at existing academic literature enables the present approach to be well appreciated. Where available, and informed by practitioners’ interpretive, subjective, qualitative insights (Section 5.3.4), the study examines practice empirically, as a phenomenon (Section 5.4.3.1). It pursues practice theoretically, employing a practice theory (Section 5.4.3.2): activity theory (Nicolini, 2013) (Section 5.5). Yet rather than endorse practice as a philosophy (Section 5.4.3.3) in any absolute sense, associated ideas augment the established interpretive stance (Section 5.3.4).

Ontologically, “social reality” is recognised to be “fundamentally made up of practices” (Feldman and Orlikowski, 2011: 1241). The shape and character of its “units of analysis” are inherited from the practice theory chosen, activity theory (Nicolini, 2013: 9) (Section 5.5). Epistemologically, the study accepts “adopting a practice approach radically transforms our view of knowledge, meaning and discourse”, and that “from a practice perspective, knowledge is conceived largely as a form of mastery that is expressed in the capacity to carry out a social and material *activity*” (Nicolini, 2013: 5) [italics added].

5.5 Activity theory

5.5.1 Introduction

Activity theory is among practice theories (Nicolini, 2013). But its “underlying ideas... are difficult to grasp” (Kaptelinin and Nardi, 2006: 29-30), and so the literature review (Chapter 2) delved into the tradition’s history. Complimenting this, Section 5.5.2 initially consults CHAT-associated philosophy. Alert to the present study’s purpose and RQs (Section 5.2), Section 5.5.3 latterly identifies theoretical apparatus suggesting its suitability as a theoretical framework. Where unambiguous, its “third generation” (Engeström, 2001: 135; originally Engeström, 1987) is emphasised as especially assistive.

5.5.2 CHAT-associated philosophy

The historical narrative (Chapter 2) touched on a connection to Marxism (Bakhurst, 2009). At its simplest, “Marxism is a social, political, and economic philosophy named after Karl Marx” (Investopedia, 2021). Allen et al. (2011: 786) admit “the extent to which activity theory can be used without also accepting Marxist theory in its entirety is... an issue of contention”; in the main, they have mobilised it “as a lens[,] without drawing upon its economic or societal analysis”. To Aimtech, it has offered “a lens to view the world, a common vocabulary, and a set of tools” (Allen et al., 2011: 786).

The present application is in keeping, in that it does not engage explicitly with the Marxist ideas. Yet, this is not to suggest the study overlooks CHAT-associated philosophical commentary outright. In fact -and following on from the established interpretive stance (Section 5.3.4) and clarity from consulting the practice theory literature (Section 5.4.4)- a handful of scholarly observations supply further specificity. Philosophically, the present study appreciates “the concept of activity... constitutes a basis for understanding the nature of knowledge and reality” (Miettinen, 2006: 389).

Holzman (2006: 6) emphasises that “among the numerous articulations of activity theory”, exists “a non-dualistic approach to understanding and transforming human life that takes dialectical human activity as its ontology”. More precisely than offered when outlining the present study’s interpretive underpinnings (Section 5.3.4) and practice-related particulars (Section 5.4.4), its ontology is clarified to be human activity. In that the present study’s ontology stems from activity theory, and that activity theory is a practice theory (Nicolini, 2013), this also reflects an ontology-practice theory connection.

In accordance with assumptions of activity theory, the present study sees “subjective and objective phenomena as fundamentally inseparable” (Kaptelinin and Nardi, 2006: 137). More specifically, it acknowledges “activity systems as contradictory unities of subjective and objective aspects in ongoing development” (Allen et al., 2013: 850). In employing “Engeströmian activity theory”, the activity system is taken as the “prime unit of analysis” (Peim, 2009: 173) [italics omitted]. Given the established, general commitment to interpretivism (Section 5.3.4), it is apposite that the activity system comprises a “subjective actor” i.e. “subject” (Allen et al., 2011: 784).

Where expansion is of interest, “activity, in fact, cannot be understood from outside; it can only be appreciated from within” (Nicolini, 2013: 116). Engeström and Miettinen (1999: 10) also urge appraisal of the “[activity] system view” together with that of its subjects: “the analyst must

select a subject ... through whose eyes and interpretations the activity is constructed". Whilst beyond present scope, Engeström (2000a) offers an elaborate angle on the epistemology of activity theory in relation to a baseball match-fixing saga.

Although the present study has no explicit interest in expansion, the CHAT-associated philosophical commentary fine-tunes its interpretive stance (Section 5.3.4) and position on practice (Section 5.4.4). Where available, practitioners' first-hand interpretive, subjective, qualitative insights can be understood as those of subjects and/or the community; epistemologically, their insights offer an appreciation of practice(s) that translate theoretically to the activity system(s) they themselves occupy, and where applicable, any associated. Their insights therefore inform in an ontological sense.

5.5.3 Theoretical framework

Activity theory is not confined to qualitative research (Karanasios, 2014). Yet from the critical review of academic literature (Chapter 2), it pairs perceptibly well. Extant works using activity theory have contributed to the calibre of theoretical insights sought by the present study (e.g. Allen et al., 2013; Forsgren and Byström, 2018; Karanasios and Allen, 2014). Its use aligns well with the purpose and RQs (Section 5.2). "Third generation" CHAT (Engeström, 2001: 135; originally Engeström, 1987) stands out as especially suitable.

The most prominent prompt relates to the concept of congruence. Congruence was initially introduced to the CHAT tradition directly via this route (Allen et al., 2013) (Chapter 2). Allen et al. (2013: 841) appended to the existing assumption of "contradictions leading to change"; "congruencies" label "stabilizing forces within activity systems", instead "foster[ing] reproduction". Third generation CHAT is the native theoretical framework for congruence; opting for it enables the present study to answer the RQs and thereby achieve its purpose (Section 5.2) against this invaluable apparatus.

The activity system(s) associated with third generation CHAT uniquely allow analysis of contradictions. This is desirable in light of recent empirical works, which indicate the theoretical importance of contradictions and congruence alike (Karanasios and Allen, 2014; Forsgren and Byström, 2018, Chapter 2). Even in the earliest congruence article (Allen et al., 2013: 845), a contradiction is linked to the subsequent paramedic action noted to have ushered "a more congruent activity" (Chapter 2).

Third generation CHAT is able to accommodate theoretically the interpretive, subjective, qualitative insights of subjects and/or the community that inform of the interrelated concepts/phenomena queried by the RQs (Section 5.2). RQ 1 asked how congruence is reached in practice i.e. about means towards congruence; RQ 2 asked about the role(s) of bricolage and improvisation i.e. their candidate capacities towards the same. Insights applicable to the RQs can be interpreted as -and/or by reference to- goal-driven action(s) undertaken by subject(s) and/or the community (Section 2.2.3, Chapter 2).

Within CHAT, the tool component can cater for a “composite artefact” (Nicolini, 2013: 125). Acknowledging bricolage may entail multiple resources (Baker and Nelson, 2005) (Chapter 3), this is significant to its study (Goddard et al., 2016). In contrast to the activity’s typical tool(s), repertoire-sourced resource(s) likely lack alignment with “any particular project” (Levi-Strauss, 1972: 17) (Chapter 3) -or indeed the focal activity’s object. Insights relevant to the role(s) of bricolage (RQ 2) are thereby accommodated theoretically.

CHAT apparatus may also aid understanding of negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice, as asked about by RQ 3. In particular, the concept of contradictions. “Contradictions refer to anything within the system that opposes the overall motive of the system, the aim or purpose that subjects within the system are individually or collectively striving toward” (Allen et al, 2013: 840) (Section 2.4.2, Chapter 2). Although contradiction(s) should not be assumed to have an “untoward bearing” (Section 2.4.2, Chapter 2), this CHAT concept may at least assist in explaining theoretically, insights concerning challenge(s) (RQ 3) and critical incidents (Section 5.6).

Allen et al. (2011: 786) regard “CHAT as a lens” able to “illuminate” specific “challenges” in “information science research”, one of which is “theorizing technology”. Attractive to IS scholars, activity theory meets “the challenge of studying the *interaction between* technology and actors”; it considers the part played by technology “in activity”, yet biases neither “material” nor “social” (Karanasios and Allen, 2018: 439) [italics added]. This is surely encouraging for the “management literature on technology in organizations”, wherein technology has been largely “missing in action” (Orlikowski and Scott 2008: 3). Equally, for the “organization studies literature” to have neglected “the everyday materiality of organizing” (Orlikowski, 2007: 1444).

A firm theoretical grasp of technology, such as that offered by CHAT, is important to the present study. Elaborated below (Section 5.7), empirical work is undertaken in a setting that sees regular use of and/or even reliance on an assortment of information technology (IT) product(s) and/or

service(s). On various fronts then, CHAT -especially third generation (Engeström, 2001: 135; originally Engeström, 1987)- is the favoured theoretical framework. It connects well, moreover, with Critical Incident Technique (CIT) (Flanagan, 1954).

5.6 Critical Incident Technique

Of relevance to the present study, this section introduces Critical Incident technique (Flanagan, 1954) (CIT) and characterises the critical incidents as interpreted.

The present study is especially interested in elevating theoretical understanding of congruence - and indeed in all of the interrelated concepts/phenomena queried by the RQs (Section 5.2)- as they manifest within and/or in respect of critical incident(s). This acknowledged, CIT is relevant. CIT stems from work undertaken in the United States (US) air force during the Second World War (Flanagan, 1954). A "methodology", it spells out ways of gathering "observed incidents having special significance and meeting systematically defined criteria" (Flanagan, 1954: 327). Flanagan (1954: 335) suggests it is to be considered "a flexible set of principles which must be modified and adapted to meet the specific situation at hand".

As originally conceived, the initial stage of CIT is concerned with ascertaining "the general aims of the activity" (Flanagan, 1954: 336). Flanagan (1954: 336) argues "it is clearly impossible to report that a person has been either effective or ineffective in a particular activity by performing a specific act unless we know what he is expected to accomplish". Next, attention turns to "Plans and Specifications" (Flanagan, 1954: 337) [italics omitted]. Flanagan (1954: 337-338) stresses "observers" receive "precise instructions" so as "to focus attention on those aspects of behavior which are believed to be crucial in formulating a functional description of the activity" [italics omitted].

For Flanagan (1954: 338), "one practical device for obtaining specific data is to obtain records of "critical incidents" observed by reporting personnel". He defines these as "extreme behavior, either outstandingly effective or ineffective with respect to attaining the general aims of the activity" (Flanagan, 1954: 338). Arriving at "agreement" i.e. "objectivity for the observations" of "independent observers", is dependent on their adherence with "the same set of rules"; it is likely that certain "specifications" are necessarily explicated in advance of data collection (Flanagan, 1954: 338).

Among these are attributes of "the situations observed" e.g. "information about the place, the persons, the conditions, and the activities" (Flanagan, 1954: 338) [italics omitted]. Fittingly and from the perspective of information behaviour scholarship, "use of the formalized activity system can contribute towards the development of the idea of a situation" (Allen et al., 2011: 784). In related work, Mishra et al. (2011b: 1) drew influence from CIT in conjunction with activity theory to study the information sharing of multiple agencies "when responding to a major incident" (Section 3.5, Chapter 3).

The present study similarly cites both CIT and CHAT as influences. CIT connects well with CHAT and other aspects established already. To reiterate in brief, the interpretive philosophical stance embraces a "complex" and "rich" ontology; it endorses the epistemological worth of e.g. "narratives, stories, perceptions and interpretations" (Saunders et al., 2015: 136), drawing on the first-hand, interpretive, subjective, qualitative insights of practitioners (Section 5.3.4). Some insights were suggested to inform of critical incidents (Section 5.3.4).

Following the study's general commitment to interpretivism (Section 5.3.4) and clarity regarding its position on practice (Section 5.4.4), the ontology was clarified -more precisely- to be human activity (Section 5.5.2). Practitioners' insights came to be understood as those of subjects and/or the community; epistemologically, their insights were recognised to endow understanding of practice(s) that translate theoretically to the activity system(s) they occupy, and where applicable, any associated (Section 5.5.2). They were therefore argued to inform in an ontological sense (Section 5.5.2).

Beyond these pre-established points, it is contended that some of the insights of subjects and/or the community are about critical incident(s) concerning the activity system(s) they occupy and/or associated other(s). Critical incidents were recalled by the target sample (Section 5.8) when gathering data (Section 5.11) and interpreted by the student researcher as relevant theoretically (Section 5.12.5). Characteristically, critical incidents are actual, typical and/or hypothetical events; they may e.g. have and/or continue to inhibit(ed) and/or prevent(ed) continued activity/activities, inclusive of incumbent object. Influenced by Lyytinen and Newman's work (2008) (Section 2.6, Chapter 2), critical incidents may be understandable with respect to contradiction(s), e.g. prompting them.

Where applicable, critical incidents comprise the interrelated concepts/phenomena queried by the RQs: means towards congruence (RQ 1), bricolage and/or improvisation (RQ 2), as well as any negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in

practice (RQ 3) (Section 5.2). These aspects of critical incidents may pertain to the focal activity system(s) and/or associated other(s); CHAT apparatus e.g. goal-driven action(s) and contradictions may aid understanding theoretically. Consideration of critical incidents assists in answering the present study's RQs and therefore serves its purpose (Section 5.2).

5.7 Empirical setting: IT provision in UK academia

This section establishes the empirical setting to be IT provision in UK academia; the IT provision activity is recognised as responsible for the safe and continued provision of IT products and services at UK (United Kingdom) universities.

Through supervisory discussion, IT provision at UK universities came to be considered a particularly suitable and opportune empirical setting. UK universities typically offer an assortment of information technology (IT) product(s) and/or service(s) to their population of users. The IT user base is typically sizeable, comprising e.g. students at various levels of study, as well as academic and non-academic staff. In this empirical setting, IT users utilise IT regularly. IT can be essential, with IT users relying on it for their work. Notwithstanding, critical incidents (Section 5.6) can occur.

Critical incidents are events; they may e.g. have and/or continue to inhibit(ed) and/or prevent(ed) continued activity/activities, inclusive of incumbent object (Section 5.6). In the empirical setting of IT provision at UK universities, critical incidents can concern IT provision activity and/or associated other(s) e.g. that/those of staff and/or student IT user(s). Irrespective, a UK university's IT provision activity remains responsible for the safe and continued provision of its IT products and services. To invoke CIT terminology, this is indicative of its "general aims" (Flanagan, 1954: 336).

One IT practitioner sums up concisely:

“what we are here to do in IT, is enable the university to do its business effectively”

Service Manager for Frontline Services, Interviewee 1, University A

Elaborated in the findings and discussion (Section 6.2, Chapter 6), theoretical understanding is gained by reference to CHAT vocabulary. In brief, the object of a university's IT provision activity is interpreted as the safe and continued provision of IT products and services for IT users, i.e. the

community. At this uppermost level in the hierarchy, the object in fact equates to its motive (Kaptelinin, 2014). In a university's IT provision activity, IT practitioners are subjects/community; their work involves engaging in goal-driven action(s), which contribute towards satisfying the object and motive.

5.8 Target sample: IT practitioners

This section looks at sampling and substantiates the decision to target IT practitioners specifically.

Touching on the "what", "who" and "where", the study's empirical setting (Section, 5.7) alluded to matters of "sampling and selection" (Mason, 2018: 80). To disclaim, the study does not sample "representationally"; its sample is therefore not "representative of a wider population or universe" (Mason, 2018: 90) [italics omitted]. Nevertheless, it does act to "generate the data" required to answer the RQs (Section 5.2) (Mason, 2018: 83). Most immediately then, the sampling can be considered "purposeful" (Tracy, 2012: 134) or "purposive" (Bryman and Bell, 2011: 442).

Whereas purposive sampling corresponds with "certain research goals", a "convenience sample" is noted as nothing more than one within incidental reach (Bryman and Bell, 2011: 442). Interestingly, "there can be an element of convenience in many sampling techniques" (Oates, 2006: 98). To an extent that becomes evident, the present sample can also be characterised as one of "convenience" -or as "opportunistic" (Tracy, 2012: 134). Recruitment further relies on snowball sampling (Oates, 2006; Tracy, 2012) (Section 5.9).

Researchers have to ponder which "unit or categories" to sample (Mason, 2018: 94). Options include texts, artefacts, objects, settings, organisations, events, practices, places, times and people (Mason, 2018: 100). The present study samples people, whom can be sampled "as individuals, bodies, identities, groups, [or] collectives" (Mason, 2018: 94) [italics omitted]. Determining "which people" commands classification, and demographics typically aid in "social research" (Mason, 2018: 94). But "conventions" have to be considered critically, in respect of "your own particular project" (Mason, 2018: 95).

Reasonably, a decision to sample people must be founded on a feeling that they constitute "meaningful data sources for the intellectual puzzle" (Mason, 2018: 94). A more nuanced observation is that where "ontological perspective" emphasises "experiences" as "meaningful",

these experiences can even be sampled *in place of* "people or their characteristics per se" (Mason, 2018: 95) [italics omitted]. Relatedly, people may also be held as "potential witnesses to aspects of the world", whose "testimonies" pertain to whatever actually captures curiosity (Mason, 2018: 95-96).

These points provide the present study food for thought. Demographically, individual people are sampled on the basis of their occupation/profession. Those targeted were required to be an IT practitioner of some capacity, working in IT at a UK university. Rather than defining any further and/or more specific criteria, the student researcher assumed a broad and inclusive attitude towards the target sample. Demographic attributes such as sex, race or religion were immaterial to the study's purpose and RQs (Section 5.2).

Glancing back to the interpretive stance (Section 5.3.4), practice theory particulars (Section 5.4.4) and CHAT-associated philosophical influence (Section 5.5.2), the target sample aligns well. In IT provision in UK academia, IT practitioners are subjects/community of the IT provision activity (Section 5.7). Optimally positioned, they have experience and/or can act as witnesses. Epistemologically, where available, IT practitioners' first-hand interpretive, subjective, qualitative insights offer understanding of the IT provision activity system, and, where available, associated other(s) e.g. that/those of staff and/or student IT user(s); their insights therefore inform in an ontological sense.

To elaborate, where available, IT practitioners hold/carry insights about the general work of the IT provision activity, and, where available, associated other(s) e.g. of staff and/or student IT user(s). Where available, they also hold/carry insights about critical incident(s) (Section 5.6; 5.7). Therein and where available, IT practitioners hold/carry insights pertaining to the interrelated concepts/phenomena queried by the RQs (Section 5.2). That is, means towards congruence (RQ 1), bricolage and/or improvisation (RQ 2), and any negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice (RQ 3). Where available, IT practitioners' first-hand interpretive, subjective, qualitative insights assist in answering the RQs and therefore serve the purpose (Section 5.2).

5.9 Recruitment process

5.9.1 Introduction

In keeping with the broad and inclusive attitude towards the target IT practitioners (Section 5.8), the student researcher was open-minded when actively identifying and recruiting prospective

participants. Necessarily limited, this section recites the process. Section 5.9.2 starts with university A, where discernibly drying interest influenced the decision to expand attention beyond just one academic institution (Section 5.9.3). Events at universities B (Section 5.9.4) and C (Section 5.9.5) are subsequently recounted. Section 5.9.6 ends by acknowledging other active efforts.

5.9.2 University A

Conveniently, one supervisor suggested he knew of a mutual acquaintance working in IT at a university (A, Table 1). In December 2016, the student researcher contacted them -an IT Support Advisor at the IT service desk- by email, to ascertain whether s/he could assist. The student researcher and IT practitioner met in person for an informal conversation about both the research and IT at the respective university. The IT practitioner also mentioned the study to a colleague -attempted snowball sampling (Oates, 2006; Tracy, 2012).

Again conveying convenience, the supervisor also knew of an IT Service Desk Manager at university A. The supervisor contacted them in February 2017 to offer some background to the research, and the IT Service Desk Manager appeared to agree to help. As previously, the student researcher contacted them by email. But meeting in person, the IT Service Desk Manager was doubtful of being able to provide. The student researcher promptly relayed this to the supervisor, whom then re-contacted the IT Service Desk Manager.

After this, the IT Service Desk Manager -a gatekeeper- allowed access. Correspondence between the student researcher and supervisors, and the student researcher and IT Service Desk Manager, ensued. The IT Service Desk Manager requested clarity on certain matters, e.g. the premise of the research, anonymity and timeframes; the student researcher responded comprehensively, and provided an information sheet for participants. Following this, the IT Service Desk Manager assisted the study in a number of notable ways.

The IT Service Desk Manager advised s/he had "circulated a request for volunteers... to a number of IT support teams" at the university. S/he also became the first participant. Additionally, s/he isolated IT managers that were happy to participate, asking them to arrange with the student researcher. The student researcher was thankful to see three different members of IT management distribute information about the study to colleagues by email. This also resembles snowball sampling (Oates, 2006; Tracy, 2012).

The study benefitted 8 participants from university A, spanning IT management -including senior management- and those more frontline-focused. Some worked at the university's IT Service Desk, and some were affiliated with the business school faculty. Despite the differences, each of the IT practitioners are interpreted as subject(s)/community in the IT provision activity, working overall towards the safe and continued provision of IT products and services for IT users, i.e. the same object and motive (Section 5.7).

5.9.3 Expanding beyond one university

Unfortunately, enthusiasm among prospective participants eventually appeared to dry up inasmuch as no further IT practitioners were willing to engage with the study. At this point and although it had not been the intention from the off, the student researcher was prompted to turn elsewhere. Specifically, visiting the websites of other UK universities and/or the respective institution's IT department, helpdesk or equivalent. The purpose was to add further suitable IT practitioners to the sample.

When looking online and although the particulars understandably varied by university, the student researcher recognised similarities or common features. For example, the public-facing websites referred to the provision of alike IT product(s) and/or service(s). Typically, they also identified way(s) for IT users -i.e. the university community- to initiate contact. The specific communication method(s), e.g. webform, webchat, email address(es), etc., influenced the participant recruitment effort going forwards.

5.9.4 University B

As one exemplar, the student researcher used a generic university email address or webform in June 2017 to initiate contact with a university's (B, Table 1) IT department. The correspondence briefly introduced the study and asked if it would be possible to interview IT support staff and to circulate a participation request to IT staff. It was picked up by the Service Desk Manager, a senior IT practitioner comparable to the gatekeeper at university A. Optimistically, s/he suggested s/he was "sure we can find people for you", and also sought clarity on numbers, "gender, age, type of role, [and] seniority of role". The student researcher responded promptly and comprehensively.

Within a week, the Service Desk Manager emailed back. A gatekeeper, s/he presented an especially compiled list of IT practitioners expressing interest. It included him/herself and other members of IT management, e.g. Head of Digital Architecture, Infrastructure Support Manager

and Campus IT Services Team Leader. Email addresses were explicated alongside each, and the Service Desk Manager encouraged direct contact. This can be considered a sort of snowball sampling to have “produce[d] a sampling frame” (Mason, 2018: 118). That is, “a resource from which you can select your smaller sample” (Mason, 2018: 116).

The student researcher trusted and felt confident proceeding from the list, not least because it stemmed from the earlier email contact and criteria conveyed. As senior IT management, its curator, the Service Desk Manager, was immeasurably better placed to judge “It is actually a pretty good spread of the different areas”. The student researcher conscientiously shared the list -and consulted with- the supervisory team. One approved: “This is positive news. I agree you should pursue these interviews”. Altogether, 6 IT practitioners were attained from university B.

5.9.5 University C

Communication methods available and/or referred to online equally influenced recruitment at university C. Using a web-based library chat facility in approximately June 2017, the student researcher learned the university was “part of a nationwide co-op”, offering a “reference service” apparently “staffed by librarians from all over” geographically. Via this, he introduced the study, asked about interviews with IT support staff, and requested circulation of a participation request to IT staff. From this as an initial approach -and the snowball-like efforts of IT practitioners- the sample grew by 2.

One was an IT Support Officer, whose occupation involved serving university students and staff with IT-related issues directly; in this sense, akin to the frontline work of IT practitioners at the Service Desk of university A. The other held a managerial position, as the Library Systems and Support Manager. In terms of sample size, the addition of 2 was modest. But more memorable events were to unfold in respect of university C, following email contact with the Head of Applications and Digital Services in October 2017.

Responding, the Head of Applications and Digital Services carbon-copied (CC) the student researcher into an email to his/her personal assistant (PA), requesting s/he “arrange this please”. Although the PA did not participate in the study personally, s/he represented a particularly assistive gatekeeper. The PA made concrete arrangements with IT practitioners on behalf of the student researcher, extended a warm invite to the university for data gathering, and provided practical information e.g. a link to a map.

Owing to the extensive assistance of the PA, the sample gained a further 4 participants. Accompanying the Head of Applications and Digital Services were the Head of Research IT, Head of Performance Improvement Reporter and a Project Delivery Director. In seniority, they were more comparable to the members of senior management already sampled, than to those whose work involved frontline responsibilities. Beneficially, this raised the number of IT practitioners recruited from university C to 6.

5.9.6 Other active efforts

The recruitment of multiple, suitable participants from 3 UK universities (A, B and C) was obviously advantageous to growing the study's sample. Although omitted for brevity, it should be stressed that the student researcher's efforts to actively identify and recruit prospective IT practitioners extended much beyond these 3 academic institutions. Despite this, not all efforts were necessarily as fruitful as those recounted -if, indeed, at all. This is felt to have had an effect on the shape of the resulting sample.

5.10 Resultant sample and reflecting on skew

This section presents the resultant sample and reflects on its skew.

Table 1 lists the resultant sample, an aggregate of 22 IT practitioners from 6 UK universities i.e. academic institutions. Following on from acknowledgement of the student researcher's other active efforts to build the sample (Section 5.9.6), the final Table shows that it was unfortunately only possible to recruit solitary, suitable IT practitioners from 3 further universities (D, E and F). In this sense, it may be suggested that the sample is skewed; reflection is reasonable.

Interviewee no.	University	Job/ position/ description
1	A	IT – Service Manager
2	A	Senior IT Support Advisor
3	A	IT Support Officer
4	A	IT Support Officer
5	A	Business school IT practitioner
6	A	Senior IT Support Advisor
7	A	Faculty Database Manager
8	A	IT Support Advisor
9	B	Applications Analyst Team Leader
10	B	Campus IT Services (Team Leader)
11	B	IT Project Manager
12	B	IT Support Officer
13	B	Head of Digital Architecture
14	B	Service Desk Manager
15	C	Library Systems and Support Manager
16	D	IT Operations Manager
17	C	Head of Research IT
18	C	Head of Performance Improvement Reporter
19	C	Head of Applications and Digital Services
20	C	Project Delivery Director
21	E	IT Support Manager
22	F	IT Service Manager
Interview duration: 20-54 mins; all audio-recorded		

Table 1. Sample of IT practitioners

Tracy (2012) touches on the subject of skew within a broader discussion of sampling. In her own words, "one downside of snowball samples is that they can quickly skew to one kind of group, clique, or demographic" (Tracy, 2012: 136). This, she accounts for on the basis that "participants tend to suggest others who are similar to themselves" (Tracy, 2012: 136). Insofar as recruitment entailed snowball sampling at different points *and* the resultant sample (Table 1) is skewed, there may be merit in the argued association.

Noted above (Section 5.9), recollection of the recruitment processes is not exhaustive. At the same time, it is not necessarily realistic to suppose the student researcher could have been aware of the totality of third-party effort(s) to build the sample. Although unclear, snowball sampling -or attempt(s) thereof- could possibly have occurred at universities D, E and F. Nevertheless, it is clear with respect to universities A, B and C, that snowball sampling contributed tangibly to upping the numbers. Whilst snowball sampling may explain the skew somewhat, it may also be attributed elsewhere.

At each of the universities from which multiple IT practitioners were recruited (A, B and C), a gatekeeper is distinguishable. Although their assistance varied, all were instrumental; their interventions complimented those of the student researcher, facilitating access and participation at the affiliated academic institution specifically. It is unclear whether there were equivalent figure(s) aspiring and/or attempting to act as gatekeeper(s) at the universities yielding only single IT practitioners (D, E and F).

It does not escape attention, moreover, that the gatekeepers at universities A and B were *senior* IT practitioners, and that the gatekeeper at university C -whilst not an IT practitioner him/herself- was close to senior IT practitioners. In the immediate, this may indicate the importance of seniority or proximity to it: it seems plausible that seniority could favour fruitful gatekeeping. Yet, Table 1 shows the IT practitioners from universities D, E and F were themselves senior. Seniority then, guaranteed neither effective gatekeeping nor snowball sampling of additional, appropriate IT practitioners.

Similarly and as suggested, the student researcher's recruitment efforts did not always lead to sample growth. This may reflect on the student researcher's ability to persuade IT practitioner(s) to participate in the study; greater experience and/or a stronger such ability may well have resulted in a less skewed -and instead more evenly balanced- sample. This acknowledged, the skew may also and/or alternatively be attributed to an unwillingness or lack of interest on the part of those targeted.

Whatever the case, the skew is inadvertent and felt to relate to recruitment. Although a skew *can* be undesirable (Tracy, 2012), it is not problematic that the present sample is skewed in the direction of 3 universities (A, B and C). Neither minimum nor maximum numbers of IT practitioners per university were formally pre-defined (Section 5.8). Irrespective of academic institution, all (Table 1) represent the subjects/community of its IT provision activity -and thus, where available- hold/carry insights that assist in answering the present study's RQs, and which therefore serve its purpose (Section 5.8). The resultant sample is a collective.

5.11 Gathering data

5.11.1 Introduction

This section expands on data gathering. Section 5.11.2 begins by acknowledging alternative methods available for examining the focal and interrelated concepts/phenomena of interest. Continuing, Section 5.11.3 concentrates on interviewing; semi-structured (SSI) is substantiated. Section 5.11.4 then details the design of the SSI protocol, illuminating influence where apparent. Section 5.11.5 considers accompanying documentation and ethics, before Section 5.11.6 recounts the conduct -or carrying out- of interviews.

5.11.2 Alternative data collection methods

As noted (Section 5.3), Saunders et al. (2015: 124-125) argue a “credible research philosophy... underpin[s] methodological choice, research strategy[,],... data collection techniques and analysis procedures”. In the present study, the choice of SSI (Section 5.11.3) and design of the SSI protocol (Section 5.11.4) connect well with aspects established already. Also, and although “often overlooked”, Ravitch and Riggan (2012: 24) recognise the literature review to “inform research design and methodology”. Looking back (Chapters 2-4), there are evidently alternative methods to collect data concerning the interrelated concepts/phenomena queried by the RQs (Section 5.2).

Whilst not exhaustive, these include observation, documentation, and interviews. Qualitative and quantitative methods are each utilised, as are multiple and mixed. Observation is seen in studies that make use of CHAT (e.g. Engestrom, 2000b; Detlor, 2017), and by research in the bricolage (e.g. Baker and Nelson, 2003; Bechky and Okhuysen, 2011) and improvisation literatures (e.g. Njenga and Brown, 2012; McGann and Lyytinen, 2008). From the literature review, it is clear the observation method has been of value. Certainly, within the “Collecting the Data” stage of CIT, Flanagan (1954: 339-340) advises “direct observations are to be preferred” [italics omitted].

Unfortunately, there are numerous concerns relating to observation as a data collection method. It could involve waiting for something of specific interest to happen. This, in turn, points to the potential for uneventful timeframes. It would also be physically impossible to observe past event(s), ruling them out uniformly. Rather, observation(s) e.g. of the interrelated concepts/phenomena queried by the RQs (Section 5.2), would be restricted to any unfolding and actually being observed in the present.

Even if practicable, there may be ambiguity as to exactly what is witnessed. Means towards congruence (RQ 1), bricolage and/or improvisation (RQ 2) and/or negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice (RQ 3) may manifest, but the student researcher observing may not sense it. This could owe e.g. to the technical nature of IT practitioners’ work. Observation would rely on the observer’s interpretation, precluding access to IT practitioners’ first-hand insights assistive in answering the present study’s RQs and which therefore serve its purpose (Section 5.8).

An alternative is documentation, as collected by existing works in the CHAT (e.g. Detlor, 2017), bricolage (e.g. Bechky and Okhuysen, 2011) and improvisation literatures (e.g. Garreau and Adrot, 2009; Orlikowski, 1996). In "business and management research", an assortment of "documentary sources" can be leveraged (Bryman and Bell, 2011: 544). "Organizational documents" are especially significant; yet, "access to an organization does not automatically extend to "certain documents" (Bryman and Bell, 2011: 550).

Orlikowski's (1996) study at software company, Zeta (Section 4.7, Chapter 4), is pertinent. It drew on documentation including records created by "specialists" to reflect their effort(s) assisting callers; these were "accessible" by colleagues (Orlikowski, 1996: 71). But Adrot's (2011) study of the 2003 French heat wave (Section 4.5, Chapter 4) also attracts interest. In particular, the finding that staff using email understood its "traceability" and so to "prevent criticism", apparently "avoided mentioning controversial content, which limited discursive exchanges about the widespread bricolage and improvisation practices" (Adrot, 2011: 6).

With respect to the present study and whilst documentation may be abundant in IT provision in academia (Section 5.7), it may be equally out of reach. Even if accessible -and irrespective of documentation type- there could be any number of reasons it does not reference or hint at the interrelated concepts/phenomena of interest to the RQs (Section 5.2). As with observation, documented content could also be ambiguous. Lastly and if bricolage and/or improvisation is/are intentionally understated or omitted when the documentation is created/recorded, this would obviously carry to its form when collected as data.

Each of these points raise concern as to the suitability of documentation collection. More precisely and in common with observation, doubt in its ability to return the calibre of IT practitioners' first-hand insights assistive in answering the present study's RQs and which therefore serve its purpose (Section 5.8). Fortunately, observation and documentation do not represent the only methods available in qualitative research. The present study more suitably opts to use interviewing as its method of data collection/gathering. This decision is substantiated below.

5.11.3 Interviews, semi-structured (SSI)

Interviewing has again been employed by studies in the CHAT (e.g. Allen et al., 2013; Karanasios and Allen, 2014), bricolage (Domenico et al., 2010; Bechky and Okhuysen, 2011) and improvisation literatures (e.g. Garreau and Adrot, 2009; Mendonca, 2007). Likewise, the present

study gathered data from 22 IT practitioners at 6 UK universities (Section 5.10) by method of interview. But perusing the qualitative methods literature, it is clear interviews can differ (Oates, 2005; Tracy, 2012; Bryman and Bell, 2011).

One kind is “group interview”, within which the “focus group method” is a “form” (Bryman and Bell, 2011: 503). Relative to ethnography and observation, collecting data from multiple participants at once is clearly more efficient. But focus groups are “difficult to organize” (Bryman and Bell, 2011: 516). If participants have “a significant experience in common”, it is sensible (Tracy, 2012: 169). Yet, whilst the present study welcomes the possibility that congruence is worked towards collaboratively, this is not presupposed; IT practitioner(s) are anticipated to have “individually differentiated experiences” and so focus groups are less than ideal (Tracy, 2012: 169).

The present study gathered “non-numeric data” (Oates, 2005: 266) by interviewing the 22 IT practitioners *individually*. Given “the need to standardize”, “structured interviews” tend to lack flexibility (Bryman and Bell, 2011: 467). They are essentially questionnaires completed by the researcher (Oates, 2005). Others are instead absent of much or any structure; it is possible only a “single question” is posed (Bryman and Bell, 2011: 467). Seemingly in between is semi-structured (Bryman and Bell, 2011).

Semi-structured interviews and observation constituted the “interview-based approach” assumed by Allen et al. (2013: 842) when studying the UK ambulance service (Section 2.4.3.1, Chapter 2). To offer a reminder, the new system forced the ambulance to stay put for a while; this concerned the community, so “one of them” i.e. a paramedic, briefly explained (Allen et al., 2013: 845). A project manager clarified some “have got a very good routine going”, adding “it is something they haven’t been taught, they’ve developed that themselves” (Allen et al., 2013: 845).

Although the study employed multiple methods, the project manager's disclosures were clearly verbal: they appear to have been conveyed via semi-structured interview. In the student researcher's understanding(s)/interpretation(s), they are indicative of an intentional effort to instil congruence into the activity that was, at least initially, improvised (Section 2.4.3.1, Chapter 2). This past work (Allen et al., 2013) thus exemplifies how the semi-structured interview method can return the kind of insights (Section 5.8) sought, e.g. those of value to the present study's purpose and RQs (Section 5.2).

Generally, researchers using semi-structured interviews are equipped with "a list of themes to be covered and questions" (Oates, 2005: 188). The questions -as asked- may not match up "exactly" as in the "schedule" (Bryman and Bell, 2011: 467). Interviewers are open to re-ordering them, relative to the "flow of the 'conversation'" (Oates, 2005: 188). Questioning can transcend the "guide", where the interviewer "picks up" on matters mentioned by the interviewee (Bryman and Bell, 2011: 467).

Those interviewed can "introduce issues" they consider to be "relevant" i.e. applicable to the themes (Oates, 2005: 188). Semi-structured interviews are thus able to accommodate IT practitioners' first-hand interpretive, subjective, qualitative insights (Section 5.8). Via semi-structured interviewing, the present study is able to directly elicit IT practitioners' first-hand insights assistive in answering the RQs and which therefore serve its purpose (Section 5.8). Section 5.11.4 details how the design of the SSI protocol facilitated.

5.11.4 Design of SSI protocol

The extant literature also indicates different aspects of a study can relate to its SSI protocol/guide/instrument. Detlor's (2017: 20) study of a Canadian storytelling initiative (Section 2.4.3.3, Chapter 2) noted the influence of the research questions on the "design of the interview instrument", and of activity theory "constructs" on the form of interview questions. Similarly, in their work on information sharing, Mishra et al. (2013b) recognised "activity theory as a framework" to have been significant to the "interview structure"; CIT also aided in the creation of "specific interview questions" (Section 3.5, Chapter 3).

The SSI protocol used may have changed somewhat throughout the study. Appendix A appears to evince connections with -or the influence(s) of- other aspects of the study. It elicits IT practitioners' first-hand interpretive, subjective, qualitative insights, where available (Section 5.8). That is, insights about the general work of the IT provision activity, and associated other(s) e.g. of staff and/or student IT user(s), critical incident(s) (Section 5.6; 5.7) and the interrelated concepts/phenomena asked about by the RQs (Section 5.2). Insofar as the SSI protocol assists in answering the present study's RQs, it serves its purpose (Section 5.2). Examples illustrate.

To start, the SSI protocol reflects the interest in practice (Section 5.4.4). The "person profile" section asks e.g. about the IT practitioner's role and what it involves. The "General IS-related problems/difficulties" section queries e.g. IT-related problem(s) experienced, and user groups affected. Questioning covers e.g. how these problems are dealt with generally, whilst staying

alert to the prospect of divergence. It also probes efforts to learn, and whether documentation is kept. IT practitioners' insights (Section 5.8) ultimately contribute to a concrete impression of IT provision in UK academia (Section 5.7).

In places, the student researcher's comprehension of CHAT appears to have been of influence. In parentheses under interview question (IQ) 5, references to prescribed procedure and resource(s) used appear to reflect alertness to the rules/norms and tools elements of the activity system, respectively. This aligns with the study's ontology, human activity (Section 5.5). Below IQ 6, the note to "think CHAT goals and motives" evidences clear CHAT influence; it indicates that these CHAT concepts were felt potentially relevant to the corresponding IQ.

Concern for critical incidents (Section 5.6; 5.7) also appears to have fed in, with a further section focusing on "Specific IS-related incidents -and action(s) taken". IT practitioners are asked for their insights (Section 5.8) on e.g. any specific IS-related problem(s) that were particularly troublesome, unfamiliar or otherwise significant (IQ 8). That is, to have unfolded in practice. IQ 9 aims to establish who was affected and how, which in itself appears to echo the student researcher's cognisance of CHAT concepts. Namely, the triangle's community element and the idea of more than one interconnected activity.

Following this, IQ 10 asks how the issue was resolved i.e. in practice. In parentheses beneath, questions touch on specifics e.g. difficulties. The example of conflicting opinions appears to reflect the student researcher's recognition of the CHAT concept, contradictions. These aspects of the SSI protocol assist in obtaining IT practitioners' insights (Section 5.8) relating to the interrelated concepts/phenomena queried by the RQs (Section 5.2) e.g. means towards congruence (RQ 1) and any negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice (RQ 3), where available. Also, in the service of RQ 2, IQ 11 uses the word "improvise" explicitly.

"Closing questions" end. In IQ 13, IT practitioners are asked e.g. about any other vivid incidents that stand out to them -again, meaning in practice. In the student researcher's view, the word "bricolage" is unlikely to be used colloquially by IT practitioners. This and/or similar thinking seems to have influenced the decision not to cite it explicitly in the prepared IQs. Rather, it is alluded to. IQ 14 asks whether they have ever had to simply tolerate ill behaving IS, even for a short period; in parentheses below, it is asked whether anything has ever been partially resolved. IQ 14 appears to have been included with bricolage and/or making do in mind, linking it back to RQ 2 (Section 5.2).

5.11.5 Accompanying documentation and ethics

Facilitating the process of gathering data, two additional documents were prepared: a participant information sheet (Appendices B & C) and a consent form (Appendices D & E). The participant information sheet formally invited participation, emphasising it to be voluntary. It briefly outlined the purpose of the project and explained what participation would entail. Ethical matters were alluded to, e.g. anonymity. Importantly, it identified the "Primary Researcher", supervisory team and corresponding contact details. As also relates to ethics (Bryman and Bell, 2011), the consent form confirmed comprehension of a number of matters and formally sought consent.

Each of the accompanying documents were adapted from forms shared by colleagues at the AIMTech Research Centre in Leeds, UK. In some instances and to encourage engagement, a modest financial incentive was offered: a £10 voucher of the participant's choosing; this was reflected in the documentation (Appendices C & E). Appropriate ethical permissions were approved by the University of Leeds. These concerned data collection at the initial university (Appendix F), the £10 participation incentive (Appendix G), data collection at other universities (Appendix H) and the outsourcing of interview transcription (Appendix I).

5.11.6 Conducting interviews

The separation of sections reciting the recruitment process (Section 5.9) and gathering of data (Section 5.11) is purely presentational. Indeed as the former conveyed, recruitment was far from straightforward. The student researcher did not proceed in a linear fashion e.g. by recruiting the total sample of IT practitioners (Table 1) in batch -and subsequently gathering all data by interview. Rather, there was substantial oscillation. Relatedly, analysis (Section 5.12) also began before either had ceased. Interviewing was undertaken between March 2017 and February 2018, a period spanning almost a year.

The duration of each semi-structured interview ranged 20-54 minutes. In the main, they were carried out in person at quiet places, although in one or two instances telephone was more convenient. Regardless, rapport (Bryman and Bell, 2011) was understood to be essential. As per Section 5.11.3, some questions -as actually asked- did not match up "exactly" with the "schedule" (Bryman and Bell, 2011: 467). Some were adjusted/changed and/or skipped/omitted etc., where judged appropriate.

Recording the interview audio provided a “complete record”, and allowed exclusive attention on the “process of the interview” (Oates, 2005: 191) and interviewee. The student researcher manually transcribed approximately the first ten, verbatim. Found to be “time-consuming” (Bryman and Bell, 2011: 483) however, the remainder were outsourced in accordance with further ethical permission(s) from University of Leeds. “Transcribing” transformed the “audio recordings” into “typewritten records” (Tracy, 2012: 177). The eventuating “words” were “non-numeric data” i.e. “qualitative data” (Oates, 2006: 266) [italics omitted].

5.12 Analysis

5.12.1 Introduction

Analysis is now discussed. Section 5.12.2 establishes it to be qualitative. Section 5.12.3 then differentiates forms of reasoning; traces of abduction are argued to be discernible. Section 5.12.4 explores early analysis, which involved thematic coding with NVivo. Section 5.12.5 turns to advanced analysis by tabulation, which encompassed logging critical incidents (Section 5.12.5.1) and listing means and challenges (Section 5.12.5.2). Lastly, Section 5.12.6 reflects on the continuous consultation with academic literature.

5.12.2 Analysing qualitative data

The entirety of the analysis was based on the data gathered from the 22 IT practitioners at 6 UK universities (Section 5.10). As a brief reminder, semi-structured interviewing (Section 5.11.3) was acknowledged as able to directly elicit IT practitioners’ first-hand insights assistive in answering the RQs and which therefore serve the purpose (Section 5.8). The interview audio was recorded and subsequently transcribed, becoming “typewritten records” (Tracy, 2012: 177) (Section 5.11.6). The resulting product, “words”, were “qualitative data” (Oates, 2006: 266) [italics omitted] (Section 5.11.6).

Correspondingly, the student researcher undertook qualitative data *analysis*. To be precise, the qualitative data analysis was performed on the textual data containing and/or representing the IT practitioners' first-hand interpretive, subjective, qualitative insights (Section 5.8). The qualitative data analysis -as carefully delineated- was instrumental in arriving at answers to the present study's RQs and to ultimately fulfilling its purpose (Section 5.2). Where appropriate, connections to other aspects of the study are identified.

On its part, the methods literature is awash with nuanced advice on how to deal with data (e.g. Boyatzis, 1998; Flick, 2009; Glaser and Strauss, 1967). Regarding “qualitative data analysis”, Oates (2005: 267) emphasises “there are no hard and fast rules about how to do it”. Whilst “coding” tends to be the “starting point”, there is “no one correct approach” (Bryman and Bell, 2011: 584-587). “Thematic coding” i.e. the “labelling or tagging of themes as being particular types”, informs “thematic analysis”, at least “initially” (Gomm, 2009: 360). However, there are different places “categories can come from” (Oates, 2005: 268-269).

5.12.3 Reasoning: Deduction, induction and abduction

If categories derive from “existing theories you have found in the literature or have developed yourself”, a “deductive approach” is at play (Oates, 2006: 269) [italics omitted]. Where “observed in the data”, an “inductive approach” is apparent (Oates, 2006: 269) [italics omitted]. Each represents an opposing “relationship between theory and research” (Bryman and Bell, 2011: 13). Yet these “forms” (Lipscomb, 2012: 244) or “models of reasoning” (Brinkmann, 2014: 721) are accompanied by another: “abduction”.

Induction is “data-driven” (Brinkman, 2014: 720). Qualitative “researchers’ interactions with the data” see “patterns, concepts and theories emerge... without pre-supposing such outcomes” (Kennedy, 2018: 4). The absence of “theoretical preconceptions” is endorsed by Glaser and Strauss’ (1967) Grounded Theory (Timmermans and Tavory, 2012: 168). But “over drinks, grounded theory practitioners readily admit that pure inductivism is impossible and that some theoretical knowledge is necessary” (Tavory and Timmermans, 2014: 16).

In reality, “inductive analysis cannot be cleanly separated from all theory given researchers’ existing beliefs and views of the world” (Rinehart, 2021: 304). Often contrasted with induction, deduction (e.g. Oates, 2006; Bryman and Bell, 2011) is “a theory-driven analysis” (Brinkmann, 2014: 721). Existing theory informs hypotheses (Bryman and Bell, 2011). But researchers can focus so heavily on “aspects of the data prescribed by the theory”, that they neglect “other[, potentially fruitful] aspects” (Kennedy, 2018: 3).

Beyond inductive and deductive, Tavory and Timmermans (2014: 4) offer “an alternative navigational map for constructing empirically based theorizations”. Influenced by “American Pragmatism”, in particular by Charles S. Peirce, they regard “research as recursively moving back and forth between a set of observations and a theoretical generalization” (Tavory and Timmermans, 2014: 4). Their own “approach” –“abductive analysis”- is based principally on Peirce’s concept of “abduction” (Tavory and Timmermans, 2014: 5).

This “third mode of reasoning” was “developed” by Peirce (1960/1979) (Kennedy, 2018: 4). It begins at “consequences” and proceeds to build “reasons”; spelled out: “The surprising fact C is observed. But if A were true, C would be a matter of course. Hence, there is a reason to suspect that A is true” (CP 5.117, cited by Tavory and Timmermans, 2014: 37). Scholars have considered and discussed abduction as regards qualitative research (e.g. Brinkmann, 2014; Tavory and Timmermans, 2014; Rinehart, 2021).

In abduction, an “observation” is “perceive[d]” to be “related to other[s]” insofar as there is a “hidden” and “unknown cause and effect”, or the “phenomenon is similar to other phenomena already experienced and explained” (Tavory and Timmermans, 2014: 37). Crucially, “proposition A is neither assumed” a priori, like with deduction – “nor observed... as it ideally is in induction” (Tavory and Timmermans, 2014: 37). It is instead “guessed at, presumed” afterwards, to account for “observations we cannot easily explain away” (Tavory and Timmermans, 2014: 37).

In his “broader theory of inference, meaning, and action”, Peirce argued “people constantly perform abduction in their everyday life” (Timmermans and Tavory, 2012: 171). When met with “surprising phenomena”, he contended they are “continuously recalibrating their expectations of the future” (Timmermans and Tavory, 2012: 171). For Peirce, “surprise[s]” were of two sorts: “novelty” i.e. “a new experience”, and “anomaly” i.e. “an unexpected experience” (Timmermans and Tavory, 2012: 171).

Surprises are seen in respect of a researcher’s “existing beliefs, theory, knowledge, and views of the world”, and so may not be shared (Rinehart, 2001: 305). That an observation is considered surprising, presupposes “an affinity and familiarity with broader theoretical fields” (Timmermans and Tavory, 2012: 173). As such and in contrast to the advice “inductivist approaches” come with, “abduction assumes extensive familiarity with existing theories [both] at the outset and throughout every research step (Timmermans and Tavory, 2012: 173).

“In science [certainly], surprising findings call for an explanation” (Timmermans and Tavory, 2012: 171). Some suggest “abduction captures the process of coming up with A”, yet just “how innovative A is, or where exactly it comes from, remains an issue of debate” (Tavory and Timmermans, 2014: 38). Notwithstanding, abduction is in character a “creative inferential process aimed at producing new hypotheses and theories” from “surprising research evidence” (Timmermans and Tavory, 2012: 167). A novel hypothesis directs further observation (Tavory and Timmermans, 2014).

The present study did not intentionally adhere to any abductive approach, nor with the workings of abduction as advanced by Peirce (e.g. Tavory and Timmermans, 2014). Nevertheless, traces

of abductive reasoning are perhaps recognisable retrospectively. Past literature was consulted from the off, but rather than aiming to “verify, falsify, or modify a unified, firmed-up theory” -as with deduction- rationale rested in “knowing the literature” (Timmermans and Tavory, 2012: 173) and establishing direction (Chapters 2-4). Further traces are illuminated, as become apparent.

5.12.4 Early analysis: Thematic coding with NVivo

Early analysis employed NVivo exclusively. The student researcher used its "nodes" functionality to add and adjust theoretical categories. Some were labelled in accordance with select CHAT vocabulary/activity system elements (Chapter 2; Section 5.5). In analysing the textual data containing and/or representing IT practitioners' first-hand interpretive, subjective, qualitative insights (Section 5.8; 5.12.2), fragments were assigned to nodes. Relevant to reasoning and abduction especially (Section 5.12.3), the extant literature -or, more accurately, the student researcher's extensive appreciation of it- was significant at this infant stage. NVivo clearly enabled the analysis to align with the study's ontology, human activity (Section 5.5).

Textual data were also located in nodes corresponding to concepts/phenomena of specific interest to the purpose and RQs e.g. bricolage and/or improvisation (RQ 2) (Section 5.2). It was further possible to create nodes for novel concepts/phenomena -especially helpful to RQs 1 and 3, which were framed generally. At least initially, there was a tendency to code any textual data felt potentially relevant. Thematic analysis advanced gradually, as more data were considered; all placements of textual data to NVivo node(s) were subject to the student researcher's ever-improving interpretation.

Axiologically, the process reflects how the “researcher interpretations [were] key to [the] contribution” (Saunders et al. 2015: 136) (Section 5.3). But the student researcher further interpreted that whilst comprehensive, this coding strategy left the door open for what could be undesirably brief and/or overly general responses from the IT practitioners (Section 5.8) interviewed (Section 5.11.3). Ultimately, NVivo was felt to be of limited analytical value to the present study. As such, it was utilised alone for only a relatively short period.

5.12.5 Advanced analysis: Introducing tabulation

In the original conception of Critical Incident Technique, “the purpose of the data analysis is to summarize and describe the data in an efficient manner so that it can be effectively used for many *practical* purposes” (Flanagan, 1954: 343-344) [*italics added*]. Although a “general frame

of reference” should be established, a “set of incidents can be classified” in “countless ways” (Flanagan, 1954: 344). For the present study, the student researcher arrived at a way to substantially strengthen and further focus analysis; knowledge of existing academic literature was significant.

In particular, the student researcher recalled work by Kajamaa and Engeström (2014). As per its critical appraisal in the literature review (Section 2.4.3.5, Chapter 2), Kajamaa and Engeström (2014: 1) express interest in “stability and change”. In Finnish healthcare, their activity theoretical study distinguished “disruptions”, “mending efforts” and “mending solutions” (Kajamaa and Engeström, 2014: 7). Intriguingly, disruptions did not necessarily provoke mending efforts; nor did mending efforts guarantee mending solutions.

Beyond what was written in the literature review, Kajamaa and Engeström (2014) presented these data in a simple table. Three main columns correspond with others containing basic counts (Appendix J). Perceiving prospect, the student researcher appropriated and heavily extended the idea of tabulation in parallel to NVivo (Section 5.12.4). Foremost, where there was judged to be theoretical relevance and sufficient empirical evidence, critical incidents (Section 5.6; 5.7) were systematically logged on an incident-by-incident basis.

5.12.5.1 Critical incident log

Glancing at the Critical incidents log offers an impression of how critical incidents were carefully considered on like fronts (Appendix K). The study’s RQs (Section 5.2) influenced its structure. Accommodating RQ 1, concerned with means towards congruence, columns recorded “initial” and/or “additional efforts”; the same aided RQ 2, pinpointing instance(s) of bricolage and/or improvisation, where in evidence. Facilitating RQ 3, concerned with negative influence(s)/mediator(s) on -i.e. challenge(s) to- means towards congruence in practice, another column was labelled “challenge(s)”.

Populating cells and logging critical incidents, the student researcher worked from the textual data containing and/or representing the IT practitioners' first-hand interpretive, subjective, qualitative insights (Section 5.8; 5.12.2). Each row represents a critical incident (Section 5.6; 5.7). One column identified the providing interviewee. Noticing some IT practitioners were able and/or prepared to provide multiple suitable and rich accounts and yet others little or nothing, each critical incident was itself assigned a unique identifier i.e. incident number. Further columns captured supplementary information.

The inclusion and consideration of antecedents i.e. antecedent conditions was inspired by Lyytinen and Newman (2008) (Section 2.6, Chapter 2). More generally than in their work, the Critical incident log's "Antecedents" column accommodated detail from relatively early on in the respective critical incident; it could e.g. indicate the rationale of means. The "Outcome" column may also have been influenced by Lyytinen and Newman (2008) (Section 2.6, Chapter 2). Again more generally than in their work, it was helpful in e.g. making sense of the effectiveness or otherwise of means.

Where available and/or applicable, certain kinds of content were integrated per log. This included e.g. brief prose, including verbatim quotes. Cells also nested theoretical categories/codes, often capitalised for visibility. As appropriate, aspect(s) of critical incident(s) were interpreted using CHAT vocabulary/activity system elements (Chapter 2; Section 5.5). This aligns well with the study's ontology, human activity (Section 5.5). Gazing horizontally lent a contextualised and conceptual account of the critical incident, imparting an appreciation of how and/or why different details related.

Retrospectively, this thematic coding and logging of critical incidents can perhaps be appreciated as "mnemonics", which Tavory and Timmermans (2014: 52) consider in relation to abduction. They suggest "coding and memo writing... ensure that we thoroughly familiarize ourselves with our observations, that we do not forget the interactions we have been privy to once we put them down on the page" (Tavory and Timmermans, 2014: 53). The present study's painstaking, manual processes unquestionably marked critical incident detail into the student researcher's memory.

Moreover and "in writing field notes, in transcribing, in coding, and in memo writing", researchers "constantly objectify the world"; they "then return to the field" (Tavory and Timmermans, 2014: 55). Tavory and Timmermans (2014: 55) insist "transformations of experience... allow us to render familiar experiences alien, [i.e.] to defamiliarize our world". This is beneficial, e.g. an interviewer taking in a transcript may be alerted to what was "almost invisible" beforehand (Tavory and Timmermans, 2014: 57).

Discussed in respect of abduction, "defamiliarization" (Tavory and Timmermans, 2014: 55; Timmermans and Tavory, 2012: 176) is in hindsight perhaps perceptible in the present study [*italics omitted*]. Its design did not explicitly direct further and/or modified data collection following analysis. In a sense however, the coding and logging of critical incidents defamiliarised the original "stream of experiences" (Tavory and Timmermans, 2014: 55). Much beyond the task

of semi-structured interviewing (Section 5.11.3), these processes illuminated substantial theoretical insight.

Building the Critical incident log up was far from a straightforward, one-time event. In retrospect, it chimes with the idea of “revisiting observations”, which Tavory and Timmermans (2014: 58) recognise in respect of abduction. Influenced by Marion (2002), they argue how “even without methods, “experiencing the phenomenon” should not be conceived of as a singular occurrence” (Tavory and Timmermans, 2014: 58). Marion (2002) regards perception to be “saturated” (Tavory and Timmermans, 2014: 58). “The phenomenon overflows our initial perception”, i.e. there is more to it than can possibly be registered at once (Tavory and Timmermans, 2014: 58). As such and in “daily life[,] we often revisit our experiences”; in so doing, “we re-experience them in different ways” (Tavory and Timmermans, 2014: 58).

In research, “methods are designed to first[ly] defamiliarize the field and then allow us to revisit the same observation again and again in light of new theorizations” (Tavory and Timmermans, 2014: 58). They offer the option to “revisit the same text and find new meanings, as well as patterns and inconsistencies that we would miss if we did not objectify our experience in writing” (Tavory and Timmermans, 2014: 58). Tavory and Timmermans (2014: 58) are interested in “the researcher’s revisiting of recorded phenomena in light of existing theoretical accounts”.

Although the present study did not aim to adhere with abduction -nor with any associated notion- its peculiar revisiting processes were slightly similar. As textual data were appraised and critical incidents logged, the meticulous process involved making gradual improvements both to the log per se, and to the theoretical categories. More palpably, aspect(s) of the critical incident being considered at present might have emphasised matter(s) not contemplated and/or recorded before. This could prompt a revisit to critical incident(s) already logged, and the tabular log format made this as simple as scrolling up vertically. The original transcript could also be reconsulted.

The key question in such circumstances was whether it would be worthwhile recording the same or similar detail(s) for all critical incidents, where available and/or appropriate. If so, this could easily be addressed. Ultimately, it effected change(s) to what the Critical incident log actually logged -and how. As analysis matured, there was a gradual move away from refinements to the device itself; an increasing share of analytical attention shifted to the theoretical categories, i.e. the developing conceptualisation.

When logging a critical incident, aspect(s) were often felt familiar. This could also provoke a revisit to critical incident(s) logged already, and again a possible return to the semi-structured interview transcript. Concern was with consistency, i.e. whether the tentative coding of the present data would be in keeping with prior treatment(s). If so, analysis would continue without controversy; otherwise, it encouraged contemplation as to why. This brought continuous changes to the theoretical categories, and reassessment of where data were most suitably allocated.

Certainly to begin with, the detail documented per critical incident was extensive. Following supervisory advice however, the student researcher focused on the theoretical categories and other content felt most important to answering the research questions (Section 5.2). The structure and organisation of the Critical incident log meant scrolling up and down vertically was convenient. Indeed, it facilitated further tabular analysis -again, undertaken in parallel to the use of NVivo (Section 5.12.4).

5.12.5.2 Means and Challenges lists

In the service of RQs 1 & 2 (Section 5.2), the student researcher worked from the “efforts” column(s) -and where appropriate, other(s) of the Critical incident log (Appendix K)- to extract theoretical categories/codes denoting means towards congruence. These were analysed away from the intricacies of the belonging incident, and eventually placed in another table arranged by means. Critical incident evidence was included. Early categories were undesirably specific and numerous. Ostensibly, it seemed there was an abundance of distinct means and/or sometimes scarce empirical support.

Separate tabulation, however, facilitated a process reminiscent of “Reduction”, in which “the analyst may discover underlying uniformities in the original set of categories or their properties, and can then formulate the theory with a smaller set of higher level concepts” (Glaser and Strauss, 1967: 110). Similarities between categories/codes were deciphered. Referring to “Axial coding”, Oates (2005: 275) suggests “some codes can be incorporated under broader headings”. Where overarching commonalities were interpreted, theoretical categories/codes were merged i.e. consolidated.

This careful, strictly manual analytical process informed the development and finalised form of the seven heterogeneous means and Means list generally (Facet A, Figure 7, Section 6.6, Chapter 6; Appendix L). Additionally, in some capacity, other empirical data i.e. data not necessarily pertaining to critical incidents as interpreted, may also have informed the same. Looking at the

final list, however, all instances of means do appear to identity a unique identifier i.e. incident number corresponding to one in the Critical incident log (Appendix K) (Section 5.12.5.1).

Attempting to answer RQ 3 (Section 5.2), the student researcher worked from the "challenge(s)" column and/or other(s) of the Critical incident log to extract theoretical categories/codes representing challenges. These were also tabulated separately. Critical incident evidence was identified. Some instances were interpreted as challenges to congruence i.e. to continued activity per se and some as challenges to congruence efforts i.e. to overarching congruence efforts comprising any number and/or variety of heterogeneous means. This distinction was regarded a delicate matter of interpretation, perhaps even remaining open to it.

The procedures reminiscent of reduction and axial coding were repeated and the theoretical categories were continuously refined. This informed the development and resulting shape of the six areas of challenge and Challenges list overall (Facet C, Figure 7, Section 6.6, Chapter 6; Appendix M). In some capacity, other empirical data i.e. data not necessarily relating to critical incidents, may also have informed the same. In the final list, however, all instances of challenge again appear to identity a unique identifier i.e. incident number corresponding to one in the Critical incident log (Appendix K) (Section 5.12.5.1).

Ongoing augmentations to the seven heterogeneous means and/or six areas of challenge fed back reciprocally into the Critical incident log, where they were updated and/or appended. Switching between tables (Appendices K, L, M) and NVivo, tremendous efforts aimed for correspondence. Nevertheless, absolute accuracy is neither claimed nor essential: all implements assisted analysis rather than presentation. Most importantly, manipulating them in concert contributed to answering the present study's RQs and ultimately to fulfilling its purpose (Section 5.2).

Considerably later, post-referral, and when preparing the final response to RQ 3 (Section 9.3, Chapter 9), the student researcher reflected and grew concerned. In particular, about whether the instances interpreted earlier as challenges to congruence efforts were distinguished accurately and deservedly. Relatedly, concern as to exactly what RQ 3 interrogated and whether the empirical evidence and existing analysis aptly addressed it. Looking back to RQ 3, it asked "What influences/mediates efforts towards congruence in practice?" (Section 4.9, Chapter 4; Section 5.2).

RQ 3 cites concern with "efforts towards congruence", and so at face value the earlier analysis attended to it appropriately. Yet, at the time RQ 3 was framed, the student researcher did not

necessarily have either supporting empirical evidence and/or the firmed up theoretical understanding of potentially multiple means comprising greater congruence efforts (Chapter 7; 8; Section 9.2, Chapter 9). Despite the language employed by RQ 3, it appears to have queried negative influence(s)/mediator(s) on -i.e. challenge(s) to- intentional, stabilising, goal-driven action(s) i.e. individual means, rather than overarching congruence efforts.

In short and whereas RQ 3 asked about negative influence(s)/mediator(s) on -i.e. challenge(s) to- individual means towards congruence, the analysis had focused on challenge(s) to greater congruence efforts. Retrospectively, the student researcher reflected on why. In the interest of integrity, it may be attributable to oversight and/or inattention. This noted, it is suspected that a developing theoretical understanding -itself influenced by analysis- in some sense contributed to the decision to analyse challenge(s) to overarching congruence efforts over individual means.

Post-referral, the student researcher considered more closely whether the six established areas could be interpreted as a challenge to and/or associated with means towards congruence. Qualifying instances were interpreted, by extension, as a challenge to and/or associated with any overarching congruence effort. Given the already extensive analysis, however, only some of the vast number of instances were re-analysed, and addition(s) and/or adjustment(s) reflected only in the Challenges list (Appendix M). This continued until it was felt that there was indeed sufficient empirical support.

5.12.6 Consulting academic literature

Thus far, it is quite clear analysis adhered to neither “strict deductivism”, wherein research is possible “only when we know, more or less, what we expect to find”, nor to “strict inductivism”, for which “theory is something that simply mushrooms out of the data” (Tavory and Timmermans, 2014: 21). Rather -and resonating with assumptions of abductive reasoning- the influence of existing academic literature and its theoretical ideas were pointed to. Importantly, this continued throughout.

It was true of studies critically reviewed a priori (Chapters 2-4). To exemplify, it was useful to look back at select scholarly works to clarify with confidence whether collected empirical data indeed indicated and/or qualified as improvisation as formerly understood. Re-consultation with existing literature was also helpful e.g. when determining whether specific data could or should reasonably be considered a sort of “network bricolage” (Baker et al., 2003: 265) [italics omitted] (Chapter 3).

Moreover, and as will be recalled, RQs 1 and 3 were framed generally (Section 5.2). For data relevant to RQ 1 -concerned with means towards congruence- the opportunity was taken to newly consult wider academic literature. Only after the fact, this perhaps reflects an effort, typical of researchers adhering with abduction, to “develop their theoretical repertoires throughout the research process” (Timmermans and Tavory, 2012: 180). A case in point is the abundance of information-related data, which empirical evidence signalled as significant to congruence. Newly consulting relevant wider literature, the student researcher realised the findings were most suitably considered and categorised as manifestations of information behaviour (IB) (Chapter 7).

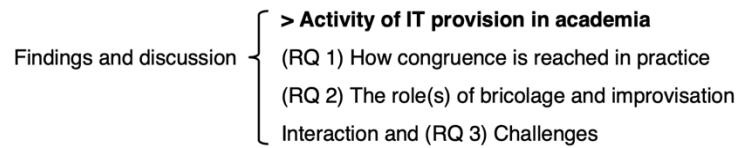
Yet, irrespective of exactly when concepts/phenomena aroused attention, the firmly pre-established grasp of the CHAT literature (Chapter 2; Section 5.5) enabled accurate activity theoretical interpretations. In addition, and owing largely to the attentive analysis and tools used/developed, the student researcher realised each critical incident typically or always comprised multiple heterogeneous means towards congruence. It was felt desirable -if not essential- to account theoretically for their interaction. Consultation with existing academic literature (Chapter 3) and its theoretical ideas was significant to this, as is explicated in the findings and discussion (Section 9.2.2, Chapter 9).

5.13 Summary and conclusion

The outgoing chapter attended to all methodological aspects of the present study. Section 5.2 began by reiterating the purpose and RQs. Introducing basic philosophy, Section 5.3 substantiated its general commitment to interpretivism. In Section 5.4, practice theory was explored and the present position spelled out. Acknowledging activity theory as a practice theory, Section 5.5 noted CHAT-affiliated philosophy and foregrounded features indicating its suitability as a theoretical framework. Section 5.6 then introduced Critical incident technique (CIT) and characterised the critical incidents as interpreted.

Section 5.7 subsequently established the study’s empirical setting to be IT provision in UK academia. Section 5.8 read into sampling in general and also justified the choice of IT practitioners. The active process of recruitment was recounted by Section 5.9; Section 5.10 then presented the resultant sample and reflected on an apparent skew. Data gathering, specifically by semi-structured interviewing (SSI), received attention in Section 5.11. Following this, Section 5.12 delineated the qualitative data analysis.

6 Findings and discussion: Activity of IT provision in UK academia



6.1 Introduction

IT practitioners' interpretive, subjective, qualitative insights afford the present study abundant empirical evidence. In all, findings are presented and discussed across four chapters (Chapters 6-9). This, the first, sets the scene by endowing an activity theoretical understanding of the general work of IT provision activity in UK academia. Activity system modelling is employed at two levels of granularity². Section 6.2 initially proposes a single activity system (Figure 5) and briefly discusses its elements. Complimenting this, Section 6.3 presents a perspective comprising multiple activity systems (Figure 6).

Section 6.4 goes on to consider the CHAT concept of contradictions, indicating the kinds perceptible in the empirical evidence. Beyond this, Section 6.5 acknowledges the concrete occurrence of critical incidents; empirical evidence gives a flavour of those found. Section 6.6 then turns to a figure (Figure 7) which represents visually how forthcoming findings and discussion chapters (Chapters 7-9) are ordered and structured. Before advancing in accordance, Section 6.7 summarises and concludes this chapter.

6.2 Single activity system and constituent elements

6.2.1 Introduction

Suggested above, activity system modelling is employed at two granular levels. Section 6.2.2 presents the first, a single activity system (Figure 5). Similar to other work (e.g. Allen et al., 2008), CHAT concepts -in particular the activity system's constituent elements- lend a logical way to break down the discussion. In turn, Section 6.2.3 briefly addresses: the subject(s) (Section 6.2.3.1); object/motive/outcome (Section 6.2.3.2); tool(s)/resource(s) (Section 6.2.3.3); the community (Section 6.2.3.4); division of labour (Section 6.2.3.5); and rule(s)/norm(s) (Section 6.2.3.6).

² The present study's use of the words "granularity" and "granular" was inspired by the use of the word "granularity" by Lyytinen and Newman (2008: 599-600), and perhaps use of the same and/or similar words by Professor Mike Newman in and outside of lectures when the student researcher earlier studied at The University of Manchester (Section 2.6, Chapter 2).

6.2.2 Single activity system

The present study draws on an aggregate of 22 IT practitioners from 6 UK universities i.e. academic institutions (Section 5.10, Chapter 5). IT practitioners indeed offer a trove of interpretive, subjective, qualitative insights applicable to the RQs and purpose (Section 5.2, Chapter 5). These include those about the general work of the IT provision activity and/or associated other(s) e.g. of staff and/or student IT users (Section 5.7; 5.8, Chapter 5). Careful analysis (Section 5.12, Chapter 5) of this empirical evidence informs visual representation, foremost as a single activity system (Figure 5).

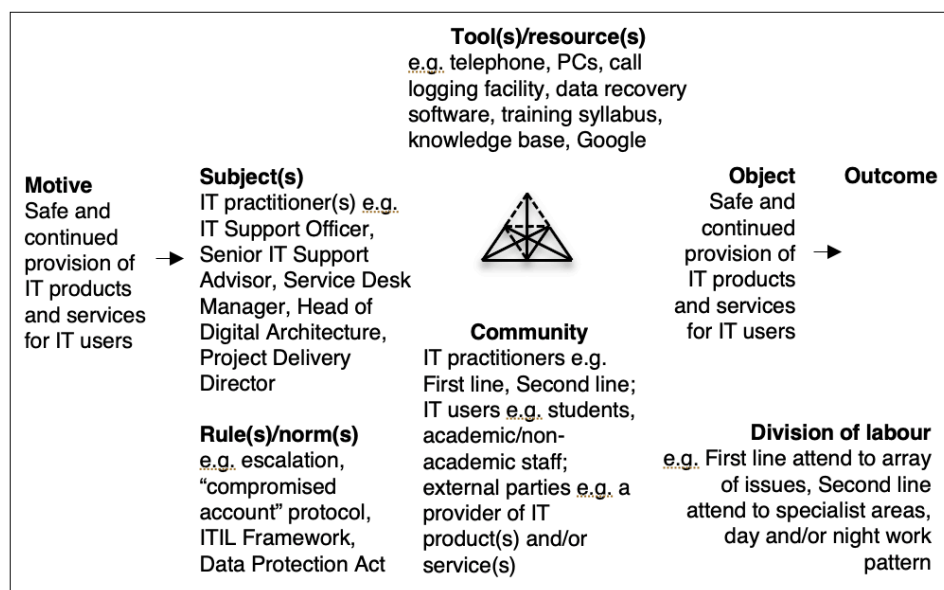


Figure 5. IT provision in UK academia as a single activity system

In the context of UK academia (Section 5.7, Chapter 5), the exact composition or makeup of IT provision activity can understandably differ from one university to the next. As such and rather than depicting any particular one of the 6 universities, the single activity system presented is necessarily more general. Figure 5 conveys a visual, indicative interpretation of the form of IT provision activity in UK academia. It comprises a number of significant features, and a handful of these are especially noteworthy.

6.2.3 Constituent elements

Akin to other academic work (e.g. Allen et al., 2008), CHAT concepts -above all else the constituent elements of the activity system (Figure 5)- provide a convenient way to divide the discussion. It is noted, nevertheless, that sometimes content could equally have been located

under alternative section(s) -a claim carrying to the representation of IT provision activity as multiple activity systems with a shared object (Section 6.3). This perhaps reflects the tight interrelatedness of CHAT concepts.

6.2.3.1 Subject(s)

When introducing the study's empirical background, IT practitioner(s) were interpreted as subject(s)/community of the IT provision activity at their respective university (Section 5.7, Chapter 5). Immediately, their insights inform of themselves and their work as a subject. There is not just one type of IT practitioner in the context of UK academia. Instead, there are various job titles/roles/positions e.g. "IT Support Officer", "Senior IT Support Advisor", "Service Desk Manager", "Head of Digital Architecture" or "Project Delivery Director". This highlights how IT practitioners form a community (Section 6.2.3.4).

6.2.3.2 Object/motive/outcome

Importantly, and irrespective of precise job title/role/position, all of the IT practitioners (subject(s)/community) work ultimately towards the object of IT provision activity. According to Leontiev (1977: 6), "the main thing that distinguishes one activity from another lies in the difference between their objects". Indeed, "the object of activity endows it with a certain orientation" (Leontiev, 1977: 6). Across UK universities, the activity of IT provision is identifiable by its regard for IT and the community of IT users.

Then, there is the distinct but related principle of "motive", i.e. its peculiar motivation [italics omitted] (Leontiev, 1977: 6). It can be "both material and ideal" (Leontiev, 1977: 6). Theoretically, "the motive is the object that the subject *ultimately needs to attain*" (Kaptelinin, 2014) [italics added]. In all, "different activities are distinguished by their motives" (Leontiev, 1977: 6). Quoted when introducing the empirical background (Section 5.7, Chapter 5), the Service Manager for Frontline Services at one academic institution offers insight into how these abstract dynamics play out there:

"what we are here to do in IT, is enable the university to do its business effectively"

Service Manager for Frontline Services, Interviewee 1, University A

From this, the continued functioning of the university overall is inferred to be imperative; the necessity is read to motivate the IT provision activity. In short, the object of a university's IT

provision activity is interpreted as the safe and continued provision of IT products and services for IT users, i.e. the community, such that the university can conduct its “business effectively”. At this uppermost level, the object equates to its motive (Kaptelinin, 2014). IT practitioners’ goal-driven action(s) contribute to and even “enable” what would appear to be a desirable outcome.

6.2.3.3 Tool(s)/resource(s)

Laid out in the literature review (Section 2.3.2, Chapter 2), one kind of Engeström’s (1987) “concrete mediational means” is that of the “tools/instruments” on the ““subject – object” interaction” (Kaptelinin 2014). In activity, “the Subject interacts with the object using tools” (Mishra et al., 2011a: 4). IT practitioners make use of various tool(s)/resource(s). Material/physical tools may include e.g. a telephone and/or computer. Non-physically, specialist software e.g. for data recovery, is also employed. Resource(s) can include e.g. a knowledge base, or Google. Tools can also be “mental” (Mishra et al., 2011a). On their part, IT practitioners can draw e.g. on relevant knowledge.

6.2.3.4 Community

Touched on when discussing the subject element (Section 6.2.3.1), IT practitioners working in the context of UK academia form a community. This, in turn, comprises the greater university community, which includes IT users e.g. students and academic and non-academic staff (Section 5.7, Chapter 5). Yet rather than all IT practitioners being exactly alike, it was acknowledged that they can assume various job titles/roles/positions (Section 6.2.3.1). These distinctions can reflect different responsibilities and/or levels of seniority. The division of labour concept assists understanding.

6.2.3.5 Division of labour

In Engeström’s (1987) triangle, division of labour mediates the relationship between a community and its object (Kaptelinin 2014; Section 2.3.2, Chapter 2). Whereas First line IT practitioners can attend to a broad range of issues, Second line IT practitioners tend to focus more narrowly on specialist areas. Others may be delegated to testing or to development of a new IT product and/or service. Again, the exact division of labour differs by institution. IT, moreover, invests in training initiatives for its IT practitioners:

“we have a specific training plan for the first year that you’re in, so you’ll do a service desk analyst training ITIL foundation, which is like er, it’s hard to explain ITIL foundation, it’s very dry”

Training exposes engaging IT practitioner(s) (subject(s)/community) to a syllabus that aims to endow them with competence required for the role. Any tool(s)/resource(s) used in this way may be interpreted as a sort of manufactured mediator, conducive to the “internalization” of information. That is, influencing “a shift from the external to the internal”; during practice, the retrieval and physical application of anything learned epitomises “externalization”: the inverse (Kaptelinin, 2014) [italics omitted].

An IT practitioner’s job title(s)/role(s)/position(s) and/or corresponding responsibilities and/or seniority, however, do not necessarily remain static. IT practitioners instead retrace movements, e.g. having had other IT-related job(s) at the same university or having moved upwards to a more senior position. IT practitioners may also boast relevant knowledge from elsewhere. As one example, an IT Support Officer claims past knowledge of a particular “computer management tool” at a different UK university is “partly why I got the [present] job”. Even so, s/he was made to “do a, a driving test on the tool”.

6.2.3.6 Rule(s)/norm(s)

In addition, an individual subject’s relation with the greater community is mediated by rules (Kaptelinin, 2014, citing Engeström, 1987). Allen et al. (2011: 2171) recognise that “rules and norms influence the subject but are also influenced by the community”. For Allen (2011: 2171), whereas rules are “linked to an external[,] objective source of authority”, norms denote “the evolved implicit or explicit behavior”. Empirical evidence i.e. IT practitioners’ interpretive, subjective, qualitative insights indicate each is at play in the activity of IT provision in UK academia.

Some cite adherence to the ITIL (Information Technology Infrastructure Library) framework: a British Government initiative promoting “best IT practices”, with a regard for “meeting customer needs” (Cherwell, 2018). Regarding rule(s), anything involving users’ data necessarily accords with the Data Protection Act (Legislation.gov.uk, 2018). The exact and/or typical norm(s) assumed by IT practitioners will inevitably differ by job title(s)/role(s)/position(s) and/or responsibilities and/or seniority (Section 6.2.3.5). An IT practitioner’s conduct relative to rule(s) and/or norm(s) is theoretically significant to answering the study’s RQs (Section 5.2, Chapter 5), as divulged by Chapter 7.

6.3 Multiple activity systems, shared object

Complimenting the solitary activity system (Figure 5), this section extends a view made up of multiple activity systems.

To this point, IT provision in the context of UK academia has been shown as a single activity system. Its constituent elements -together with other CHAT concepts- furnished theoretical explanation. But as acknowledged in the literature review (Section 2.3.2, Chapter 2), Engeström's (2001: 136) "prime unit of analysis" is in fact "a collective, artifact-mediated and object-oriented activity system, *seen in its network relations to other activity systems*" [italics added]. Following suit, Figure 6 offers an expanded perspective.

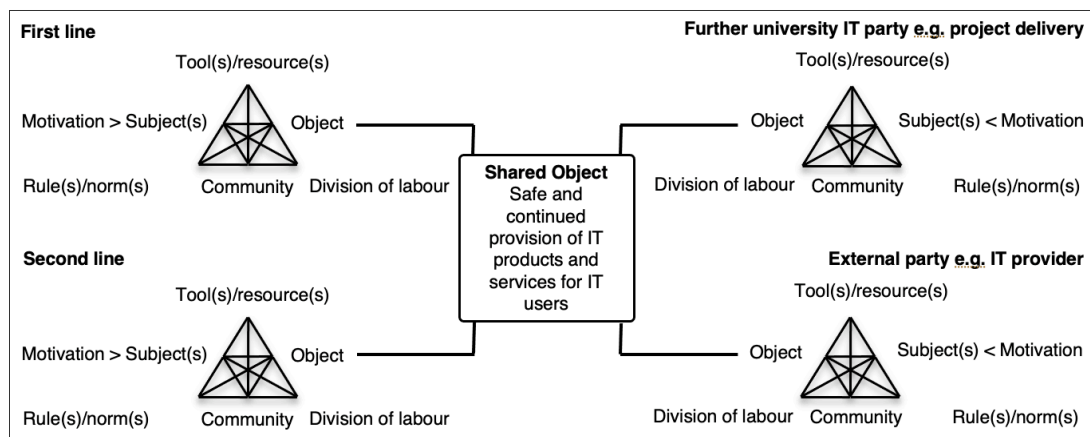


Figure 6. IT provision in UK academia as multiple activity systems

Again general and indicative, Figure 6 portrays IT provision as comprising smaller IT groups -each allocated its own activity system. These can differ in respect of some of the elements already discussed e.g. the precise nature of the IT-related work i.e. division of labour (Section 6.2.3.5) and/or what practice entails ordinarily i.e. rule(s) and/or norm(s) (Section 6.2.3.6). The figure also visualises an external provider of IT product(s) and/or service(s). Whilst the exact makeup and arrangement varies by university, the smaller IT groups converge around a "shared or jointly constructed object" (Engeström, 2001: 136). That is, the safe and continued provision of IT products and services for IT users.

6.4 Considering contradictions

This section offers an indication of the kinds of contradictions interpreted in the empirical evidence.

Emphasised as assistive (Section 5.5.3, Chapter 5), activity system(s) allow analysis of contradictions. Recalled from the literature review (Section 2.4.2, Chapter 2), Allen et al. (2013:

840, citing Murphy and Rodriguez-Manzanaras, 2008: 1063) “initially define a contradiction straightforwardly “as a tension, contrast, denial, or opposition between two propositions”. They “refer to anything within the system that opposes the overall motive of the system, the aim or purpose that subjects within the system are individually or collectively striving toward”, and “threaten the very existence of the system” (Allen et al., 2013: 840); yet, contradictions should not be assumed to have an “untoward bearing” (Section 2.4.2, Chapter 2).

On this understanding, the present study’s findings unearth many examples of what may be interpreted as contradiction(s). Intriguingly, a contradiction that comes to concern IT provision activity may be identified principally in the activity/activities of the greater university community of IT users. A student or staff member IT user might e.g. encounter an issue using an IT product and/or service in their work. The exact details can differ. Yet, seen as a secondary contradiction, the tool(s)/resource(s) can be considered at odds with e.g. their object of activity.

From the perspective of the IT provision activity (Figure 6), such a contradiction exists extrinsically, elsewhere. At face value then, it is perhaps reasonable to wonder exactly how and/or why contradiction(s) of this sort even relate to IT practitioner(s). The key to comprehension lies in the object and motive of a university's IT provision activity: the safe and continued provision of IT products and services for IT users, i.e. the community, such that the university can conduct its “business effectively” (Section 6.2.3.2).

Empirical evidence also indicates IT user(s) can become antagonised to the effect that their emotions spill over and affect IT practitioner(s). From the perspective of the IT provision activity (Figure 6), such an instance can be recognised as a secondary contradiction conditioning the relation between the IT user (community) and an IT practitioner (subject(s)). Contradiction(s) can therefore transcend the merely technical realm and be social in nature. A Senior Support IT Advisor offers general insight and recalls a particular interaction with a staff member IT user:

“We don’t get them very often, but we can occasionally get people where, they are very frustrated, they’re at the end of their tether, but they actually. I remember them on the phone they’d actually swore at me”

Senior Support IT Advisor, Interviewee 6, University A

In the IT provision activity (Figure 6), an IT practitioner may similarly experience an issue utilising an IT product and/or service in the course of their work. An occurrence might be interpreted as e.g. a secondary contradiction between the tool(s)/resource(s) and e.g. object of activity (Section 6.2.3.2). Contradiction(s) can again be social, with empirical evidence exposing the potential for

conflict between IT practitioners. Such might be cast as e.g. a primary contradiction within the subject(s) element (Figure 6) and/or as a secondary contradiction residing between the focal IT practitioner(s) (subject(s)) and other(s) (community) (Figure 6).

Third generation CHAT has assisted in indicating the kinds of contradictions associated with IT provision activity in UK academia. Contradictions are foregrounded throughout the forthcoming findings and discussion chapters (Chapters 6-9), where appropriate. Yet, to exhaustively catalogue typical examples would fail to answer the present study's RQs and fulfil its purpose (Section 5.2, Chapter 5). Rather, and whilst accepting contradictions are not necessarily "untoward" in "bearing", they can contribute an activity theoretical explanation of the empirical evidence -much of which concerns critical incidents.

6.5 Occurrence of critical incidents

In this section, critical incidents are acknowledged to occur and empirical evidence gives a flavour of those found.

Much of the present study's empirical evidence pertains to critical incidents. Established already, these are actual, typical and/or hypothetical events; they may e.g. have and/or continue to inhibit(ed) and/or prevent(ed) continued activity/activities, inclusive of incumbent object; theoretically, they may be understandable with respect to contradiction(s) e.g. prompting them (Section 5.6, Chapter 5). In the empirical setting of IT provision at UK universities, critical incidents can concern the activity of IT provision and/or associated other(s) e.g. of staff and/or student IT user(s) (Section 5.7, Chapter 5). The critical incidents logged (Section 5.12.5, Chapter 5) typically relate to IT product(s) and/or service(s).

Notwithstanding, the specifics can vary tremendously. If a critical incident has and/or continues to inhibit(ed) and/or prevent(ed) continued activity/activities, this may only apply to a modest one or two IT user(s) e.g. a student spilling on their laptop; a more severe critical incident might affect multiple tool(s)/resource(s) and/or IT user activities e.g. a data centre outage. Empirical evidence indicates IT practitioners may act in intentional ways to influence activity/activities to continue i.e. assume means towards congruence. To a lesser extent and effect -and as becomes clear (Chapters 7-9)- other people e.g. non-IT staff and IT users, may also engage in means towards congruence.

6.6 Progressive presentation of tri-fold conceptualisation

This section previews how the forthcoming findings and discussion chapters progressively present the tri-fold conceptualisation.

Before advancing to address the research questions (RQs) (Section 5.2, Chapter 5), attention is directed to Figure 7. Although only modest in footprint, it impactfully portrays how the forthcoming findings and discussion chapters (Chapters 7-9) are ordered and structured. Specifically, it renders a visual representation of precisely how the study's RQs translate to facets of the eventuating theoretical contribution: a tri-fold conceptualisation. The remainder of this section unpacks its significant features.

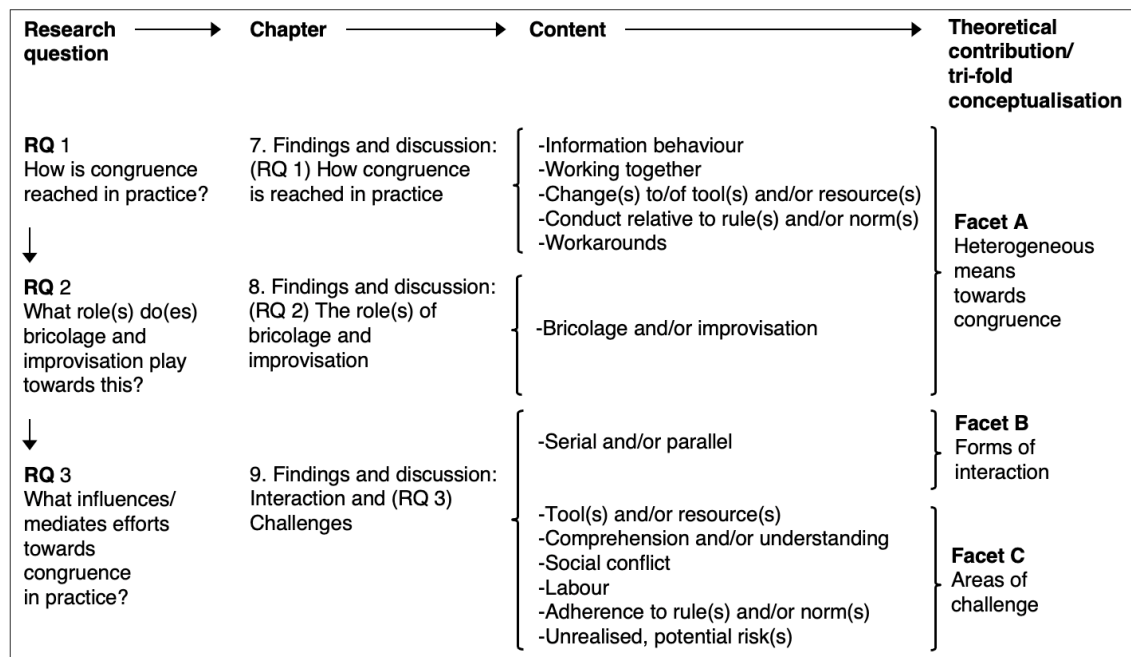


Figure 7. From research questions to theoretical contribution

To start from the upper-left, Figure 7 indicates RQ 1 -which asked how congruence is reached in practice i.e. generally about the intentional ways in which activity is influenced to continue- is dealt with by Chapter 7. One-by-one, it covers: information behaviour; working together; change(s) to/of tool(s) and/or resource(s); conduct relative to rule(s) and/or norm(s); and workarounds. Moving to the right, however, it becomes apparent that these concepts/phenomena represent only the first five of seven heterogeneous means towards congruence, comprising Facet A of the tri-fold conceptualisation.

Dropping down, it is clear RQ 2 -which more specifically queried the role(s) of bricolage and improvisation- receives a response in Chapter 8. In terms of content, the concepts of bricolage and improvisation are discussed together. These final two of the seven heterogeneous means

towards congruence complete Facet A of the resulting tri-fold conceptualisation. But as well as responding to RQ 2, their elucidation can be considered to extend the answer to the preceding and more generally framed RQ 1.

Lower still, the title of Chapter 9 reflects its initial regard for interaction. Two forms, serial and parallel, are discussed together. This elevates the answers to RQs 1 and 2, and also constitutes Facet B. It then addresses RQ 3, which asked what influences/mediates efforts towards congruence in practice i.e. about challenge(s) to means towards congruence. Successively, it explores challenges to and/or associated with congruence efforts in six areas: tool(s) and/or resource(s); comprehension and/or understanding; social conflict; labour; adherence to rule(s) and/or norm(s); and unrealised, potential risk(s). This constitutes Facet C.

In the course of presenting the forthcoming findings and discussion chapters (Chapters 7-9), tremendous efforts are made in the interest of logical and intuitive organisation. Each of the facets (Facets A-C) are disclosed and developed in turn; tied tightly, they comprise a theoretical contribution that amounts to a tri-fold conceptualisation. Notwithstanding, Figure 7 is intended as an accompaniment. It is repeated at the top of each of the remaining findings chapters. Readers can consult it at any time to reorient themselves.

6.7 Summary and conclusion

IT practitioners' interpretive, subjective, qualitative insights supply the present study plenty of empirical evidence. Findings are presented and discussed over four chapters (Chapters 6-9). This, the first, laid the foundation with an activity theoretical look at the general work of IT provision activity in UK academia. Activity system modelling was utilised at two levels. Foremost, Section 6.2 presented a single activity system (Figure 5) and briefly examined its constituent elements; complimenting this, Section 6.3 portrayed a perspective made up of multiple triangles (Figure 6).

Section 6.4 went on to consider the CHAT concept of contradictions, suggestive of the sorts discernible in the empirical evidence. Section 6.5 then identified the concrete occurrence of critical incidents, with exemplary empirical evidence lending a flavour of those found. Following this, Section 6.6 put forward and explained a figure (Figure 7) depicting visually the order and structure of subsequent findings and discussion chapters (Chapters 7-9). In keeping with this, attention now turns.

7 Findings and discussion: (RQ 1) How congruence is reached in practice

Findings and discussion	{	Activity of IT provision in academia
		> (RQ 1) How congruence is reached in practice
		(RQ 2) The role(s) of bricolage and improvisation
		Interaction and (RQ. 3) Challenges

7.1 Introduction

This chapter is the second of four to present and discuss the study's findings (Chapter 6-9). Consistent with Figure 7, it begins to answer to RQ 1, which asked how congruence is reached in practice i.e. generally about the intentional ways in which activity is influenced to continue (Section 2.5.3, Chapter 2; Section 5.2, Chapter 5). Section 7.2 commences presentation of the heterogeneous means towards congruence: Facet A of the tri-fold conceptualisation (Figure 7).

Empirical evidence is placed and ordered logically throughout. Where of theoretical intrigue, connections are identified with other evidence in different section(s) and/or chapter(s) of the broader findings and discussion (Chapters 7-9). Some empirical evidence is revisited, again in different section(s) and/or chapter(s) of the findings and discussion (Chapters 7-9). This is conducive to cohesion. Section 7.3 summarises and concludes the chapter, before attention turns in accordance with Figure 7.

Research question	Chapter	Content	Theoretical contribution/ tri-fold conceptualisation
RQ 1 How is congruence reached in practice?	7. Findings and discussion: (RQ 1) How congruence is reached in practice	-Information behaviour -Working together -Change(s) to/of tool(s) and/or resource(s) -Conduct relative to rule(s) and/or norm(s) -Workarounds	Facet A Heterogeneous means towards congruence
↓ RQ 2 What role(s) do(es) bricolage and improvisation play towards this?	8. Findings and discussion: (RQ 2) The role(s) of bricolage and improvisation	-Bricolage and/or improvisation	
↓ RQ 3 What influences/mediates efforts towards congruence in practice?	9. Findings and discussion: Interaction and (RQ 3) Challenges	-Serial and/or parallel -Tool(s) and/or resource(s) -Comprehension and/or understanding -Social conflict -Labour -Adherence to rule(s) and/or norm(s) -Unrealised, potential risk(s)	Facet B Forms of interaction Facet C Areas of challenge

Figure 7. From research questions to theoretical contribution (repeated)

7.2 First five means towards congruence

7.2.1 Introduction

In response to RQ 1 (Section 5.2, Chapter 5), this section starts presenting the heterogeneous means towards congruence: Facet A (Figure 7). Section 7.2.2 notes extant use of identical/similar terms, characterises the heterogeneous means towards congruence and specifies their significance. The first five of seven are examined in turn: information behaviour (Section 7.2.3); working together (Section 7.2.4); change(s) to/of tool(s) and/or resource(s) (Section 7.2.5); conduct relative to rule(s) and/or norm(s) (Section 7.2.6); and workarounds (Section 7.2.7).

Although these concepts/phenomena were not formally pondered a priori, they *have* attracted scholarly attention. Discussion of each therefore integrates brief consultation with pertinent literature; this enables optimal understanding when and/or where they manifest as heterogeneous means towards congruence. Select empirical evidence is employed to illustrate. Each of the first five heterogeneous means are succinctly summarised. Section 7.2.8 then offers a more general succinct summary.

7.2.2 Means: Use of identical/similar terms, character and significance

Critical incidents occur in IT provision at UK universities (Section 6.5, Chapter 6). Empirical evidence indicates IT practitioners may behave in intentional ways to influence activity/activities to continue i.e. engage in means towards congruence. To a lesser extent and effect, others may also assume means towards congruence. Beyond academic research, the “means” label is found in everyday, colloquial language. It refers variously to e.g. money, tactic(s) and/or strategy, and to modes of transportation. During the present study, the student researcher recalled the television series, *By Any Means with Charley Boorman: An expedition from Ireland to Sydney* (2008). The programme portrays a considerable journey that draws on different forms of transport. This influenced, as a minimum, the choice of the word “means”.

Back in academia, the term “means” has been used before in the CHAT tradition. Vygotsky (1978) contended “cultural means” mediate the subject and object relation; “tools and signs” are simple sorts of “cultural means” (Miettinen et al. 2009: 1317). “Means of culture” also encompass “language, theories, technical artifacts, as well as norms and modes of acting”, and someone “internalizes” as much in “socialization” (Miettinen et al. 2009: 1317-1318). Regarding “externalization”, Miettinen et al. (2009: 1318) explain “human actions and cognition are ‘reified’

into cultural artifacts” e.g. “concepts, instruments, methods, and rules”, which then “serve as the means for further practice”.

Additionally, in Engeström’s (1987) activity system, “cultural means” i.e. “tools and signs” mediate the subject and object (Miettinen et al., 2009: 1318) [italics omitted]. The division of labour and rules mediate the same (Miettinen et al. 2009: 1318). Relatedly, Miettinen et al. (2009: 1318) observe that if the object “changes”, both the “means and division of labour also need to be transformed”. “Remediation”, as CHAT scholars label it, refers to the “process” whereby means are “redesigned to meet the requirement of the changed object” (Miettinen et al. 2009: 1318).

The present study used the word “means” tentatively; in plain English, it denotes nothing more extravagant than e.g. intentional way(s). Characteristically, the means towards congruence are intentional way(s) in which activity/activities is/are influenced to continue. With CHAT vocabulary (Chapter 2), means can be understood as intentional, stabilising, goal-driven action(s) via which activity/activities -inclusive of incumbent object(s)- is/are influenced to continue. Whilst the study advances theoretical understanding of congruence -a CHAT concept- other ideas were of influence to the characterisation of the means.

Specifically, the work and ideas of Professor Mike Newman, communicated in and outside of lectures -and with overlap- an article (Lyytinen and Newman, 2008) (Section 2.6, Chapter 2). Foremost, their work influenced the idea that people (subject(s)/community) may work intentionally, engaging in means which at least attempt to -and may successfully- instil stability into activity/activities i.e. congruence. It also influenced the idea that means towards congruence may be prompted/influenced by contradiction(s) and possibly involve attempt(s) to eradicate or ease or eradicate it/them. Their ideas may also have influenced the idea that means towards congruence may be prompted/influenced by critical incident(s), and possibly involve attempt(s) to or ease or eradicate it/them.

Their ideas were also of influence to the idea that although means towards congruence may successfully instil stability i.e. congruence into activity/activities and that this may involve successfully easing or eradicating contradiction(s), they may be unsuccessful in either or both respects. Their work may also have influenced the idea that means towards congruence may be successful or unsuccessful in easing or eradicating critical incident(s). Their ideas also influenced the understanding that means towards congruence may in fact introduce new contradiction(s) -

possibly different in kind- into activity/activities, destabilise activity/activities, have unintended effect(s) and/or introduce or prompt critical incident(s).

Their work was influential to the idea that means towards congruence may attempt to and/or have any of these effect(s) in the same and/or other activity system(s) -at the same time or later. Their ideas were influential e.g. as the student researcher analysed the data and presented the study's findings (Chapters 6-9). Similar ideas are apparent in the extant CHAT literature. In their UK ambulance service (Section 2.4.3.1, Chapter 2), Allen et al. (2013: 842) note that "the resolution of one set of tensions and contradictions creates new ones which will, in turn, need expansive learning cycles of resolution". This was of similar influence.

Of course, IT practitioner(s) and/or other(s) may engage in any number and/or variety of action(s) and these may influence activity/activities to continue. This acknowledgement obliges explanation of why the heterogeneous means towards congruence are significant. Substantiation is supplied from the Methodology chapter (Chapter 5). Therein, Oates (2005: 188) suggested semi-structured interview participants can "introduce issues" they regard as "relevant" to the themes (Section 5.11.3, Chapter 5). Also, Saunders et al. (2015: 136) recognised "researcher interpretations [are considered] key to [the] contribution" in interpretivism (Section 5.3.3, Chapter 5).

Via semi-structured interview (Section 5.11.3; 5.11.6, Chapter 5), the sample of IT practitioners offered interpretive, subjective, qualitative insights they themselves felt applicable; these included those about the intentional way(s) i.e. means. This suggests their significance, over alternative form(s) of action. These insights were input to qualitative analysis (Section 5.12, Chapter 5) and the student researcher's interpretation was instrumental to the development and eventual shape of the seven heterogeneous means and Means list generally (Facet A, Figure 7; Appendix L).

7.2.3 Information behaviour

7.2.3.1 Introduction

As per Figure 7, information behaviour (IB) is the first to be presented and discussed. Whilst not formally contemplated beforehand, IB has attracted academic attention. Section 7.2.3.2 therefore consults wider, pertinent literature. Section 7.2.3.3 explains how IB manifests as means towards congruence. Empirical evidence then illustrates (Section 7.2.3.4). In order, critical

incidents entail: Microsoft Outlook performing poorly (Section 7.2.3.4.1); inaccessible results (Section 7.2.3.4.2); Dropbox reimbursement (Section 7.2.3.4.3); computer cluster door fault(s) (Section 7.2.3.4.4); a proactive approach to IB (Section 7.2.3.4.5); the cluster door fault(s) revisited (Section 7.2.3.4.6); essay submission software (Section 7.2.3.4.7); and Denial of Service (DoS) (Section 7.2.3.4.8). Section 7.2.3.5 summarises succinctly.

7.2.3.2 Pertinent literature

Although not explicitly considered a priori, IB boasts a long history. Helpfully, scholars are eager to chart it. Case and Given (2016: 4) establish that “information behavior research [resides] within the broader discipline of information *studies*” [italics added]. It attends to “people’s information needs; ... how they seek, manage, give, and use information, both purposefully and passively, in the varied roles that comprise their everyday lives” (Fisher, 2009: 1). The literary landscape can be looked at hierarchically, as “a series of nested fields” (Wilson, 1999: 262-263).

The broadest, IB research, envelops “information seeking”: the “methods people employ to discover, and gain access to information resources” (Wilson, 1999: 263). The latter encompasses studies with a finer focus on “information *search* behavior” i.e. “interactions between ...user... and information systems” (Wilson, 1999: 263) [italics added]. The “most commonly discussed” is information seeking, which denotes a “conscious effort to acquire information in response to a need or gap in your knowledge” (Case and Given, 2016: 6). But Case and Given (2016: 8) note a mismatch in what scholars purported to pursue -and their de facto interest in “information *sources*” [italics added].

The 1970s witnessed a shift “toward the person as a finder, creator, interpreter, and user of information” (Case and Given, 2016: 8). In recent years, works sensitive to the “broader context” have gained popularity (Case and Given, 2016: 8). This is attributed to a recognition that “information needs do not arise in a vacuum” (Case and Given, 2016: 48). Rather, the “seeker ... exists in an environment that partially determines, constrains, and supports the types of needs and inquiries that arise” (Case and Given, 2016: 48).

Case and Given (2016: 4) argue the examination of such matters calls for “research approaches that attend to a[n] holistic view”. The field accommodates alternative methodological and metatheoretical vantage points, with scholars “characterizing groups of theories and their underlying assumptions” (Case and Given, 2016: 181). Case and Given (2016: 182) cite Kuhn’s (1962) notion of “Paradigm”, which attends to the “various points of view ... researchers take in their search for explanations”.

Given the present study's interpretive stance (Section 5.3.4, Chapter 5), ““Interpretivist” paradigms” (Case and Given, 2016: 203) are pertinent. Interpretivist paradigms uniformly assume the “social world... contains agents who have intentions and make meanings”, calling for methodological toolkits divergent from positivist scholars (Case and Given, 2016: 203). Under this umbrella, CHAT has been applied most liberally in research focusing on “the workplace and computer usage” (Case and Given, 2016: 204). More recently, scholars interested in IB indicate equal interest in CHAT (Case and Given, 2016). Some promote the utility of CHAT to IB (e.g. Wilson, 2006b; Allen et al., 2011).

In Leeds, UK, the AIMTech Research Centre has defined its exclusive use. An acronym, its name exposes a broader interest in “Adaptation Information Management and Technology” (LUBS, 2018). Exemplary works investigate a variety of information-related phenomena, including information systems (Allen et al., 2008), information behaviour (Allen, 2011), information sharing (Mishra et al., 2011b), information practices (Mishra et al., 2011a), as well as information seeking and use (Mishra et al., 2015).

7.2.3.3 Manifesting as means towards congruence

As means towards congruence, information behaviour manifests in three ways. Presented firstly, as IT user alerts to IT; these may/may not indicate limited comprehension and/or understanding. Shown secondly, IT practitioner(s) comprehend and/or explain issue(s) and/or requirement(s); this can occur among IT practitioner(s) or between IT practitioner(s) and other(s). Looked at lastly, IT practitioner(s) may engage in information broadcasting before, during or after issue(s); this may even be accredited to other(s). With critical and iterative reference to IB theory, empirical evidence illustrates.

7.2.3.4 Empirical evidence

7.2.3.4.1 *Outlook slow*

Presented firstly, information behaviour as means towards congruence begins with the user(s) of IT facilities e.g. student(s) and/or staff. IT user(s) extend alert(s) to IT practitioner(s); typically technical in nature, they may be e.g. request(s) and/or grievance(s). UK universities tend to have various mediating mechanisms e.g. email, telephone, and even physical front desks, in support of such interactions. The comment below typifies the sorts of issue(s) encountered:

“We had all sorts of complaints from people, saying their emails weren’t sending and their Outlook wasn’t opening and it hadn’t actually failed but it was just very, very slow.”

From the perspective of the IT provision activity (Figure 5, Section 6.2, Chapter 6), alert(s) can be interpreted as a movement of information from the community (IT user(s)) towards subject(s) (IT practitioner(s)). Hypothetically at least, some instances may remain one directional: for fortunate IT user(s), efficient address of the issue(s) may negate the necessity for an explicit IB response. More likely however, the IT user(s) will expect and/or request advice i.e. be seeking information. For Wilson (2006a: 660), the two-way affair would amount to “information exchange” [italics added].

7.2.3.4.2 *Results inaccessible*

The attempted seeking of information is apparent in the sort of student IT user alerts that exhibited when “server load issues” were encountered:

“I can’t get my results, what’s happening?”

Applications Analyst Team Leader, Interviewee 9, University C

Past literature is pertinent. That “a conscious effort to acquire information [unfolds] in response to a need or gap in your knowledge”, summarises current thinking (Case and Given, 2016: 6). Yet, scholars have differing conceptions of need (Case and Given, 2016). Regarding information seeking, Wilson (2006a: 663) takes into account “environment” “role” and “person”. “Information”, moreover, is but “one means towards the end of satisfying... fundamental needs” (Wilson, 2006a: 665). In some sense, the alerting IT users may be considered to have had a need to view their results or otherwise to understand why they could not. In this critical incident, from the perspective of an affected IT user their continued activity was clearly inhibited and/or prevented; this seems to have prompted them to alert IT. From the same angle, a secondary contradiction can be interpreted in that the function of the tool(s)/resource(s) being used was at odds with the object of accessing results.

Yet whether uni or bi-directional, an IT user alert to IT is unlikely to resolve issue(s) and/or instil congruence alone. Information seeking, Wilson (2006b) insists, “is not an ‘activity’, but a set of ‘actions’ that support some higher level activity”. The present study’s findings point to “purposive behaviors that do not [necessarily] involve seeking”; that is, information behaviour (Case and Given, 2016: 6) more broadly. As the discussion progresses, evidence indicates the three forms of IB qualifying as means can be understood suitably as action(s) comprising larger congruence efforts.

It is further felt that the student IT user(s) alerting IT envisaged their own effort(s) might contribute to the overarching ambition. This point is inspired by Leontiev's (1981: 189) observation: in his hunting tale, those scaring the game appeared to appreciate “the link between the expected result of the action performed by him and the end result of the hunt as a whole”. In Tolman's (1999: 72-73) assessment of the tale, this indicates a “degree of consciousness” of the different roles. For student IT user(s) alerting IT, it was perhaps consciousness that -and/or of how- IT practitioner(s) might be able to assist.

This talks to a shortcoming in past research. Case and O'Connor (2016: 649) note “several prominent scholars” are of the view that studies “of human information behavior... rarely measure how received information is applied or its effects on the recipient, that is, its outcomes”. Whilst the present study does not measure quantitatively, its qualitative insight is relevant. From an IT user's alert, the IT practitioner(s) would become informed; they would themselves pursue further means, in a larger congruence effort, towards enabling the student IT user's activity to continue -ultimately, endowing it with congruence.

7.2.3.4.3 *Dropbox reimbursement*

Suggested above, IB as means towards congruence may manifest differently. IT practitioner(s) comprehend and/or explain issue(s) and/or requirement(s); this exhibits between IT practitioner(s) and other(s) and/or among IT practitioner(s). An IT Service Desk Manager recalls a critical incident concerning an academic IT user. The IT user was utilising Dropbox, and earlier alerted IT to request reimbursement. It is unclear whether the alerted IT practitioner(s) sought to comprehend the IT user's issue(s) and/or requirement(s); they did, as a minimum, however, explain that the answer was no.

The decision to refuse reimbursement was apparently in keeping with “the guide” i.e. university rule(s)/norm(s). Yet, it ran contrary to the academic IT user's wishes. In the IT provision activity, a secondary contradiction conditioned the community (academic IT user) – subject(s) (IT practitioner(s)) relation; in the IT user activity, the tension can be interpreted inversely. The issue was then “escalated” to the interviewee. As means towards congruence, conduct relative to rule(s) and/or norm(s) is explored below (Section 7.2.6).

The IT Service Desk Manager expands on his/her approach:

“I went and had a discussion with this person to understand whether, and in my discussions, it was quite clear that there was functionality that he could, was not being provided for by the university, but was a fundamental business need”

Looking back to the literature review (Section 2.4.3.5, Chapter 2), this IT practitioner can be read to have undertaken “cognitive-emotional mending” (Kajamaa and Engeström, 2014: 13). In healthcare, this is when “an individual tries to gain personal understanding and make sense of a situation” (Kajamaa and Engeström, 2014: 13). Present evidence extends empirical support to IT provision in UK academia. The interviewee engaged in IB to properly comprehend and/or explain the academic IT user’s issue(s) and/or requirement(s).

Owing to this, the IT Service Desk Manager identified a “fundamental business need” and decided that the Dropbox *should be* reimbursed. Whilst this defied the prior decision, s/he appreciates his/her subordinates were “just taking the black and white on paper”. The IT practitioner reflects, “a university like ours, I think there’s always gonna be... a small number of exceptions which need to be treated as such”. S/he seemingly associates the disposition with an ability to “enable the university to do its business effectively”.

The incident lends insight into “what information is actually used for” (Case et al., 2016: 649). The IT Service Desk Manager's IB did not newly enable the IT user to use Dropbox in his/her activity. It did, however, confer to the IT practitioner a greater comprehension of the academic's issue(s) and/or requirement(s), and influenced the decision to reimburse it after all. This can safely be assumed to have eased or altogether diffused the tension. As such and in that the academic IT user could continue his/her activity exactly as initially requested i.e. with the tool reimbursed, congruence was perceptibly promoted.

7.2.3.4.4 Cluster: door fault(s)

As indicated, IT practitioner(s) may instead/also interact among themselves to comprehend and/or explain issue(s) and/or requirement(s). Rather than reciting any single such episode, an IT Support Advisor sketches out his/her experience overseeing the respective university’s computer cluster areas. S/he stresses the importance of IT users’ physical security. Indeed, the object of a university's IT provision activity is the safe and continued provision of IT products and services for IT users, i.e. the community (Section 6.2.3.2, Chapter 6).

At computer clusters, numerous mediatory measures assist. Yet on occasion, supposedly secure doors have failed to close. In the IT provision activity, this may be read as a secondary contradiction: the integrated tool(s)/resource(s) (cluster doors) are failing to secure the computer cluster in accordance with the object. In such an event, IT practitioners may

communicate using radio transceivers. Illustrating, the interviewee's comment implies two-way traffic i.e. "information exchange" (Wilson, 2006a: 660):

"I might kind of be, kind of like, "oh there's like a key there and there, you can kind of try and reset it"."

IT Support Advisor, Interviewee 8, University A

This insight compliments academic research on information sharing. Studying major incident response, Mishra et al. (2011b: 4) identified inter-agency exchange of "expertise" to be important. Present findings again foreground its importance, but intra-organisationally. Like the "Dropbox reimbursement" episode (Section 7.2.3.4.3), it may elevate understanding. But as with IT user alerts to IT, IB in the form of IT practitioner(s) comprehending and/or explaining issue(s) and/or requirement(s) is unlikely to overcome issue(s) by itself.

7.2.3.4.5 A "proactive" approach

Suggested above, IB as means towards congruence can also take the shape of information broadcasting. This involves broadcasting identical or near-identical information to select group(s) such as IT practitioner(s) and/or those comprising the greater university community e.g. IT users e.g. students and/or staff (Section 6.2.3.4, Chapter 6). Typically facilitated by technology, information can be broadcast before, during or after issue(s) inhibit and/or prevent continue activity/activities, as may be true of critical incidents. Information broadcasting may even be undertaken by other(s).

An IT Service Manager promotes the "proactive" approach at their university:

"In the old days it was the calls that informed us, if there was a problem on campus with network access you would, the phone would be like a hotline, well what we try and do now is if there's a problem on campus and we're probably pre-empted about there's going to be an issue, say they have to take out some power supply, you know, with one of our network cabinets, we would be really proactive about that and try and inform the users in advance."

"Twitter would be one of the things that we use"

IT Service Manager, Interviewee 22, University F

In the past, a "problem on campus with network access" would see the "phone" resemble a "hotline". This can be understood as information behaviour, exhibiting as masses of IT user alerts. At present -and apparently by contrast- IT are likely to be "pre-empted" in respect of a "problem" or "issue". The IT Service Manager emphasises that they "would be really proactive", attempting

to “inform the users in advance”. Twitter, the social media platform, is identified as a communication medium utilised. Curious about the pre-empting, the student researcher asked questions.

In response, the interviewee explained:

“so building relationships with our estates departments, so if there’s something happening on estates we would get to know about it as a department. You know, as much information as we can get before something occurs.”

IT Service Manager, Interviewee 22, University F

The IT Service Manager appears to associate the “building” of “relationships” with the gathering of “information”. Towards congruence, two different manifestations of IB can be discerned. Liaising with “estates departments”, IT practitioner(s) firstly comprehend and/or explain issue(s) and/or requirement(s); this is interpreted to elevate or even enable their ability to then broadcast pertinent information to IT users “before something occurs”. As such, IT users may be able to pursue other heterogeneous means (Facet A, Figure 7), permitting their activities to continue irrespective.

7.2.3.4.6 *Cluster: door fault(s) (II)*

Findings also illustrate information broadcasting whilst issue(s) exhibit e.g. during critical incidents. In evidence introduced above, an IT Support Advisor recounted IT cluster door fault(s) (Section 7.2.3.4.4). As noted, in the IT provision activity these may be seen as a secondary contradiction in that these tool(s)/resource(s) (cluster doors) are failing to secure the computer cluster in line with the object. Although IT users may be oblivious, the safe and continued achievement of their own object(s) is at risk. To add to the account, IT practitioner(s) may opt to temporarily close the IT cluster.

In effect however, this altogether prevents IT user(s) from achieving any object mediated by the cluster facility and its containing equipment. The interviewee concedes that closure can be unpopular. This may be understood as a realisation -or at least an increased likelihood- of novel contradiction(s) tainting the community (IT user(s)) – subject(s) (IT practitioner(s)) relation. This emergent unease appears to provoke information broadcasting, which conveys that there is a problem and accounts for the closure:

“You say like “Sorry we have to close this cluster due to security reasons”, like you know, “cause there’s an issue with the door” or whatever. You don’t go like “Security reasons” as such, as of late because they might freak out”

What stands out is the conscientious attempt to control the content. Rationalising, the interviewee alludes to terrorism. Contextual affairs then, can apparently influence a form of IB absent of information seeking. This insight links to past research. In incident response, Mishra et al. (2011b) note agencies e.g. the military, draw on a formal framework to classify information, which can legitimise non-disclosure to third parties. This and an agency's esoteric language or terminology could potentially impair collaboration.

IT practitioner(s) consider both the content of their message -and the language chosen- so as not to introduce undue alarm into an already tense situation. This anticipatory trait resonates with the "proactive" approach articulated previously by an IT Service Manager (Section 7.2.3.4.5). Whilst contradiction(s) persist, the information broadcast aims to avert additions. For transparency, the manner in which this message might manifest is unclear. Irrespective, congruence would call forth further means.

7.2.3.4.7 Essay submission software

The same IT Support Advisor explains information can be broadcast *after* issue(s) inhibit and/or prevent continued activity/activities. S/he recalls a failure of "Turn it in", an essay submission tool. In common with cluster closures (Section 7.2.3.4.6), affected students were unable to attain their object(s) via the default mediator. The incident offers various theoretical insights; efforts undertaken whilst tool-related issue(s) endured are presented when later discussing means of working together (Section 7.2.4).

At present, it attracts attention that once the tool returned to function, IT practitioner(s) broadcast information via email:

““Turn it in is now working” oh “you can upload your work as you normally would””

IT Support Advisor, Interviewee 8, University A

Like the "proactive" approach (Section 7.2.3.4.5), the ability to broadcast information owed in large part to a prior manifestation of IB. When IT user(s) earlier alerted IT, IT practitioner(s) used the ticketing system to collate their details. That is, they adhered to rule(s) and/or norm(s) (Section 7.2.6). These means contributed to enabling IT practitioner(s) to "contact some of the" IT users i.e. broadcast information to them. They used a "template email" and personalised it e.g. with the individual's name. In effect, it informed IT users that their object(s) could again be achieved as ordinarily.

7.2.3.4.8 *Denial of Service (DoS)*

Acknowledged above, information broadcasting may be carried out by other(s). One Senior Support IT Advisor recalls when the university IT Service Desk was inundated by seemingly unrelated IT user alerts. IT practitioners had difficulty understanding. But a pivotal moment came when JANET, the third-party service provider, took to social media to recognise widespread Denial of Service (DoS); this information broadcast provided IT practitioners at the university a more accurate grasp. It was a critical incident.

Consequently, university IT practitioners were able to amalgamate previously segregated reports into a single “major incident” -and also to prioritise the matter. Unfortunately, the specifics of the resolution are unclear. Nonetheless, the account lends valuable insight. In particular and corroborating evidence above, means of IB taking the form of information broadcasting can be taken as but a constituent of a broader congruence effort. The outgoing incident also hints at collaboration.

7.2.3.5 Succinct summary: Information behaviour

Aligning with Facet A of the trifold conceptualisation (Figure 7), IB was the first of the concepts/phenomena presented. Not formally pondered a priori, Section 7.2.3.2 looked to wider, pertinent literature. Section 7.2.3.3 explicated its manifestation as means towards congruence. Drawing on empirical evidence, Section 7.2.3.4 illustrated. Successively, critical incidents saw: ill-performing Microsoft Outlook (Section 7.2.3.4.1); out of reach results (Section 7.2.3.4.2); reimbursement of software (Section 7.2.3.4.3); troublesome computer cluster doors (Section 7.2.3.4.4); a proactive approach to IB (Section 7.2.3.4.5); further insight from cluster doors (Section 7.2.3.4.6); essay submission software (Section 7.2.3.4.7); and DoS (Section 7.2.3.4.8).

7.2.4 Working together

7.2.4.1 Introduction

Dropping down Figure 7, working together is now explored. Although again not considered previously, it has attracted academic interest. Section 7.2.4.2 looks laterally, to pertinent literature. Section 7.2.4.3 expands on working together as means towards congruence. Empirical evidence illustrates (Section 7.2.4.4); one-by-one, critical incidents exhibit: an IT practitioner unable to assist (Section 7.2.4.4.1); an Apple expert (Section 7.2.4.4.2); a revisiting of the essay

submission software incident (Section 7.2.4.4.3); a faulty mouse (Section 7.2.4.4.4); and troublesome a/v (Section 7.2.4.4.5). Section 7.2.4.5 summarises succinctly.

7.2.4.2 Pertinent literature

Empirical evidence signals the “stabilizing influence” (Allen et al., 2013: 849) of working together. Whilst not assessed in advance, existing academic literature echoes intrigue in the concepts/phenomena of working together, collaboration and teamwork. In West’s (2012: 3-4) evaluation, although “teamwork” has attended to “major challenges” for millennia, “the landscape of teamwork has changed fundamentally” over the past two centuries. Not only do “teams” have to work with “other teams”, but equally “with organizational systems and processes” so as to conquer “challenges” and reach “goals” (West, 2012: 4).

Comparable concerns feature in the CHAT tradition. In passing, Section 2.3.3 of the literature review (Chapter 2) mentioned “knotworking” (Engeström, 2000b: 972) [*italics omitted*]. Knotworking captures how ordinarily separate parties converge and work together (Engeström, 2000b). It labels “a longitudinal process” (Engeström, 2000b: 973). Work by Yrjö Engeström and colleagues (Engeström, 2000b; Engeström, 2001; Engeström, 2003) exemplifies how it can result in radical change to the object.

With or without reference to knotworking, researchers affiliated with the AIMTech Research Centre have applied CHAT when examining concepts/phenomena associated with working together. Pertinent studies have probed “information sharing during multi-agency major incidents” (Mishra et al., 2011b: 1), “information sharing and interoperability... [in] major incident management” (Allen et al., 2014: 418), and a mobile IS development in policing (Allen et al., 2013). Juxtaposed with the work by Engeström and colleagues, these place perceivably greater emphasis on distinct organisations.

This acknowledged, there is felt to be a tendency to examine only the time-limited turnout of parties ordinarily detached. In the present study, empirical evidence certainly indicates university IT practitioner(s) may work together with other(s) for limited timeframes. Yet as established, IT practitioners in UK academia form a community; IT provision can be considered to comprise smaller IT groups, each occupying its own activity system and linked by the shared object (Figure 6, Section 6.3, Chapter 6). In this context, working together can also play out over extended periods.

7.2.4.3 Manifesting as means towards congruence

Despite one IT Support Manager (Interviewee 21, University E) insisting IT practitioners "supporting the IT support office" at their university "own problems", working together manifests variously as means towards congruence. Emphasised initially, it can involve those internal to a university: IT practitioner(s), the non-IT community and/or even IT user(s) themselves. Stressed subsequently, working together can involve third parties external to the university e.g. IT provider(s). Empirical evidence illustrates, with continuous critical reference to pertinent literature.

7.2.4.4 Empirical evidence

7.2.4.4.1 *Unable to assist*

In its most contained form, working together as means towards congruence involves university IT practitioner(s). Although not necessarily perceptible, they can be physically co-located or dispersed across a campus. In one exemplar, a now Senior IT Advisor recalls a non-IT member of staff having difficulty uploading resource(s) to the VLE (Virtual Learning Environment). In this critical incident, the staff member IT user's continued activity was inhibited and/or prevented. Relatively new at the time, the interviewed IT practitioner reveals s/he was unable to help.

The IT user grew agitated, which is read to have spilled over into the IT provision activity (Figure 5, Section 6.2, Chapter 6) as a secondary contradiction scarring the community (staff member IT user) – subject(s) (IT practitioner) relation. It is interpreted that the object of IT provision activity (Section 6.2.3.2, Chapter 6) was itself not being met for as long as IT were failing to adequately assist. The IT practitioner "escalated" the issue(s) to his/her then supervisor, that "had a bit more knowledge with it".

Inasmuch as the latter took charge, this resembles "role shifting" (Bechky and Okhuysen, 2011: 246) (Section 3.5, Chapter 3). Bechky and Okhuysen (2011: 240) found this kind of "organizational bricolage" enabled continuity [*italics omitted*]. It is clear the initial IT practitioner was acting in the interest of the staff member IT user's continued activity -and as such, towards the continued activity of IT provision i.e. congruence. The escalating IT practitioner also adhered to rule(s) and/or norm(s). Conduct relative to rule(s) and/ or norm(s) is considered as means towards congruence below (Section 7.2.6).

7.2.4.4.2 *Apple expert*

Evidence also indicates a more casual kind of working together:

“there’s peer support within the teams, so, informally, people know that [Interviewee 2] is a guru in Apple. “I’ve got this Apple query [Interviewee 2], can you just...?” So, there’s definitely that, because they work in such a close area there’s definitely that sharing there”

Manager for Frontline Services, Interviewee 1, University A

These comments can be understood in light of wider academic literature. They may reveal reflexivity in the IT practitioner community: a state which sees “team members valuing the different perspectives, knowledge bases, skills and experience of team members” (West, 2012: 5). Reinforcing the worth of information behaviour, it seems the cited “guru” -a Senior IT advisor- is able to offer others “knowledge and skills”, i.e. “informational resources” (Cross et al., 2016: 76) [italics omitted].

Li et al. (2015: 2), moreover, apply the term “extra miler” to members contributing more than others to “team processes and ultimately team effectiveness”. The Senior IT advisor may be deserving of the same. For Li et al. (2015), his/her proximal positioning within the IT community may account for his/her effectiveness. Cross et al. (2016: 77) however, warn of potential problems like “workflow bottlenecks and employee burnout” that can accompany too much collaboration. Whilst plausible, present evidence does not suggest such strain.

It can be inferred that an “Apply query” tends to stem from an IT user, having earlier alerted IT. But whether or not, an IT practitioner requesting the expertise of a more informed colleague exposes an inability to deal with it themselves -chiming with the “Unable to assist” incident (Section 7.2.4.4.1). The IT practitioner’s continued activity is inhibited and/or prevented. Depending on the specifics, tool-related issue(s) may also be recognised as contradiction(s). Once solicited, the Senior IT advisor’s assistance contributes to the continued activity of IT provision i.e. to congruence; where applicable, this carries to the IT user activity.

7.2.4.4.3 *Essay submission software (II)*

Suggested above, working together as means towards congruence can also involve the non-IT community internal to a university. This was in evidence in the “essay submission software” incident, introduced earlier when discussing IB as means towards congruence (Section 7.2.3.4.7). As a reminder, the “Turn it in” tool had failed, meaning affected students could not attain their object(s). An information broadcast *after* the issue(s) inhibited and/or prevented continued

activity/activities effectively notified them that their object(s) could again be achieved as ordinarily.

It was acknowledged that efforts undertaken *whilst* tool-related issue(s) endured would be presented when discussing means of working together. To elaborate, then, prior to the information broadcast IT practitioners had worked together. Yet unfortunately, a prospective solution was disallowed because “it was not an official patch”. Management then suggested students be advised to email work directly to lecturer(s). But the interviewed IT Support Advisor -also a student- contested on the basis of the university’s anonymity rule. From the perspective of a student IT user activity, following the advice would see them (subject(s)) contradict the rule(s)/norm(s).

IT practitioners directed students in this way regardless. This IB, in which IT practitioner(s) comprehended and/or explained issue(s) and/or requirement(s) (Section 7.2.3), provoked dissatisfaction. In the IT provision activity (Figure 5, Section 6.2, Chapter 6), tension embodied the community (student IT user) – subject(s) (IT practitioner) relation. The interviewee apparently came up with the more satisfactory proposal, that students direct work to university administrative staff; s/he does not specify to whom s/he proposed this, but it would have been necessary for IT practitioner(s) to communicate it to IT user(s) e.g. by means of IB, for them to benefit.

“It was kind of like, they [students] could’ve, essentially if they really wanted to send their assignment out they could just, potentially just send it to the school so that the school can then kind of remove the name from the [inaudible: thing?] and then send it through”

IT Support Advisor, Interviewee 8, University A

In the student IT user activity, the software (tool(s) and/or resource(s)) normally handled anonymisation. Working together manifested in that the administrative staff assumed novel labour, anonymising work and forwarding it on. This afforded a workaround of the tool-related issue(s) and contributed to enabling affected students to achieve their object(s) in the interim. Workarounds are presented as means towards congruence in Section 7.2.7. When “Turn it in” was restored, they would have been able to submit as ordinarily. IT practitioners’ advice i.e. IB and administrative staff’s labour were therefore redundant.

7.2.4.4.4 *Outlook or mouse?*

As indicated, within the university, working together as means towards congruence can also involve IT user(s) themselves. An Applications Analyst Team Leader recalls how a student IT user experiencing issue(s) accessing Outlook alerted IT by telephone. In the beginning however, IT practitioner(s) had difficulty diagnosing the problem(s). Among challenges to and/or associated with congruence efforts (Facet C, Figure 7), comprehension and/or understanding is looked at in Chapter 9. At present, the IT practitioner suggests they:

“try and get you to open another application and that doesn’t open either”

Applications Analyst Team Leader, Interviewee 9, University C

By means of IB, the interviewee advised the telephoning IT user. Whilst meagre, it involved the IT user taking on labour and working collaboratively with the IT practitioner(s). This apparently aimed to improve comprehension and/or understanding; indeed, in the IT provision activity, efforts to isolate and/or diagnose issue(s) are customary. As means towards congruence (Facet A, Figure 7), conduct relative to rule(s) and/or norm(s) is examined below (Section 7.2.6). The IT practitioner(s) still had trouble, but the effort was not without worth.

Working together signalled the suitability of visiting the student IT user. Once there, the interviewed IT practitioner pinpointed the problem to something deceptive: a broken mouse. For the student IT user whose activity was inhibited and/or altogether prevented, work could continue when the IT practitioner sourced and substituted a functioning one. The incident valuably illustrates multiple heterogeneous means towards congruence (Facet A, Figure 7).

7.2.4.4.5 *a/v in teaching spaces*

Lastly and as suggested, working together as means towards congruence can involve third parties external to the university e.g. IT provider(s). An IT Support Officer recalls that a problematic video link system inconvenienced teaching activities in a number of rooms at once. The IT practitioner attended, but akin to the “Outlook or mouse?” incident (Section 7.2.4.4.4) had difficulty diagnosing the problem(s). In the interim, s/he accommodated e.g. with a temporary projector: a workaround. Workarounds are considered as means towards congruence below (Section 7.2.7).

Although it stopped shy of sorting the actual issue(s), it at least allowed teaching to continue. This aspect echoes the temporary solution to the “Turn it in” tool failure (Section 7.2.4.4.3). Congruence, in some sense, could be argued from this point. But, set on restoring normality, the

IT practitioner evinced information behaviour in seeking assistance from the third-party organisation responsible. In turn, representatives attended. Something of a saga, there were multiple sequential modifications to the division of labour:

“he couldn’t work it out, he got his mate out”

“at the end of the day there were 4 of them”

IT Support Officer, Interviewee 5, University A

Apparently appreciating the importance of teaching, the IT practitioner also acknowledges less pressing matters were made to wait:

“the daily work kind of got pushed to one side. That became the, the priority for that day”

IT Support Officer, Interviewee 5, University A

This resonates with Bechky and Okhuysen’s (2011: 248) observation of film crew members addressing surprise by “reordering the work” (Chapter 3). Whilst the displaced IT tasks were likely unrelated, their ordering was similarly demoted. In common with the “Outlook or mouse?” incident (Section 7.2.4.4.4), the problem was again deceptively simple: a mains power plug. Reasonably, it can be assumed that the accurate diagnosis and subsequent address allowed teaching activities to resume in the familiar way.

7.2.4.5 Succinct summary: Working together

Consistent with Figure 7, the second of the concepts/phenomena discussed was working together. Not formally considered in advance, Section 7.2.4.2 looked briefly at broader, pertinent literature. Section 7.2.4.3 explained how working together manifests as means towards congruence. In Section 7.2.4.4, empirical evidence illustrated; in turn, critical incidents comprised: an IT practitioner unable to assist (Section 7.2.4.4.1); an Apple expert (Section 7.2.4.4.2); a revisit of the essay submission software incident (Section 7.2.4.4.3); a faulty mouse (Section 7.2.4.4.4); and troublesome a/v (Section 7.2.4.4.5).

7.2.5 Change(s) to/of tool(s) and/or resource(s)

7.2.5.1 Introduction

Following Figure 7, change(s) to/of tool(s) and/or resource(s) are now considered. Whilst not formally assessed a priori, wider academic work is pertinent. Section 7.2.5.2 thus takes a fleeting

look. Section 7.2.5.3 elaborates on change(s) to/of tool(s) and/or resource(s) as means towards congruence. Section 7.2.5.4 illustrates with empirical evidence. Successively, critical incidents show: a “major incident process” (Section 7.2.5.4.1); a “technical solution” and “special queue” relating to My Print (Section 7.2.5.4.2); an online lecture check-in facility (Section 7.2.5.4.3); and a “Compromised account” process” (Section 7.2.5.4.4). Section 7.2.5.5 succinctly summarises.

7.2.5.2 Pertinent literature

Evidence indicates change(s) to/of tool(s) and/or resource(s) can be conducive to congruence. Although not explicitly contemplated from the off, past literature is pertinent. Offering “A Brief History of Research on Technology and Organizing”, Leonardi and Barley (2010: 3) recognise early researchers subscribed to a “determinist vision of technology that gave materiality a strong causal role”. Adherents argued “our actions are caused by technological, cultural and other forces prior to, external to, and independent of our behavior” (Leonardi and Barley, 2008: 160).

But accounts neglected how “social systems shaped technologies and their use” (Leonardi and Barley, 2010: 3). Scholars subsequently stressed a “more agentic or voluntarist ontology” (Leonardi and Barley, 2010: 5). Voluntarism, the admission that “humans have agency” (Leonardi and Barley, 2008: 160), falls “under the banner of “social constructivism”” (Leonardi and Barley, 2010: 2). To Leonardi and Barley’s (2010) reckoning, members of this camp adequately portrayed shortcomings of the perspective proceeding it.

In the present study, the kinds of change(s) to/of tool(s) and/or resource(s) of most intrigue are intentional. This precludes the endorsement of any perspective trivialising “the role of history, social context, and human agency in shaping technology production, use, and change” (Orlikowski, 2009: 10). An account of the findings necessarily sympathises with voluntarism. But the interests of social constructivists are themselves fragmented; five “perspectives” can be distinguished (Leonardi and Barley, 2010). Among other partings, scholars pursue different “social phenomena” (Leonardi and Barley, 2010).

For Leonardi and Barley (2010), it is therefore reasonable to query exactly “What’s Under Construction Here?” Peculiar to the present study, change(s) to/of tool(s) and/or resource(s) are only of interest in respect of their contribution to congruence. Leonardi and Barley (2010: 2) also express concern with the unrestrained “swing... toward social constructivism”. Whilst praising the appreciation of agency, they encourage increased emphasis on “materiality and power”; this would raise the relevance of research, both to organisation studies and possibly social science at large (Leonardi and Barley, 2010: 47).

From the historical narrative of the CHAT tradition and congruence (Chapter 2) and the suggested suitability of CHAT as a theoretical framework in the present study (Section 5.5.3, Chapter 5), it is clear CHAT is able to account theoretically for agency-endowed subject(s) *and* materiality. Its utility has been variously validated in studies undertaken by those at the AIMTech Research Centre, Leeds, UK. CHAT equally assists in understanding change(s) to/of tool(s) and/or resource(s).

7.2.5.3 Manifesting as means towards congruence

As means towards congruence, change(s) to/of tool(s) and/or resource(s) can vary in their manifestation. The change(s) can differ by locale i.e. affect different activity system(s). Additionally and whilst some change(s) are relatively short-lived, they may also and/or instead leave a longer term impression. Ostensibly counterproductive, some instances even entail backtracking on/disabling of functionality. Select empirical evidence illustrates, with critical reference to pertinent wider literature.

7.2.5.4 Empirical evidence

7.2.5.4.1 *Major incident process*

To begin, change(s) to/of tool(s) and/or resource(s) can be temporally modest. One Senior IT Support Advisor illustrates a hypothetical "university-wide" issue, e.g. the failure of Desktop Anywhere -a remote computing facility- at a time when students need to revise. From the perspective of a student IT user activity, such a critical incident would see their continued activity inhibited and/or altogether prevented. Fortunately, at this IT practitioner's institution, there is a "major incident process".

For an event in which "all the phones and network" fail, the IT practitioner identifies IT are "testing" an "emergency network" which allows them to "text" other IT and/or non-IT university staff member(s) e.g. "head of departments". That is, the facility enables means of information behaviour (Section 7.2.3). Should the telephones falter, IT are also equipped with the "capability of logging into the phones on mobiles". "Just as much as we can do to... really keep the service desk going", s/he exclaims.

The highlighted aspects of the major incident process can be considered to temporarily remediate the activity of IT provision (Figure 5, Section 6.2, Chapter 6). Yet, rather than accommodating a "changed object" (Miettinen et al. 2009: 1318), this is prompted by the kinds of critical incident(s) that inhibit and/or prevent continued activity/activities (Sections 5.6; 5.7,

Chapter 5). The change(s) to/of tool(s) and/or resource(s) are means by which the IT provision activity -inclusive of its incumbent object (Section 6.2.3.2, Chapter 6)- can continue in the interim, irrespective. That is, the means promote congruence.

7.2.5.4.2 *My Print: “technical solution” and “special queue”*

In complimentary evidence, a Senior IT Support Advisor isolates issues with “My Print” when printing was essential to IT users. In this critical incident, these issues inhibited and/or altogether prevented the continued activity/activities of any affected IT user. From the perspective of their activity/activities, it may be seen as a secondary contradiction in that the tool(s)/resource(s) were not functioning in accordance with the object of printing. Below, the IT practitioner’s recollection of a “technical solution” is striking:

“we’ve actually managed on that day when people can’t print to erm, re-route the, that printer, that particular printer we had, even though it’s on My Print, so we managed to directly print to it via IP address?”

Senior IT Support Advisor, Interviewee 2, University A

Although vague in some respects, these remarks invite a number of theoretical points. Most immediately, it is clear the fix was intentional: it presupposes human agency. Moreover, the interviewee’s use of the contraction “we’ve” seems to suggest input from multiple IT practitioners comprising the university IT community: the change(s) to/of tool(s) and/or resource(s) appear(s) to have been collaborative. In some capacity, they worked together (Section 7.2.4). The IT practitioner interviewed provides further insight:

“they’ve actually made like a special queue for that printer now that will take it out of the My Print thing... and actually sort of drop it off so in the event of a My Print problem, it’s actually available to be able to print to printers like that”

Senior IT Support Advisor, Interviewee 2, University A

The cited “special queue” attracts theoretical interest. Foremost, it is plainly apparent this technology did not present spontaneously as some sort of “exogenous force” (Orlikowski, 2009: 10). Rather, it was created especially. Although not clearly identified, the change(s) to/of tool(s) and/or resource(s) is/are again attributed to multiple people. When drawn on, it will validate the claim that “tools and artefacts, are, in fact, the outcome of previous work” (Nicolini, 2013: 104-105). Like the emphasised aspects of the major incident process (Section 7.2.5.4.1), it remediates activity in anticipated contingencies.

Exactly how it works is unclear. Yet, if a “My Print problem” occurs then the “special queue” enables print jobs to go ahead for as long as it persists. From the perspective of affected IT user(s) -and whether or not they are even aware- the switchover itself reflects change(s) to/of the tool(s) and/or resource(s) used in their activity. This allows it to continue. From the Senior IT Support Advisor’s comments, it can further be sensed that use of the special queue may come to be routine and/or normalised. Conduct relative to rule(s) and/or norm(s) is explored as means towards congruence below (Section 7.2.6).

7.2.5.4.3 *Online lecture check-in*

Whilst well-intended, evidence also indicates change(s) to/of tool(s) and/or resource(s) can unexpectedly usher in the kinds of issue(s)/problem(s) that may feature in critical incidents. An IT Support Advisor explains IT introduced an “online check-in system”, a tool with which students newly register lecture attendance via the internet. Although “new instrumentality” *can* overhaul the object (Engeström, 2000b: 966; Section 2.3.3, Chapter 2), the incumbent object of registration remained exactly that. Unfortunately and as noted, its introduction was fraught with issue(s)/problem(s).

These findings perhaps reify Engeström’s (2001: 137) thought, that “when an activity system adopts a new element from the outside (for example, a new technology...), it often leads to an aggravated secondary contradiction where some old element... collides with the new one”; that “such contradictions generate disturbances and conflicts”, also echoes. But where Engeström (2001: 137) anticipates “innovative attempts to change the activity”, he ultimately has in mind its “expansive transformation”. In IS change, Lyytinen and Newman (2008: 598) warn “interventions can result in unintended second- and third- order effects that produce path-dependent impacts on the system”.

When initially introduced, issue(s) e.g. compatibility meant some student(s) were unable to use it to register attendance: in the activity/activities of student IT user(s), a secondary contradiction between the tool(s)/resource(s) and object. The interviewee also notes “academic staff... would get a lot of complaints from students”: in the academic staff activity, a secondary contradiction came from the community (student(s)) to themselves as subject(s). The IT Service Desk also received complaints, showing strain had carried over: in the IT provision activity, a secondary contradiction between the community (complainant(s)) and subject(s) (IT practitioner(s)).

Whilst issue(s) persisted, IT reverted IT users to the old, functionally inferior pen and paper registration method. Bricolage -integral to which is making do- is examined as means towards congruence in Chapter 8. IT designated more development time, i.e. subsequent change(s) to/of tool(s) and/or resource(s). Interestingly, this was influenced by complaints communicated by IT user alerts to IT: IB (Section 7.2.3). Whilst the IT Support Advisor was “not fully sure” of the current state of play, reintroduction will, as before, aim to assist lecture registration.

7.2.5.4.4 *Compromised account process*

In other evidence, IT practitioner(s) effect change(s) to/of tool(s) and/or resource(s) in the interest of congruence, but which can inhibit and/or prevent the continued activity of a specific IT user. A Senior IT Support Advisor explains their “server team and UNIX team” can identify unusual account activity which may signal “spam phishing emails”. If an IT user’s account is suspected to be “compromised”, IT practitioner(s) temporarily “disable” it by way of the ““compromised account” process”. For the IT user, any activity relying on use of the account is temporarily ruled out. At first glance, disabling it may appear counterintuitive.

The “main issue” is that IT often do not possess a telephone number via which to contact the IT user, ““cause we do not use the student [system]”. They “can’t pull the student information from the student records because that is their personal contact details, and it’s dependent on them updating their contact details as well”. IT may “just disable the account”, with the IT user “not [even] aware”. The IT user may themselves alert IT, by means of IB (Section 7.2.3). But upon learning more, they can be dissatisfied: in the IT provision activity, a secondary contradiction between the community (IT user) - subject(s) (IT practitioner(s)).

Nevertheless and in the form of backtracking on/disabling of functionality, the change(s) to/of tool(s) and/or resource(s) are recognised to represent means towards congruence (Facet A, Figure 7). This shields the greater university IT user community from the same suspected risk(s), ensuring they can continue to use IT safely in their respective activities. As such, it serves the object of the university’s IT provision activity: the safe and continued provision of IT products and services for IT users (Section 6.2.3.2, Chapter 6).

7.2.5.5 Succinct summary: Change(s) to/of tool(s) and/or resource(s)

In keeping with Figure 7, change(s) to/of tool(s) and/or resource(s) were the third of the concepts/phenomena to be presented and discussed. Not formally considered beforehand,

Section 7.2.5.2 looked briefly at pertinent academic literature. Section 7.2.5.3 expanded on change(s) to/of tool(s) and/or resource(s) as means towards congruence. Section 7.2.5.4 then illustrated with empirical evidence. One-by-one, incidents exhibited: a “major incident process” (Section 7.2.5.4.1); a “technical solution” and “special queue” linked to My Print (Section 7.2.5.4.2); an online lecture check-in facility (Section 7.2.5.4.3); and a “Compromised account” process” (Section 7.2.5.4.4).

7.2.6 Conduct relative to rule(s) and/or norm(s)

7.2.6.1 Introduction

In further accordance with Figure 7, conduct relative to rule(s) and/or norm(s) is now explored. Section 7.2.6.2 recognises pertinent literature. Following this, Section 7.2.6.3 considers how conduct relative to rule(s) and/or norm(s) manifests as means towards congruence. This is illustrated by empirical evidence (Section 7.2.6.4), which, in turn, encompasses: use of ticketing and/or similar and/or related system(s) (Section 7.2.6.4.1); another look at the faulty mouse affair (Section 7.2.6.4.2); a revisiting of the troublesome a/v (Section 7.2.6.4.3); a return to the “Compromised account” process” (Section 7.2.6.4.4); a suspect bag scenario (Section 7.2.6.4.5); and password resets (Section 7.2.6.4.6). Section 7.2.6.5 summarises succinctly.

7.2.6.2 Pertinent literature

Empirical evidence suggests conduct relative to rule(s) and/or norm(s) is significant to congruence. In common with means of working together (Section 7.2.4) and change(s) to/of tool(s) and/or resource(s) (Section 7.2.5), CHAT-associated theoretical ideas are apposite. The historical narrative of the CHAT tradition and congruence (Chapter 2) noted its peculiar and nuanced regard for the rules and norms of activity. The points offered below add pertinent, complimentary clarity.

Engeström (1987: 150) outlines that activity is always “governed... by certain rules”. They are considered “principles of regulation of action and interaction” (Daniels, 2004: 123), and are among “the basic components of the [activity system] model” (Kaptelinin and Nardi, 2012: 7). As Prenkert (2010: 655) registers, they represent “mediatory elements”; they condition the subject-community relation (Kaptelinin, 2014) (Figure 2, Section 2.3.2, Chapter 2; Figure 5, Section 6.2, Chapter 6). Rules can be explicit and/or implicit (Kaptelinin and Nardi, 2006), formal or informal (Capper and Williams, 2004).

Allen (2011: 2171) regards rules to be connected to “an external objective source of authority and norms as the evolved implicit or explicit behavior that may draw upon or conflict with the rules”. Both “influence the subject but are also influenced by the community” (Allen, 2011: 2171). Assessing them alongside division of labour and community accommodates context (Allen, 2011). Whilst “social rules and regulations mediate interpersonal relationships” (Spasser, 2002: 93), Karanasios (2014: 5) notes reciprocation between rules and norms -and e.g. the “use of tools”.

Engeström’s (2000b) empirical work is also pertinent. In the context of Finnish healthcare, it illustrated vividly how intentional efforts can lead to considerable changes in the way(s) things are done. Engeström (2000b: 967) is interested in what he recognises as “a radical expansion of the object of activity”. Differentially, present findings indicate that conduct relative to rule(s) and/or norm(s) can be means by which activity -inclusive of incumbent object- can continue.

7.2.6.3 Manifesting as means towards congruence

As means towards congruence, conduct relative to rule(s) and/or norm(s) manifests in two broad ways: adherence and/or change(s). Established when modelling the activity of IT provision in UK academia, IT practitioners adhere to/with externally imposed rule(s) (Section 6.2.3.6, Chapter 6). Moreover, IT practitioners adhere to/with some practices so frequently they can be taken as norms, e.g. the use of ticketing and/or similar and/or related system(s), troubleshooting and escalation; others are executed in less common contingencies. Internal university rules, possibly implicit, can also be interpreted. The non-IT community e.g. IT users, also adhere to/with rule(s) and/or norm(s).

In addition and as suggested, conduct relative to rule(s) and/or norm(s) -manifesting as means towards congruence- can, in contrast, bring about change(s). These, understandably, do not exert influence exterior to the respective academic institution. Nevertheless and at least within the university, change(s) can affect different people and/or groups in the greater university community (Section 6.2.3.4, Chapter 6). With careful and critical reference to pertinent academic literature, empirical evidence serves to illustrate.

7.2.6.4 Empirical evidence

7.2.6.4.1 *Use of ticketing and/or similar and/or related system(s)*

Suggested above, conduct relative to rule(s) and/or norm(s) can manifest as adherence. Towards congruence, IT practitioners adhere to some practices so frequently they can be taken as norms. One that stands out is use of ticketing and/or similar and/or related system(s); this may further be interpreted as an implicit rule. At one university, an IT Support Officer clarifies that the “ticketing system is what we use to log everything that we do”. Elsewhere and among other points, a Senior Support IT Advisor posits:

“if you typed up a webform it goes through the ticketing system”

“So when we receive things through the various forms of contact, it will come in, or we log it through a system called “Service Now” which is an incident management system. So it’ll come in, as I say we convert it to an incident or a request”

Senior Support IT Advisor, Interviewee 2, University A

IT practitioner(s) come to be aware of users’ issue(s) in different ways; they then “convert it to an incident or a request”. This indicates interaction between the prior means of IB (Section 7.2.3) and subsequent conduct adherent to rule(s) and/or norm(s). But this is not the end. Rather, the IT practitioner suggests the matter may be “routed through to” Second Line -interpreted as escalation. Towards congruence, this would reflect further adherence to rule(s) and/or norm(s) and also means of working together (Section 7.2.4).

7.2.6.4.2 Outlook or mouse? (II)

Indicated above, IT practitioner(s) are also found to adhere to the norm of troubleshooting; this may or may not be interpreted as an implicit university rule. Although not explicitly identified as such, conduct of this kind was in fact evidenced by the “Outlook or mouse?” incident, introduced earlier when discussing working together as means towards congruence (Section 7.2.4.4.4). To reiterate briefly, a student IT user encountering issue(s) with Outlook had alerted IT by telephone. Unfortunately, and at least to start with however, IT practitioner(s) struggled to diagnose the problem(s).

By means of IB (Section 7.2.3), the interviewed Applications Analyst Team Leader then advised the student IT user over the telephone, to the effect that they worked together collaboratively. This was noted to have apparently aimed at aiding comprehension and/or understanding. In the IT provision activity, efforts to isolate and/or diagnose issue(s) were acknowledged to be customary. These can now be clarified as troubleshooting. Significantly, IT practitioner(s) adhere to such rule(s) and/or norm(s) as means towards congruence.

7.2.6.4.3 *a/v in teaching spaces (II)*

Also recognised above, IT practitioner(s) frequently adhere to the norm of escalation; as with troubleshooting, this may/may not be read as an implicit university rule. Whilst not previously explicated as such, it can be perceived in the "a/v in teaching spaces" incident, introduced when presenting working together as means towards congruence (Section 7.2.4.4.5). A troublesome video link system hampered teaching, and so by IB the IT Support Officer sought assistance from the third-party responsible -and all worked together (Section 7.2.4). Their involvement can now be clarified as escalation: rule(s) and/or norm(s) IT practitioner(s) adhere to as means towards congruence.

7.2.6.4.4 *Compromised account process (II)*

As suggested above, IT practitioners adhere to some norms in less common contingencies. Although not noted explicitly, this was reflected by the "'compromised account" process" introduced when discussing change(s) to/of tool(s) and/or resource(s) as means towards congruence (Section 7.2.5.4.4). To remind, IT practitioner(s) temporarily "disable" any IT user account thought to be "compromised". The change(s) to/of tool(s) and/or resource(s) protect others. Beyond points made previously, the Senior IT Support Advisor suggests "we've got to disable the account immediately. Er obviously so it doesn't compromise anyone else's account" [emphasis added]. It is therefore further recognised as rule(s) and/or norm(s) to which IT practitioner(s) adhere as means towards congruence.

7.2.6.4.5 *Cluster: suspect bag*

By contrast, and as also indicated above, conduct relative to rule(s) and/or norm(s) can manifest as change(s). An illustrational critical incident is provided by an IT Support Advisor. S/he explains students using university computer clusters can forget e.g. bags when they leave. In the past, IT practitioner(s) would e.g. examine the content and "if there's any valuables in it we would take it to security". This is taken as rule(s) and/or norm(s), with which IT practitioner(s) would adhere. It entailed working together with the non-IT university community (Section 7.2.4). Means of IB (Section 7.2.3) would obviously facilitate.

Referring to the "threat" of terrorism in the UK, however, the IT Support Advisor shares "we [IT practitioner(s)] don't wanna necessarily touch the bag anymore". The interviewee cites a change to what they do. Rather than IT practitioner(s) handling the forgotten belongings themselves,

they now telephone university security. This conduct conveys change(s) to rule(s) and/or norm(s) -which are newly adhered to. Although its anticipated longevity is unclear, the more cautious approach serves the object of IT provision activity: safe and continued provision of IT products and services for IT users (Section 6.2.3.2, Chapter 6).

7.2.6.4.6 *Change passwords*

Also established above, change(s) to/or rule(s) and/or norm(s) can affect different people and/or groups within a university. In another critical incident, a Service Desk Manager explains that IT users must newly change their passwords at regular intervals. IT email reminders i.e. IB broadcasts (Section 7.2.3), although it is unclear whether these are automated. Since the change(s) to/of the new rule(s) and/or norm(s), IT users adhere; this effects change(s) to/of their tool(s) and/or resource(s) (Section 7.2.5). Like the suspect bag scenario (Section 7.2.6.4.5), these means are undertaken in the interest of the object of IT provision activity (Section 6.2.3.2, Chapter 6).

7.2.6.5 Succinct summary: Conduct relative to rule(s) and/or norm(s)

Following Figure 7, conduct relative to rule(s) and/or norm(s) were the fourth of the concepts/phenomena discussed. Section 7.2.6.2 looked briefly at pertinent academic literature. Section 7.2.6.3 explained how conduct relative to rule(s) and/or norm(s) manifests as means towards congruence. Empirical evidence then illustrated; successively, Section 7.2.6.4 entailed: use of ticketing and/or similar and/or related system(s) (Section 7.2.6.4.1); further assessment of the faulty mouse incident (Section 7.2.6.4.2); another look at the troublesome a/v account (Section 7.2.6.4.3); reconsideration of the ““Compromised account” process” (Section 7.2.6.4.4); a suspect bag scenario (Section 7.2.6.4.5); and password resetting (Section 7.2.6.4.6).

7.2.7 Workarounds

7.2.7.1 Introduction

Keeping with Figure 7, workarounds are now examined. Although not formally considered beforehand, academic interest is apparent. Section 7.2.7.2 briefly assesses pertinent literature. Section 7.2.7.3 expands on the manifestation of workarounds as means towards congruence. Empirical evidence then demonstrates (Section 7.2.7.4); in order, critical incidents comprise: unusable lecture microphones (Section 7.2.7.4.1); a return to the Dropbox reimbursement account (Section 7.2.7.4.2); a new printing facility (Section 7.2.7.4.3); and a revisit of the

“technical solution” and “special queue” relating to My Print (Section 7.2.7.4.4). Section 7.2.7.5 summarises succinctly.

7.2.7.2 Pertinent literature

Whilst workarounds were not formally considered beforehand, there is academic interest. “Workarounds are a newly studied phenomenon; therefore there is no consensus on its definition in the literature” (Safadi and Faraj, 2010: 3). There are, nevertheless, insightful commentaries (e.g. Alter, 2014; Ferneley and Sobreperez, 2006; Röder et al., 2016; Azad and King, 2017; de Vargas Pinto et al., 2018). Alter (2014: 1042) acknowledges “workarounds have been reported and discussed in many situations”. IS research is also identifiable (e.g. Petrides et al., 2004; Boudreau and Robey, 2005; Behrens, 2009; Ilie, 2013; Röder et al., 2014; Malaurent and Avison, 2016).

A foundational point is that “workarounds are fundamentally about human agency” (Alter, 2014: 1048). That is, “the ability of people to make choices related to acting in the world” (Alter, 2014: 1048). They “elicit a wide range of viewpoints and perspectives” (Alter, 2014: 1042). As Safadi and Faraj (2010) note, workarounds have been perceived in a bad light, on different fronts. Indeed, the bulk of academic work about “computer workarounds” considers them to be “deviant behavior, rule breaking or resistance—effectively as equivalents of rule non-compliance” (Azad and King, 2017: 2).

Other remarks are more optimistic in relation to workarounds. They have been “recognised... as a valid response to poorly designed systems that fail to cater to employee needs” (Davison and Ou, 2013: 10). Azad and King (2017: 3) state “workarounds can arise broadly as responses to anomalous work situations”. Kobayashi et al. (2005: 1561) identify them as “informal temporary practices for handling exceptions to normal workflow”. These points are also suggestive of why workarounds occur.

Scrutinising the literature, Ferneley and Sobreperez (2006: 347) argue “workaround activity” can be split “into three strands”. So-called “Hindrance workarounds” exhibit when a “worker” sees standard system use as taxing; if the individual does not sense the worth of “the data that they are entering”, “approximate” values may be input instead (Ferneley and Sobreperez, 2006: 347). Ferneley and Sobreperez (2006: 347) however, emphasise a lack of “specific malcontent”. “Harmless workarounds” are similar, yet do not risk bearing on “workflow or the accuracy of captured data” (Ferneley and Sobreperez, 2006: 347).

Citing past works (Lankshear and Mason, 2001; Kobayashi et al., 2005), the third form they decipher are stressed to be “essential in order to complete the task at hand” (Ferneley and Sobreperez, 2006: 347). Such is interpreted to find support elsewhere: reviewing works on “workaround behaviour in the Information Systems (IS) area”, de Vargas Pinto et al. (2018: 432) allude to “employees... embracing workarounds to get the job done”. Alter (2014: 1042) submits: “sometimes workarounds are viewed as both unremarkable and essential for performing everyday work”.

Relatedly, Davison and Ou (2013: 1) report “corporate IT restrictions” in Chinese hotels, and workarounds executed by employees attempting to “complete their work effectively” [italics omitted]. Also, in a case study of the UK print industry (Button et al., 2003: 60), practitioners’ “activities” -which involved working around an IS- were “oriented to the realisation of the organisation’s goals”. These observations resonate with RQ 1, which asked how congruence is reached in practice i.e. generally about the intentional ways in which activity is influenced to continue (Section 2.5.3, Chapter 2; Section 5.2, Chapter 5).

Relevant insights are also relayed by Azad and King’s (2012: 358) examination of “computer workarounds” in a dual case study at a Mediterranean tax firm and hospital. Analysing their data, they invoke ideas of “institutionalization” (citing Selznick, 1949) and “decoupling” (citing Meyer and Rowan, 1977; Orton and Weick, 1990). Workarounds are found to be “persistent” (Azad and King, 2012: 368). Azad and King (2012: 369) populate a matrix, portraying four “patterns of institutionalized workarounds” -as “decoupled” or “loosely coupled” from “system” or “rule”.

Other work indicates workarounds can be undertaken by individuals or multiple people (Davison and Ou, 2013), and that they can also be collaborative in character (Button et al, 2003). Although “organizations and decisions makers” are frequently alert to workarounds (Röder et al., 2016), they can by contrast, exhibit “a tendency to stay underground” (Campbell, 2012: 724). This seems to disfavour collaborative workarounds -and any prospect of arriving at “system requirements for technology to better support workarounds” (Kobayashi et al., 2005: 1564).

For an organisation, the “consequence of workarounds” (Röder et al., 2016) has also been given thought in the extant literature. Röder et al. (2016) present a literature-informed ontology, conveying that a workaround “create[s]” “risk” associated with e.g. “economic value” or “data”. Alternatively, workarounds can be of “benefit”, e.g. in terms of “innovation potential” (Röder et al., 2016). Yet despite their own and other studies illuminating various aspects of workarounds,

Röder et al. (2016) claim a “coherent and cumulative body of work” is simply missing from the literature.

In Alter's (2014: 1041) equally critical assessment, “workarounds are understudied and undertheorized”. To his reckoning, there is no “theory of workarounds” so exhaustive as to accommodate “most types of workarounds and most situations in which workarounds occur” (Alter, 2014: 1043). He therefore puts forward his own, pertaining to those that take place in “organizational settings” (Alter, 2014: 1044). It is grounded in a definition of workaround, billed as being “broader and more inclusive than most definitions... in the literature” (Alter, 2014: 1044):

“A workaround is a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals.”

(Alter, 2014: 1044)

The definition references his own “work system”: a “unit of analysis” established a priori (e.g. Alter, 2013: 75). Expounded by Alter (2014: 1044), “workarounds affect details of a work system's operation, either temporarily or over an extended period, but do not change its overall identity, purpose, and high-level architecture”. Whilst the present study does not employ the work system, this chimes with its interest in intentional ways in which activity is influenced to continue -but which do not change its incumbent object.

Alter (2014: 1043-1044) uses Orton and Weick's (1990) notion of “five voices” to arrange the workarounds literature. Among these are “phenomena associated with workarounds” -which include “improvisation and bricolage”- and “types of workarounds” (Alter, 2014: 1048). Alter (2014: 1047) argues “various phenomena associated with workarounds lead to various types of workarounds”. Alter (2014: 1048) seems to suggest improvisation and bricolage “lead to various types of workarounds”. The present study's findings go beyond this simplistic, unidirectional account.

Omitted for brevity, Alter's (2014: 1055) elaborate exposition “describes how and why workarounds are created”. It “is a process theory” (Alter, 2014: 1055, citing Mohr, 1982, in Markus and Robey, 1988: 589-593). Alter (2014: 1055-1056) acknowledges influences e.g. “agency theory” (citing Eisenhardt, 1989) and “theory of planned behaviour” (citing Azjen,

1991). Like his definition of workaround, it is expressed in terms of the work system. Alter's (2014) work is pertinent, despite the present study not employing the work system. Instead it joins Malaurent and Avison (2016), interpreting workarounds with CHAT.

7.2.7.3 Manifesting as means towards congruence

As means towards congruence, workarounds vary in their manifestation. Discernible details typically include attribution i.e. the creator(s) of the workaround; the enactor(s) i.e. those actually carrying it out, can differ. Also, there is just what working around entailed/entails i.e. its shape or form. Of equal importance are *what* was/is worked around and/or rationale as to *why*. Workarounds vary in effect(s) and/or efficacy. Like change(s) to/of tool(s) and/or resource(s), the temporality of instance(s) can also differ. With critical reference to pertinent literature, empirical evidence illustrates.

7.2.7.4 Empirical evidence

To begin, workarounds are portrayed as prevalent:

“if somebody's got a problem we will always try and find a work around until you've got the main solution, so it is very much part of your day job”

IT Service Manager, Interviewee 22, University F

“according to like university lifecycle thing, so we can't wait that long so we sometimes say, “Do we have any work around?”

IT Project Manager, Interviewee 11, University C

7.2.7.4.1 *Lecture microphones*

In an opening example, an IT Operations Manager recalls how an incremental Microsoft Windows update clashed with drivers linked to the “roving microphones” popular among lecturers, and which allow recording. Although it is not absolutely clear, the “conflict” is interpreted to have inhibited and/or prevented use of the tool(s) used ordinarily -and thus their continued activity/activities. By means of IB (Section 7.2.3), IT practitioners advised lecturers of a “short term fix” -to instead use the microphone functionality integrated in a webcam. Immediately, this can be understood as change(s) to/of tool(s) and/or resource(s) used by the lecturer IT users (Section 7.2.5).

The IT practitioner identifies it as a “work around”. This is reasonable, given that use of the webcam microphone allowed lecturer IT users to circumvent the tool-associated technical issue whilst it ensured. Whereas the “roving”, “clip-on microphones” allowed freedom of movement, the webcam restricted lecturers to the lectern. “It was inconvenient to what they would normally do”, the IT practitioner admits. Yet, those making do with the functionally inferior tool were at least able to continue their activity/activities: these means were conducive to congruence. Bricolage -integral to which is making do- is considered as means towards congruence in Chapter 8.

7.2.7.4.2 Dropbox reimbursement (II)

Evidence also suggests rule(s) can be worked around. Whilst not explicated previously, this can be sensed in the “Dropbox reimbursement” incident introduced when presenting IB as means towards congruence (Section 7.2.3.4.3). To reiterate briefly, an academic IT user requested reimbursement for a Dropbox. IT practitioner(s) initially refused, in accordance with “the guide” i.e. university rule(s)/norm(s). The issue was then “escalated” to the IT Service Desk Manager interviewed. Comprehending and/or understanding the IT user's issue(s) and/or requirement(s) foregrounded a “fundamental business need”.

As such, the Dropbox was reimbursed. The IT practitioner acknowledged that “a university like ours, I think there’s always gonna be... a small number of exceptions which need to be treated as such”. From this, it is newly inferred that the reimbursement circumvented i.e. worked around an enduring university rule and that these means contributed towards congruence. Although it is not exactly clear, the IT Service Desk Manager may have been uniquely authorised to do this. Kobayashi et al. (2005: 1563) certainly, suggest “workarounds differ as a function of people’s roles”.

7.2.7.4.3 New printing facility

In complimentary evidence, an IT Support Officer refers to a recently adopted printing facility. Although the exact rationale underlying its introduction is unclear, it can be assumed that the change(s) to/of tool(s) and/or resource(s) (Section 7.2.5) sought to support and/or improve the printing activity of IT users e.g. students i.e. contributing to congruence. For university IT practitioner(s), it brought about a new way of obtaining and replenishing ink: change(s) to/of rule(s) and/or norm(s) (Section 7.2.6). Adhering to the new rule(s) and/or norm(s) (Section 7.2.6), they “raise a ticket”, it “sits in a queue for a while” “and eventually it gets picked up”.

Following this, the IT provider “Xerox would post the ink cartridge to us”. Yet whilst university IT practitioners are capable of installing the ink cartridge i.e. making change(s) to/of tool(s)/resource(s) (Section 7.2.5), they hold back “because the printers belong to Xerox. We’re not really supposed to”. Instead, “the technicians would come”. If understood correctly, the technicians work together with the university IT practitioners by assuming all of the labour (Section 7.2.4) of installing the ink cartridge i.e. the change(s) to/of tool(s)/resource(s) (Section 7.2.5). This can mean a delay. It can be “a problem in the busy periods”. Previously, university IT “might have had to wait a week or so before the cartridge arrived”; “it wasn’t ideal when the new printers were first installed; we would have maybe two or three printers on each floor down due to lack of ink or something to that effect”.

Although unclear, the IT practitioner suggests “something has happened” and that “now it’s not so long; maybe two days, three days”. In any event, printer-related issue(s) are obviously unfortunate for any IT user whose activity involves or requires printing. From the perspective of an affected IT user’s activity, an unusable printer can be seen as a secondary contradiction in that the tool(s)/resource(s) is at odds with the object of printing. For an affected IT user, this scenario represents a critical incident.

The interviewee elaborates:

“...in the worst case they would come to the desk and I’d print it for them on the IT service desk printer, on our printer.”

IT Support Officer, Interviewee 12, University B

The IT Support Officer would apparently contribute labour, working together with affected IT user(s) (Section 7.2.4); s/he would use his/her own printer on behalf of IT user(s). From the perspective of the IT user activity, this reflects change(s) to/of tool(s) and/or resource(s) (Section 7.2.5), allowing them to work around the tool-related issue(s) -and achieve their print-related object(s) regardless. Further insights relate to the print accounts students ordinarily use to pay for printing, i.e. rule(s) and/or norm(s) to which they adhere (Section 7.2.6).

Asked whether it is possible to deduct credit from the affected IT user’s account, the IT practitioner responded:

“Well, we could do, but no. If there’s a problem with the system we print for them.”

“Because by that time – by then we’d probably have a long queue, so it’s not very good customer service. (laughs)”

IT Support Officer, Interviewee 12, University B

The inclusive pronoun “we” implies multiple IT practitioners in the IT community contribute. This resonates with past work (Button et al., 2003), wherein workarounds were collaborative. It is also sensed that the workaround may/can be repeated, in which respect it is also “persistent” (Azad and King, 2012: 371). The decision not to charge -i.e. to work around the university rule(s) and/or norm(s)- appears to avoid risk. Among challenges to and/or associated with congruence efforts, unrealised, potential risk(s) are considered in Chapter 9.

7.2.7.4.4 *My Print: “technical solution” and “special queue” (II)*

Further workaround evidence pertains to printing at another university. Whilst not expressly foregrounded, it was perceptible in the “My Print: “technical solution” and “special queue”” incident (Section 7.2.5.4.2). To reiterate, a Senior IT Support Advisor outlined that if a “My Print problem” occurs, an especially created “special queue” allows printing to go ahead. It was noted that its use may become routine and/or normalised. The provision is clearly more specialist than the generic printer used by the IT Support Officer and colleague(s) coping with a new printing facility (Section 7.2.7.4.3).

The character of the special queue extends support for the observation -offered when discussing higher education- that “workarounds can... include... sophisticated technological solutions” (Petrides et al., 2004: 100-101). It also seems to have become “institutionalized” (Azad and King, 2012: 358). In addition, it strengthens the suggestion made in the medical context: that “successful workarounds can provide organizational solutions for exceptions that recur” (Kobayashi et al., 2005: 1561).

In light of the concept of workarounds, theoretical understanding is augmented. Technical in nature, creation of the special queue -i.e. change(s) to/of tool(s) and/or resource(s)- anticipated a “My Print problem”. Should such occur, and whether or not they are cognisant of it, affected IT user(s) switch to the special queue: contemporary or future change(s) to/of tool(s) and/or resource(s). Its use may represent change(s) and subsequent adherence to rule(s) and/or norm(s). The “special queue” lends the vehicle via which affected IT user(s) can work around and achieve their object of printing regardless.

7.2.7.5 Succinct summary: Workarounds

Following Figure 7, workarounds were the fifth of the concepts/phenomena discussed. Not formally contemplated previously, Section 7.2.7.2 considered pertinent academic literature. Section 7.2.7.3 elaborated on the manifestation of workarounds as means towards congruence. Section 7.2.7.4 then illustrated with empirical evidence; successively, critical incidents featured: unusable lecture microphones (Section 7.2.7.4.1); another look at the Dropbox reimbursement episode (Section 7.2.7.4.2); a new printing facility (Section 7.2.7.4.3); and further attention on the “technical solution” and “special queue” linked to My Print (Section 7.2.7.4.4).

7.2.8 Succinct summary: First five means towards congruence

Addressing RQ 1 (Section 5.2, Chapter 5), this section started presenting the heterogeneous means towards congruence (Facet A, Figure 7). Section 7.2.2 acknowledged existing use of identical/similar terms, characterised the heterogenous means towards congruence and substantiated their significance. Successively, the first five of seven were then explored: information behaviour (Section 7.2.3); working together (Section 7.2.4); change(s) to/of tool(s)/resource(s) (Section 7.2.5); conduct relative to rule(s) and/or norm(s) (Section 7.2.6); and workarounds (Section 7.2.7).

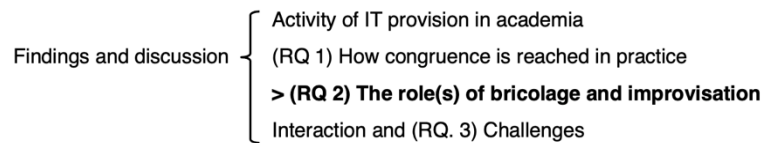
Whilst none of these concepts/phenomena were formally contemplated in advance, academic intrigue is apparent and encouraging. Discussing each, pertinent literature was therefore consulted. As such, they could be effectively appreciated when and/or where manifesting as heterogeneous means towards congruence. A selection of empirical evidence served to illustrate. The first five heterogenous means were each succinctly summarised. Below, Section 7.3 summarises and concludes the chapter.

7.3 Summary and conclusion

This was the second of four chapters to present and discuss the study’s findings. Following Figure 7, it began answering RQ 1, which queried how congruence is reached in practice i.e. generally about the intentional ways in which activity is influenced to continue (Section 2.5.3, Chapter 2; Section 5.2, Chapter 5). Section 7.2 started presenting the heterogeneous means towards congruence: Facet A of the trifold conceptualisation (Figure 7). Discussing the first five, it became clear each individually fell short of exhaustive explanation.

Rather, it was often of theoretical benefit to refer to other means (Facet A, Figure 7). Empirical evidence, indeed, indicated that IT practitioners typically draw on multiple heterogeneous and interacting means in what are interpreted as greater congruence efforts. To a lesser extent and effect, other people e.g. non-IT staff and IT users were also shown to possibly pursue means towards congruence. Attention now turns to the last of the two means, bricolage and improvisation (Facet A, Figure 7).

8 Findings and discussion: (RQ 2) The role(s) of bricolage and improvisation



8.1 Introduction

This is the third of four chapters to present and discuss the study's findings. As per Figure 7, it answers RQ 2 (Section 5.2, Chapter 5), which specifically queries the role(s) of bricolage and improvisation in relation to how congruence is reached in practice. Considered together below (Section 8.2), they are each established as means towards congruence. The chapter therefore extends the response to RQ 1 (Chapter 7). These final two heterogeneous means also exhaust Facet A of the trifold conceptualisation (Figure 7).

Tremendous care was taken to organise and order the empirical evidence, with insights flowing logically from one to the next. Noteworthy links are made to/with other evidence in different section(s) and/or chapter(s) of the broader findings and discussion (Chapters 7-9). Where beneficial, empirical evidence is returned to -likewise in different section(s) and/or chapter(s) of the findings and discussion (Chapters 7-9). This is in the interest of cohesion. Section 8.3 summarises and concludes the chapter, before the presentation progresses in line with Figure 7.

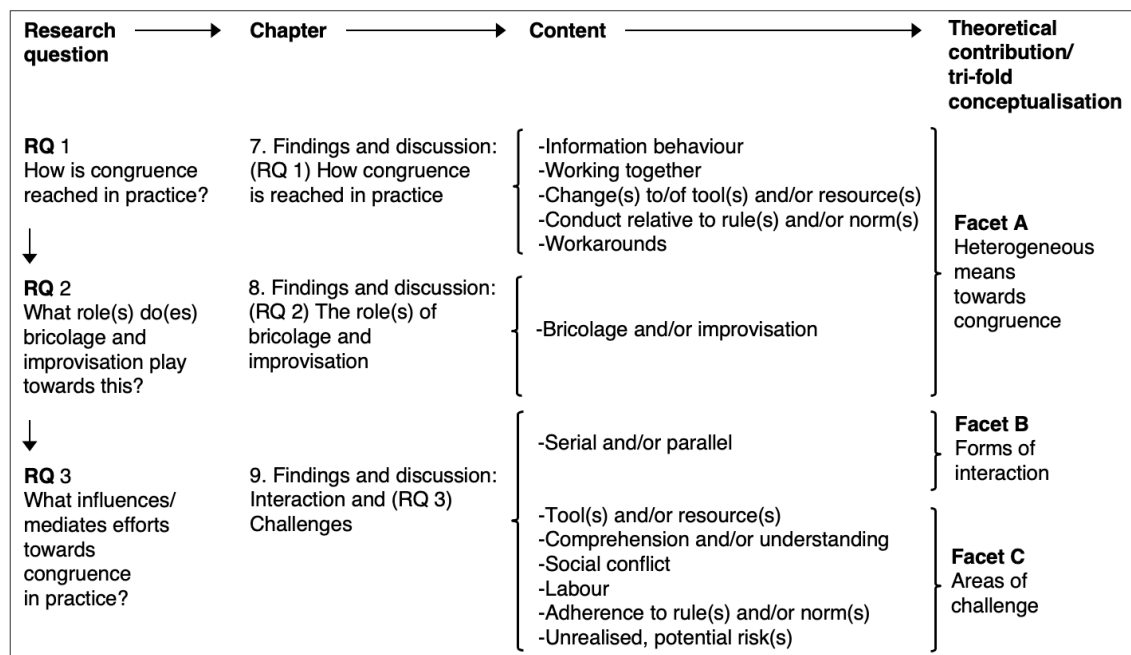


Figure 7. From research questions to theoretical contribution (repeated)

8.2 Bricolage and improvisation: Final two means towards congruence

8.2.1 Introduction

Addressing RQ 2 (Section 5.2, Chapter 5), this section recognises bricolage and improvisation as means towards congruence; it thereby builds on the response to RQ 1 and finishes Facet A (Figure 7). Unlike the former five concepts/phenomena (Chapter 7), both were formally considered beforehand. Section 8.2.2 briefly recalls the content of the literature review, as regards bricolage (Chapter 3) and improvisation (Chapter 4). Section 8.2.3 elaborates on the manifestation of each, as means towards congruence. Section 8.2.4 then illustrates using empirical evidence.

Critical incidents are rich and varied. One-by-one, they witness: a return to the inaccessible results episode (Section 8.2.4.1); a meeting requests issue (Section 8.2.4.2); an open day (Section 8.2.4.3); another look at the compromised account process (Section 8.2.4.4); a laptop spillage scenario (Section 8.2.4.5); server resets (Section 8.2.4.6); the lack of a testing environment (Section 8.2.4.7); a poor ticketing system (Section 8.2.4.8); a 2-factor authentication account (Section 8.2.4.9); a retired academic experiencing IT issue(s) (Section 8.2.4.10); a data centre outage (Section 8.2.4.11); routine power testing (Section 8.2.4.12); and a revisit of the “proactive” approach (Section 8.2.4.13). Section 8.2.5 summarises succinctly.

8.2.2 Pertinent literature

In contrast to the former five concepts (Chapter 7), bricolage and improvisation were each formally examined previously. As a brief reminder, Chapter 3. Literature review: Bricolage began by characterising and clarifying the concept of bricolage (Section 3.2). It then reviewed past academic research in a diversity of areas. Successively, these comprised: entrepreneurship (Section 3.3); academic research (Section 3.4); emergencies (Section 3.5); and information technology (IT) & information systems (IS) (Section 3.6).

Similarly, Chapter 4. Literature review: Improvisation initially characterised and clarified the concept of improvisation (Section 4.2). Following this, it appraised works in a variety of areas. In turn, these were: the arts (Section 4.4); crises, emergencies and extreme events (Section 4.5); New Product Development (NPD) (Section 4.6); and information technology (IT) & information systems (IS) (Section 4.7). For brevity and to avoid repetition, readers can refer back to these earlier chapter(s) and/or section(s) at any time.

8.2.3 Manifesting as means towards congruence

Bricolage and improvisation are each recognised as means towards congruence. Regarding bricolage, Baker and Nelson's (2005) entrepreneurship study is pertinent (Section 3.3, Chapter 3). Citing Lévi-Strauss (1967) and others, they explicated what they consider the "characteristics" of bricolage: "resources at hand", "recombination of resources for new purposes" and "making do" (Baker and Nelson, 2005: 333-334). At some companies, "each of the elements" were often discerned "separately"; "bricolage, combining all three" was less common (Baker and Nelson, 2005: 340).

In the present study and as means towards congruence, bricolage is interpreted to manifest in three slightly different ways: making do; (re-) combination of some sort; and network bricolage. Network bricolage can involve drawing on an established contact within the respective university or exterior to it. Of the critical incidents to evince bricolage, at least one reflects traces of all three; most however, do not. As such and in general, analysis is sensitive to any apparent trace - and more specifically, its significance as means towards congruence. The most commonly found trace of bricolage is making do. Where manifest, making do, (re-) combination of some sort and network bricolage can each be attributed to university IT practitioners. IT users also engage in bricolage, by making do and (re-) combination of some sort.

As suggested and as means towards congruence, IT practitioners also improvise. Intriguingly, IT practitioners and IT users can each benefit. Some of the critical incidents logged feature both bricolage *and* improvisation. However, alertness to only these two means endows but a partial picture. Rather, bricolage and/or improvisation are drawn on together with other heterogeneous and interacting means (Facet A, Figure 7) in greater congruence efforts. With reference to the five means discussed earlier (Chapter 7) -and to pertinent academic literature- empirical evidence illustrates.

8.2.4 Empirical evidence

As established, bricolage and improvisation are each recognised as means towards congruence. Yet, when detailing the design of the SSI protocol (Section 5.11.4, Chapter 5), it was argued that on its part, the word "bricolage" is unlikely to be used by IT practitioners colloquially; this and/or similar thinking appears to have influenced the choice not to cite it explicitly in the interview

questions (IQs) prepared. Reference to improvisation, in contrast, was explicit. Met by this, the interviewed IT practitioners returned some quite clear -even colourful- responses at times.

Asked if s/he “ever had to improvise in any way”, a Head of Applications and Digital Services in fact plainly dismisses it:

“I don’t think it’s applicable to the job I do to be honest.”

Head of Applications and Digital Services, Interviewee 19, University B

Whilst bricolage and improvisation are interpreted as means towards congruence, neither is argued to be uniformly evident and/or even appropriate in the empirical setting of IT provision in UK academia (Section 5.7, Chapter 5). Assuming veracity in the outgoing response, it may be explained in a number of ways. Most generally, it may imply an equivalent lack of exposure to the kind(s) of circumstance(s) associated with the manifestation of improvisation (Chapter 4). Further speculation, however, lies beyond the scope of the present study.

When similarly asked whether s/he has “ever had to improvise anything... like think on your feet kind of thing?”, an IT Service Manager elsewhere responds with markedly more enthusiasm:

“Yeah, because it’s part of your day job really, you’re always the first... if somebody’s got a problem we will always try and find a work around until you’ve got the main solution, so it is very much part of your day job, and that might be a piece of software on somebody’s own, bring your own device, or it could be, it could be anything. So I would say yes we have had to think on our feet and I’ve had to think on my feet...”

IT Service Manager, Interviewee 22, University F

It is intriguing that the IT Service Manager suggests such conduct is integral to the job. It is also notable that without explicit provocation, the interviewed IT practitioner refers to working around temporarily. Following Figure 7, workarounds were presented and discussed as means towards congruence previously (Section 7.2.7, Chapter 7). At another university, a Service Desk Manager was asked “have you ever had to think on your feet or improvise a solution or a workaround?” Responding, the IT practitioner more firmly amounts these forms of behaviour to the position itself.

S/he humours:

“Practically impossible to answer because it’s sort of my job. (laughs)”

8.2.4.1 Results inaccessible (II)

The opening account was introduced earlier, when discussing IB as means towards congruence (Section 7.2.3.4.2, Chapter 7). As a reminder, student IT users were unable to access results. In this critical incident, any affected IT user's activity was inhibited and/or altogether prevented. It was also seen as a secondary contradiction in that the function of the tool(s)/resource(s) opposed the object of accessing results. Although student IT users alerted IT, this was acknowledged as unlikely to resolve issue(s) and/or instil congruence alone. It was suggested that the IT practitioner(s) informed would pursue further means, as part of a larger congruence effort.

The interviewee exemplifies how an IT practitioner would respond to a student IT user:

“I’ll reset your password, that’ll get you in, and then you’ll be okay”

Applications Analyst Team Leader, Interviewee 9, University C

This can be understood by reference to a number of the heterogeneous means discussed already (Chapter 7). By conveying to the student IT user what they intended to do, the IT practitioner would be engaging in information behaviour (Section 7.2.3, Chapter 7). Ordinarily, the password reset can be taken as unnecessary; the IT practitioner would therefore be assuming additional labour. In this sense, the IT practitioner and student IT user would be working together (Section 7.2.4, Chapter 7). The IT practitioner's assistance would engender change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7).

Of most interest, however, the password reset is felt to reflect qualities of improvisation (Chapter 4). For example and whilst this “purposeful human behavior” was “intentional”, it equally seems to have been “extemporaneous” (Ciborra, 1999b: 78). In response to the student IT user alert and at least when undertaken for the first time, the IT practitioner is interpreted to have improvised by resetting their password. Significantly, improvisation served as means towards congruence.

This instance can be appreciated in relation to the study by Miner et al. (2001) in New Product Development (NPD) (Section 4.6, Chapter 4). “Direct outcomes” of improvisation were identified as “improvisational productions” (Miner et al., 2001: 309). Of three types, most relevant are “behavioral productions” corresponding to “new behaviors”; these witnessed “teams” improvise

“processes” i.e. “sequences of behavior” (Miner et al., 2001: 309). No password reset featured among those found in this distanced domain. Present findings thus extend the applicability of this theoretical scheme to IT provision in UK academia (Section 5.7, Chapter 5).

The resetting of a password also resembles an account from Njenga and Brown’s (2012) study of Information System Security (ISS) (Section 4.7, Chapter 4). In short, an employee needed to access specific information, but was prevented because of a technical administrative conflict. On the “spur-of-the-moment” seemingly, an ISS practitioner made change(s) to the database, enabling access (Njenga and Brown, 2012: 599). S/he at least appears to have addressed the matter outright.

In contrast and although the accolade of “quick-wittedness” (Njenga and Brown, 2012: 600) also applies to the IT practitioner resetting the student IT user’s password, the interviewed Applications Analyst Team Leader concedes the deeper issue endured. S/he rationalises a lack of concern by referencing the ITIL (Information Technology Infrastructure Library) framework adhered to (Chapter 6). Specifically, citing its distinction between “problem” and “incident” -a problem representing the “underlying cause of one or more incidents”. For the IT community, s/he suggests incident resolution is prioritised.

Inasmuch as the original “server load issues” persisted, it can perhaps be interpreted that the secondary contradiction endured. That is, the ill-function of the tool(s)/resource(s) remained at odds with the object of accessing results. Nevertheless, a student IT user with a reset password would have been able to continue and access their results; on this basis and from the perspective of their activity, congruence can be claimed. From the perspective of IT provision activity (Figure 5, Section 6.2, Chapter 6) and in that it was affording the safe and continued provision of IT products and services for IT users, the claim carries.

Moreover and because the tool(s)/resource(s)-related issues persisted, it can be reasoned that the student IT user was -albeit perhaps unknowingly- working around (Section 7.2.7, Chapter 7) them. Recalling the episode from Njenga and Brown’s (2012) study, even if the ISS practitioner’s change(s) failed to address that matter outright, the present findings specifically steer attention to workarounds. The association of improvisation and workarounds has been assessed before (e.g. McGann and Lyytinen, 2008 in Section 4.7, Chapter 4; Alter, 2014 in Section 7.2.7, Chapter 7).

In their work, McGann and Lyytinen (2008: 4) locate workarounds as merely “types” of improvisation [italics omitted]. The present findings clearly challenge this assumption. As expounded, the IT practitioner improvised. But the workaround was pursued subsequently and collaterally by the student IT user. In the context of this critical incident, it was by these means - undertaken intentionally and together with heterogeneous others in an overarching effort- that congruence came. Further empirical evidence corroborates.

8.2.4.2 Meeting requests

In complimentary evidence, a Service Desk Manager recalls when a Microsoft “security patch” was issued and installed on university computers. External in origin, this is considered change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7). Whilst well-intended, the unexpected effect was that double clicking on attachments in “meeting requests” would not open them. In this critical incident, from the perspective of IT users met with “an error message”, any object requiring access to attachments was inhibited and/or altogether prevented. Fortunately, a solution was found.

Asked about his/her strategy, s/he curiously comments:

“(Laughs) I just looked at it and tried different ways.”

“And I had a little look at it and said, “Let’s try it this way” and it worked.”

Service Desk Manager, Interviewee 14, University C

This response can be understood in respect of the improvisation literature (Section 4.2, Chapter 4). Although the IT practitioner is amused by how the solution was reached, it aptly addressed “the unforeseen” (Weick, 1998: 544). His/her conduct is interpreted to have been improvisational in character. The interviewee admits, it was “one of the very few I actually found some of the workaround for (laughs)”. The claim that it was a workaround is also reasonable, given the actual issue’s persistence.

This incident exhibits theoretical similarity to the “results inaccessible” incident, introduced earlier when discussing IB as means towards congruence (Section 7.2.3.4.2, Chapter 7) and referred to again above (Section 8.2.4.1). In short, the IT practitioner improvised; this led to the chance discovery of a viable solution. It meant IT users could work around the enduring tool(s)/resource(s)-related issue(s) and access attachments regardless. More is interpreted from the IT practitioner’s further comments.

S/he elaborates on what the solution entailed:

“So you have to go in and download the attachments to your machine”.

Service Desk Manager, Interviewee 14, University C

This can be appreciated in light of the bricolage literature (Chapter 3). Lévi-Strauss (1972: 17) originally noted that whereas engineers obtain resources as necessary for their current undertaking, “bricoleur[s]” have bits and pieces they only hope will suffice. They “make do with ‘whatever is at hand’” (Lévi-Strauss, 1972: 17). More recently, Denzin and Lincoln (2000: 6) referred to “methodological bricoleurs” capable of applying an assortment of methods. Kincheloe (2001: 679), further, associated advantage with bricolage “as an interdisciplinary approach” [italics omitted].

In the present incident, IT users were making do with what was seemingly the only method available. It is read to have been laborious vis-à-vis the convenience of double clicking. Still, these means at least allowed activity to continue: they brought congruence. As such and from the perspective of the IT provision activity, the object of safe and continued provision of IT products and services (Section 6.2.3.2, Chapter 6) was also achieved. The solution -and the heterogeneous means explaining it- are anticipated to remain relevant and/or necessary until e.g. Microsoft releases a subsequent patch.

Perhaps obvious, the IT practitioner points out:

“But you have to know that that’s what you have to do”

Service Desk Manager, Interviewee 14, University C

The IT practitioner refers e.g. to a “Twitter feed” and a “service issues webpage”, used to broadcast information i.e. means of IB (Section 7.2.3, Chapter 7) to IT users. These, however, “would require someone to know to go and look”. In his/her estimation, this issue “doesn’t feel big enough” to warrant e.g. an “all-staff email”. S/he adds, “corporate comms aren’t keen on it and I can understand why, because people get bombarded with email and some people probably hardly ever get a meeting request with an attachment in it”. There is an apparent risk of irrelevance. S/he asks rhetorically, “what is the best way to communicate?” As per Figure 7, challenges to and/or associated with congruence efforts (Facet C) are discerned by Chapter 9.

8.2.4.3 Open day

Interplay between improvisation, bricolage and other heterogeneous means (Facet A, Figure 7) is perceptible in different circumstances. A Campus IT Support Team Leader recalls events leading up to an Open Day, for which IT needed to “prepare some computer labs”. “Normally”, IT practitioner(s) distribute software to PCs via the university network. That is, they adhere to rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) which engender change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7) -towards the object of IT provision activity (Section 6.2.3.2, Chapter 6).

On this occasion, “one of the switches for that floor failed”. In this critical incident, IT provision activity was inhibited and/or altogether prevented. From this perspective (Figure 5, Section 6.2, Chapter 6), the failure can be appreciated in respect of secondary contradictions. The tool(s)/resource(s) was not facilitating the rule(s)/norm(s); it was also at odds with the object. The switch *was* receiving attention from network IT specialists, but it was anticipated to take “6 or 7 hours”. Although this may have been okay, the Campus IT Support Team Leader felt uneasy about it.

Safeguarding from any “unexpected problem” the network IT specialists may have come to encounter, s/he pursued another undertaking concurrently. Yet, the time constraint imposed by the Open Day is felt to have forced a strategy marked by “convergence of composition and execution” (Moorman and Miner, 1998a: 1) (Section 4.2, Chapter 4). It is interpreted as improvisational. Optimistically, the IT practitioner was apparently aware of other network connectivity into which they could “plug the PCs”.

Problematically however, this alternative network connectivity was in “an admin office” occupied by administrative staff. This detail can be appreciated in respect of the bricolage literature (Chapter 3). In particular, work by Domenico et al. (2010: 681) on “social bricolage” in “social entrepreneurship” reflected how the necessary resource(s) can possibly reside with and belong to others (Section 3.3, Chapter 3). Their sample also engaged in persuasion, so as “to acquire resources” (Domenico et al., 2010: 696).

Serendipitously, the Campus IT Support Team Leader clarifies it was in fact “their Open Day”. The IT and administrative staff each had a vested interest in ensuring it reached fruition. To invoke CHAT vocabulary, they had a “shared or jointly constructed object” (Engeström, 2001: 136) (Chapter 2). This perhaps eased any otherwise necessity to persuade. Still, had the IT

practitioner(s) simply uprooted the administrative staff IT users, the administration activity would have been inhibited and/or altogether prevented.

The interviewee expands on their attentive approach:

“I explained the situation, being upfront”

“I said “look, this sounds silly, but we’re gonna have to [laughs] move all of these computers.. upstairs. Kick your staff off the desks. We’ve got some laptops here, from one of the teaching rooms. They can log onto them.””

“And we setup a temporary printer for them in the corner.”

Campus IT Support Team Leader, Interviewee 10, University C

S/he also explained to them:

“It’s gonna be a bit of an inconvenience, but if they can do that, we can get this all ready.”

Campus IT Support Team Leader, Interviewee 10, University C

This evinces IB (Section 7.2.3, Chapter 7), echoing the instance in the UK ambulance study (Allen et al., 2013) (Section 2.4, Chapter 2). To remind, a new system meant the ambulance had to stay still for a while. This alarmed witnesses; for Allen et al. (2013), a tension/contradiction tainted the subject (paramedics) - community (family, etc.) relation. The paramedics came to learn “one of them” should briefly explain (Allen et al., 2013: 845). It appeared the subject(s) were cognisant of a tension/contradiction and that this prompted the intervention, which was read to have been improvised -at least initially.

The Campus IT Support Team Leader’s explanation is also interpreted as improvisation. Yet, a significant difference is discerned: it does not seem to have been provoked by comparable cognisance of any tension/contradiction between the IT practitioner(s) (subject) and administrative staff IT user(s) (community). Rather, the IT practitioner appears to have acted in a precautionary manner. This, indeed, extends to much -if not all- of what was pursued simultaneously to the work of the network IT specialists.

Thankfully, the administrative staff gave up the room and its network connectivity. Together with the improvised IB, the IT practitioner’s comments expose other heterogeneous and interacting means (Facet A, Figure 7) undertaken in the overarching congruence effort. By providing the administrative staff IT user(s) with laptops etc., the IT practitioners brought about change(s) to/of

the tool(s)/resource(s) (Section 7.2.5, Chapter 7) employed by the administration activity. This reciprocation transcends findings from the study of “social bricolage” in “social entrepreneurship” (Domenico et al., 2010).

Interestingly, the tool(s)/resource(s) supplied are felt to have been somewhat second-rate to those usually used. As such and from the perspective of the administration activity, the administrative staff IT user(s) are interpreted to have been making do with what was made available to them, i.e. to have engaged in bricolage. They were, nevertheless, able to make do with these inferior tool(s)/resource(s) so as to work around (Section 7.2.7, Chapter 7) their temporarily unavailable room and its network connectivity. The administration activity could continue; on this front, congruence is contended.

Moreover, the IT practitioner divulges:

“what we had to do was, we got, I got a couple of extra people on board, and we had to physically move the PCs to another floor, er into another room, and just plug them in [inaudible – accent: there?], so we could push the updates out”

Campus IT Support Team Leader, Interviewee 10, University C

Whilst the identity of the “extra people” is unclear, their spontaneous summoning suggests they were from within the university. Regardless, it is clear they were working together (Section 7.2.4, Chapter 7). The labour-contributing community took around 60 computers to the “admin office”, which was on a higher floor. There, they utilised its network connectivity. In the IT provision activity, this reflected change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) being used. But given its awkward whereabouts, IT practitioners are themselves read to have been making do i.e. engaging in bricolage.

Akin to the scenario faced by the administrative staff IT user(s) however, IT practitioners making do with it could work around (Section 7.2.7, Chapter 7) the non-functioning switch used ordinarily. They updated the software on the PCs: change(s) to/of these tool(s)/resource(s) (Section 7.2.5, Chapter 7). On their part, the network IT specialists “fixed” the switch “quicker” than anticipated, but by then the focal group had “put the PCs back in place, and it was all working fine”. The Open Day went ahead, signalling that the object of IT provision activity (Section 6.2.3.2, Chapter 6) had been achieved, i.e. congruence.

The events that led up to the Open Day passed in a relatively short timeframe. Correspondingly, many if not all of the heterogeneous means (Facet A, Figure 7) that allowed it to take place were

rendered redundant i.e. they were no longer relevant and/or necessary. This chimes with a claim made in the preceding meeting requests incident (Section 8.2.4.2). In particular, that the laborious, IT-afforded solution for accessing attachments -and the heterogeneous means explaining it- would only remain relevant and/or necessary until e.g. Microsoft issued a subsequent patch.

8.2.4.4 Compromised account process (III)

Although not identified previously, additional evidence of improvisation, bricolage and other heterogeneous means (Facet A, Figure 7) is seen in the ““compromised account” process” introduced when discussing change(s) to/of tool(s) and/or resource(s) as means towards congruence (Section 7.2.5.4.4, Chapter 7). IT practitioner(s) temporarily “disable” any IT user account thought to be “compromised”. For the IT user, any activity necessitating it is temporarily prevented. Learning more, the IT user can grow dissatisfied: from the perspective of IT provision activity, a secondary contradiction between the community (IT user) - subject(s) (IT practitioner(s)).

Although disabling an IT user’s account could be considered counterintuitive, the change(s) to/of tool(s) and/or resource(s) -which manifest as backtracking on/disabling of functionality- in fact ensures the greater university IT user community can continue to utilise IT safely in their own respective activities. It was further recognised to represent rule(s) and/or norm(s) IT practitioner(s) adhere to as means towards congruence (7.2.6.4.4, Chapter 7). Beyond earlier observations, the Senior IT Support Advisor recounts a memorable critical incident that lends theoretical insight pertinent at present.

A student IT user’s account had been compromised -and with that, disabled. A “colleague” of the interviewee -another IT practitioner- had been dealing with him/her on the telephone and the student IT user “started getting a bit upset”. The IT practitioner was unsure of how best to proceed, so engaged in means of IB with the interviewee to comprehend and/or explain issue(s) and/or requirement(s) (Section 7.2.3, Chapter 7). The initial IT practitioner expressed something to the effect of “Er I’m not sure what to do with this situation”.

Understanding can be gained from the bricolage literature (Chapter 3). In work on entrepreneurship (Section 3.3, Chapter 3), Baker et al. (2003: 265) referred to “dependence on pre-existing contact networks as the means at hand” as “network bricolage” [italics omitted]. It could notably go beyond “physical and financial resources[,] to include business practices and

help with solving various problems” (Baker et al., 2003: 267). ‘Picking the brain’ of the interviewee -an acquaintance presumably- the initial IT practitioner is interpreted to have engaged in network bricolage. It is not clear whether s/he intended to pass responsibility to the Senior IT Support Advisor outright.

The Senior IT Support Advisor recognises similarity with an earlier episode, presented for portraying means of working together (Section 7.2.4.4.1, Chapter 7). In *that* instance, s/he was the one unable to assist, and “escalated” the issue(s). The interviewee notes likeness to the conduct of his/her then supervisor. With respect to the present incident, the initial IT practitioner is in some sense also read to have escalated i.e. adhered to/with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7). The Senior IT Support Advisor seems to have taken the helm; in that each contributed to the overarching congruence effort, it was again collaborative: they worked together (Section 7.2.4, Chapter 7).

The Senior IT Support Advisor explains:

“I was giving her the same information, but I’d taken her to one side, I’d let her calm down. I’d spoken with her, just to actually let her know that I understand her frustration. And then, sort of explained the actual impact that she’s having, not just on her account, but on other people’s on the university.”

Senior IT Support Advisor, Interviewee 6, University A

The Senior IT Support Advisor engaged in means of IB (Section 7.2.3, Chapter 7), even relaying “the same information” to the student IT user. Yet, s/he recalls having firstly “taken her to one side”, and is seen to place palpable emphasis on care and empathy. This aspect of the latter IT practitioner’s approach is judged to have transcended the mere matter of fact, safe and continued provision of IT products and services for IT users, that characterises the object of IT provision activity (Section 6.2.3.2, Chapter 6).

The conduct may be appreciated in respect of improvisation (Chapter 4), qualifying perhaps as a “situated performance where thinking and action emerge simultaneously and on the spur of the moment” (Ciborra, 1999). Yet as acknowledged, the interviewee him/herself senses similarity with the earlier conduct of a then supervisor. This suggested resemblance may imply that the Senior IT Support Advisor’s caring and empathic approach is more appropriately understood as imitation. Valuable clarity comes from another critical incident.

8.2.4.5 Laptop spillage

The same Senior IT Support Advisor recounts an episode in which a student IT user had accidentally spilt on a laptop containing the only saved copy of their work. From the perspective of the student IT user activity, this can be considered a secondary contradiction between the tool(s)/resource(s) and their object of completing the academic work. Their continued activity was inhibited and/or prevented. The student IT user physically brought the laptop in to IT; by means of IB s/he alerted them (Section 7.2.3, Chapter 7), asking “can you get it off, can you get it off?”.

Unfortunately, however, the interviewee explains the water must be allowed to “dry out for several days”. Additionally and due to the “kind of laptop”, they could not remove its hard disk. The IT practitioners engaged in IB, explaining the issue(s) and/or requirement(s) (Section 7.2.3, Chapter 7): “we said we couldn’t get it off there”. This startled an emotional response comparable to that in the compromised account process incident (Section 8.2.4.4). In the IT provision activity, a secondary contradiction conditioned the community (IT user) - subject(s) (IT practitioner(s)) relation.

The Senior IT Support Advisor elaborates on his/her approach:

“I always sort of do the thing of taking her into another room. Letting her cal, don’t talk about the laptop at that point, just let her calm down, actually speak with her, just show her that you, that you’ve been there and you understand.”

Senior IT Support Advisor, Interviewee 6, University A

The interviewee uses remarkably similar language when recalling the compromised account process episode (Section 8.2.4.4) and laptop spillage incident. In the outgoing comments uniquely, however, the IT practitioner identifies the caring and empathic approach as something s/he “always” exercises. From the perspective of the Senior IT Support Advisor then, it is normalised -even routinised. On this basis, it seems to exemplify adherence to rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) rather than improvisation.

The student IT user was in possession of a USB (Universal Serial Bus) drive, which at least *had* held an “older copy” of the university work. Problematically, she had recently “formatted” it, i.e. deleted all of its data. Thankfully, the IT practitioners were able to perform a “data recovery”, apparently using specialist software. Pursuing this procedure itself reflected adherence to rule(s)

and/or norm(s) (Section 7.2.6, Chapter 7). As a result, they successfully located the slightly dated version of the work concerned.

The IT practitioner elucidates:

“The file on the memory stick, she’d actually deleted it off the memory stick the day before, so we did a data recovery on the memory stick, to then find the file. And it was a day out of date. But then at least she didn’t have to start again. And at least she still had half of it and she, she did have the other parts on that USB that she’d sort of copied in and edited. So, we’d managed to save part of it, but not all of it. Er but she, she left happier than she came in.”

Senior IT Support Advisor, Interviewee 6, University A

This can be understood in respect of bricolage (Chapter 3). Foremost and because only an older version was obtainable, the student IT user had little option but to make do. Further, the reference to “other parts” of work indicates (re-) combination of some sort. Albeit less than ideal, she could continue working towards her object of completing the work. From the perspective of her activity, congruence is contended. Inasmuch as the IT practitioners enabled this, congruence is also argued for the IT provision activity.

In light of the care and empathy evident in this and the compromised account process incident (Section 8.2.4.4), the student researcher was intrigued. There was a perceived affinity to the instance in the UK ambulance study (Allen et al., 2013) in which paramedics were read to have improvised -at least initially (Section 2.4, Chapter 2). Fortunately and as foregrounded (Section 5.11.3, Chapter 5), semi-structured interview questioning can go beyond the “guide”, where the interviewer “picks up” on what the interviewee says (Bryman and Bell, 2011: 467).

The student researcher asked whether anyone else does it:

“Yeah, I’ve seen [interviewee 2]. [Interviewee 2] does it quite a lot. [Person X] is. You have different ways people react to things. So [person X] and [person Y] are very good for people. We call [laughs], it sounds really [inaudible: horrible?] we call them Cryers”

“Do you know the people where they get so built up and frustrated, and the start crying.”

Senior IT Support Advisor, Interviewee 6, University A

From this response, it appears the caring and empathic approach is not only normalised and/or routinised by the interviewee, but instead that it is exercised by others in the university IT

community. This in mind, its status as improvisation again comes into question. Yet to underline, the object of IT provision activity is the safe and continued provision of IT products and services (Section 6.2.3.2, Chapter 6). A shoulder to cry on and/or an explicit, downward instruction to offer one, feels more fitting elsewhere.

Plainly, no single brief/directive could dictate all of the “different ways people [(IT practitioners)] react to things”. Whilst normalised and/or routinised by some university IT practitioners at present, it is possible and plausible that the handling of emotional IT users was once improvised. In addition, the disparaging designation “Cryers” is neither likely to have originated from above, e.g. from IT management, nor to receive any ongoing formal endorsement. It may once have also been improvised in practice.

8.2.4.6 Server resets

Complimentary evidence is found at another UK university. An Applications Analyst Team Leader tells of a technical issue exterior to his/her remit. Specifically, “performance issues” relating to “SIS” (Student Information System); “memory leaks on the servers” were referred to as “Zombies”. Whilst the interviewee does not identify or characterise it explicitly, it is reasonable to assume the tool-related “issues” inhibited the IT provision activity (Figure 5, Section 6.2, Chapter 6). It is considered a critical incident.

The IT practitioner divulges:

“on a daily basis we were getting a hundred Zombies on the system, and that was causing performance issues. And we had to live with that for a couple of years”

Applications Analyst Team Leader, Interviewee 9, University C

S/he elaborates:

“So suddenly, the system starts to deteriorate, on the basis that it’s running out of memory. So, for a good period, perhaps a year or even two years, what was happening is the DBA was rebooting the server overnight, and then slowly watching the Zombies increase, throughout the course of the day. Er we had to tolerate that for quite some time, until we moved from Solaris, as a server, er over to Red Hat. And overnight, once we’d done that migration, gone. Never had the issue again.”

Applications Analyst Team Leader, Interviewee 9, University C

A number of points can be made. The “we” to whom the interviewee refers is taken to denote the university IT practitioner community as a minimum. They had to just accept the tool-related “issues” for an extended timeframe. In light of bricolage (Chapter 3), they necessarily made do. One IT practitioner, the DBA (Database Administrator), rebooted “the server overnight”. Albeit modest, this adjustment to its operation constituted change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7).

Sensibly, however, rebooting it should not have been necessary. Prompted by what was “suddenly” faced, the very first instance is reasoned to have taken place “without a prior stipulation”, and to have attempted to address what was apparently “unexpected” (Weick, 1998: 544) (Chapter 4). The DBA's conduct is thus also interpreted to have been improvisational. But it can also be read that this solution was far from perfect. A single reboot seems to have had limited temporal effect: the “Zombies” would reoccur gradually the next day.

Seemingly as a consequence, the DBA did it nightly. Assuming this was not the case before the “issues” appeared, his/her working practice palpably changed. Extant work on improvisation is relevant (Section 4.7, Chapter 4). Orlikowski's (1996: 65) “Situated Change Perspective” viewed “organizational transformation” as “an ongoing improvisation”. Additionally, McGann and Lyytinen's (2008: 6) “dynamic model of Information Systems Evolution” portrayed “how minor user improvisations can grow into path-breaking organizational changes”.

Although the change(s) to/of the tool(s)/resource(s) was/were improvised initially, over time the sever reboot was repeated and became routine/normalised. From the perspective of this IT practitioner, the conduct did not remain improvisational but rather came to represent rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) with which s/he adheres in IT provision activity; this shift implies changes to/of its rule(s) and/or norm(s) (Section 7.2.6, Chapter 7). In addition, the DBA is acknowledged to have been making do continually in performing the repetitive server reboot practice for an extensive period.

Nevertheless and with similarity to critical incidents presented already (e.g. meeting requests, Section 8.2.4.2; Open Day, Section 8.2.4.3), making do contributed to enabling a deeper, persistent tool-related issue or issues to be worked around (Section 7.2.7, Chapter 7). In that the server rebooting shed its improvised identity however, the empirical evidence departs McGann and Lyytinen's (2008: 4) dubious taxonomy locating workarounds as but a “type of improvisation”. The altering assortment of heterogeneous and interacting means credited to the

DBA contributed to allowing the IT provision activity to continue in some capacity i.e. towards congruence.

IT eventually acquired “Red Hat”, further change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7). Apparently owing to this, the “issue” vanished. As such and whilst the DBA assumed the highlighted means for much longer than those undertaken by IT practitioner(s) in the lead-up to an Open Day (Section 8.2.4.3), they are again interpreted to have been rendered redundant. The once-improvised conduct therefore did not produce altogether “permanent changes in organizational routines” (McGann and Lyytinen, 2008: 2).

8.2.4.7 Lack of a testing environment

Further empirical evidence shows similar, as well as offering additional theoretical insight. Providing background, an IT Support Officer acknowledges that there is a considerable number of PCs and an extensive assortment of software available for IT users. Fortunately, the IT community has sophisticated and versatile tool(s) at its disposal, allowing IT practitioner(s) to safely prepare and test software before efficiently distributing it to choice computers. But they have not always been able to benefit from such tool(s).

Referring to how things were in the past, s/he discloses:

“when I’m, er[m] packaging a piece of software, in order to test it, because I didn’t have [stutters: a a a] testing environment, I would have to go an[inaudible: d] cordon off some machines... and deploy it to those [inaudible: machines]”

“So I’m deploying [inaudible: it] into the live environment, which [inaudible: isn’], not a very good thing to do.”

“So for ages I’ve been wantin[inaudible: g] [says name of previous manager, anonymised], which was my old boss to allow me to buy... a big box, [stutters, inaudible: an an; and and] [stutters, inaudible: build] er and build a Hy [stutters], it’s called Hyper V. I build a Hyper V system on it, an[inaudible: d] build a testin[inaudible: g], er a testin[inaudible: g] environment, but he wouldn’t, he wouldn’t let me. So I just [inaudible: had/have] to put up with with er[m] with testin[inaudible: g] in the live environment”

IT Support Officer, Interviewee 4, University A

Various theoretical insights can be interpreted from the interviewee’s remarks; they can be understood in respect of a number of heterogeneous and interacting means towards congruence (Facet A, Figure 7). Foremost, by reference to bricolage (Chapter 3). In the absence of the ideal,

sophisticated and versatile tool(s), the IT Support Officer was apparently making do with what are read to have been just ordinary/standard PCs that *were*, in contrast, available.

Grasp is also gained by reference to improvisation (Chapter 4). Pertinently, Miner et al. (2001: 310) noted that in New Product Development (NPD), “teams... created new physical structures without prior design”. These were termed “artifactual productions” (Miner et al., 2001: 310) (Section 4.6, Chapter 4). In segregating “some machines”, the IT practitioner removed them from ordinary use; those partitioned formed an ad hoc arrangement. As such and in the disparate domain of IT provision in UK academia, this perhaps qualifies as an equally improvised instance of the same.

For transparency, the IT Support Officer identifies it as a workaround, and as showing “not the best solution”. These claims are reasonable. By making do and improvising with the ordinary/standard computers, s/he was able to workaround (Section 7.2.7, Chapter 7) the absence of ideal tool(s). Albeit in a limited way, the IT practitioner was apparently able to e.g. test software -and work towards the object of IT provision activity: the safe and continued provision of IT products and services (Section 6.2.3.2, Chapter 6).

The empirical evidence echoes aspect(s) of other critical incidents already presented. Introduced when discussing IB as means towards congruence (Section 7.2.3.4.2, Chapter 7) and referred to again above (Section 8.2.4.1), student IT users were unable to access results and so an Applications Analyst Team Leader would improvise by resetting their password; a student IT user could therefore work around the persistent tool(s)/resource(s)-related issue(s) and access them irrespective. Similarly, when IT users had issue(s) accessing attachments in “meeting requests” (Section 8.2.4.2), a Service Desk Manager improvised and came across a workaround. IT users could work around enduring tool(s)/resource(s)-related issue(s) and access attachments.

In the incidents appraised previously, the prominent beneficiaries of the heterogeneous and interacting means were IT users. At present and although the wider IT user community may have benefitted ultimately and/or eventually, it is clear the principal beneficiary was the IT Support Officer interviewed. It is intriguing then, that this IT practitioner also drew on PCs used ordinarily by other staff members. This is evident in relation to a particular “GPO” (Group Policy Object), which would adjust the wallpaper on select PCs.

S/he expounds:

"I created the GPO, but in order to test it, I [stuttering, inaudible: ha; had] I was having to go to certain members of staff who... I know are... friendly and accommodating, and say "do you mind [inaudible: if] I... use your machine as a guinea pig?" and deploy that GPO to their machine, which could, potentially, when you're messin[inaudible: g] around with GPOs you can break, you can break a machine"

IT Support Officer, Interviewee 4, University A

Similarity is immediately sensed with the events that led up to an Open Day (Section 8.2.4.3). As a reminder, a Campus IT Support Team Leader borrowed a room and its containing network connectivity from administrative staff. Understanding came from work by Domenico et al. (2010: 681) on "social bricolage" in "social entrepreneurship" (Section 3.3, Chapter 3). The same study -specifically the finding that the resource(s) needed can possibly reside with and belong to others- is also applicable at present.

Additionally, the conduct of the IT Support Officer can be appreciated in light of "network bricolage" (Baker et al., 2003: 265), an idea foregrounded by research on entrepreneurship (Section 3.3, Chapter 3). In that s/he appears to have held a pre-formed impression of which staff members were "friendly and accommodating", it can be taken that from this IT practitioner's perspective they were existing acquaintances. On this basis, it is felt to qualify as network bricolage.

Insofar as the IT Support Officer was taking these ordinary/standard PCs out of ordinary use and instead utilising them for testing, it is also interpreted as improvisation. Regardless of the origin of the PCs, it is clear s/he was making do with tool(s)/resource(s) inferior to the ideal tool(s) available now. The IT practitioner also repeatedly alludes to the risk(s) involved in using the ordinary/standard computers in this manner. Curiously, it is unclear whether any of the contributing IT user(s)/staff member(s) were even aware of as much. Means of IB (Section 7.2.3, Chapter 7) would have assisted.

Links between bricolage and risk can be seen in the bricolage literature (Chapter 3). Their perhaps most intuitive relation is discernible from Weick's (1993) reinterpretation of the Mann Gulch fire incident (originally Maclean, 1992) (Section 3.5, Chapter 3). Glancing back afresh, the forest fire clearly presented a risk to life. Apparently prompted by this, the foreman/leader -labelled a bricoleur by Weick (1993: 629)- lit an "escape fire". It can be read that the imminent risk catalysed *that* bricoleur into action.

Other literary insight (Section 3.3, Chapter 3) is perceptibly more attuned with present evidence. In Baker and Nelson's (2005: 346) study, an entrepreneur's bricolage is charged squarely with "creating the risk of heavy fines" for a customer. Startlingly, the interviewed IT practitioner's conduct -exhibiting trace(s) of bricolage- likewise accompanied and/or even introduced risk(s). This is interpreted as a challenge to and/or associated with the congruence effort. Consistent with Figure 7, the challenge (Facet C) of unrealised, potential risk(s) is explored later (Section 9.3.8, Chapter 9).

From the IT Support Officer's comments, it can further be interpreted that the use of ordinary/standard PCs became routine/normalised. This resonates with the server resets incident (Section 8.2.4.6), in which a DBA rebooted a server on a nightly basis for an extended period. Like the server rebooting, this IT practitioner's use of ordinary/standard PCs is judged to have lost its earlier improvisational status; again, it instead came to reflect rule(s) and/or norm(s) s/he adhered to (Section 7.2.6, Chapter 7).

Also like the server rebooting and whilst the use of ordinary/standard computers omitted its improvisational identity, the IT Support Officer is considered to have made do continually. Making do contributed to allowing the enduring, tool-related issue(s) to be worked around (Section 7.2.7, Chapter 7) -and in a limited, restricted way, to achieving the object of IT provision activity (Section 6.2.3.2, Chapter 6) regardless. This reinforces that the role(s) of improvisation and bricolage, as heterogeneous and interacting means in overarching congruence efforts, do not necessarily co-extend.

Also echoing the server resets incident (Section 8.2.4.6), IT eventually obtained the ideal tool(s): change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7). It is reasoned that the emphasised, changing assortment of heterogeneous and interacting means attributed to the IT Support Officer were therefore similarly rendered redundant. Contemporary use of the sophisticated and versatile tool(s) allows achievement of the object of IT provision activity (Section 6.2.3.2, Chapter 6) more efficiently than before.

8.2.4.8 Poor ticketing system

Elsewhere, grievances seem to stem from a new tool. In particular, an IT Support Officer points to those associated with a newly introduced "ticketing system". When previously discussing conduct relative to rule(s) and/or norm(s) as means towards congruence (Section 7.2.6, Chapter 7), IT practitioners were acknowledged to adhere to some practices so frequently they can be

regarded norms. Examples included the use of ticketing and/or similar and/or related system(s); it was further perceived as perhaps an implicit rule.

Unfortunately in this account, the IT practitioner laments:

“We use a ticketing system which was recently replaced. The one we had previously worked fine. It was a bit old, but now they’ve replaced it with one that is unreliable and it crashes a lot; it’s very slow. And we just have to tolerate that. This ticketing system is what we use to log everything that we do.”

IT Support Officer, Interviewee 12, University B

Although the preceding tool was “a bit old”, it also “worked fine”. Still, a new such system was put in, representing change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7). It is reasonable to assume its introduction was well-intended, like the Microsoft-issued “security patch” in the meeting requests incident (Section 8.2.4.2). The security patch, however, had an unexpected effect: double clicking on attachments in “meeting requests” would not open them. For affected IT users, any object necessitating access to attachments was inhibited and/or altogether prevented.

The new ticketing system similarly introduced issues. From the perspective of the IT provision activity, it can be looked at as a secondary contradiction in that the performance of the tool(s)/resource(s) is at odds with any object requiring its use. For IT practitioners, activity is apparently inhibited and/or altogether prevented. It is a critical incident. The IT Support Officer accepts “we just have to tolerate” its shortcomings. It is interpreted from this that the IT practitioner community simply make do (Chapter 3) with it.

Moreover, the interviewee’s colleagues have raised the matter “many times” with whoever might be able to assist. That is, they have engaged in information behaviour (Section 7.2.3, Chapter 7). Yet unfortunately, “very little has changed”. This detail may be appreciated in respect of contradictions. In the IT provision activity, the community element could harbour a primary contradiction. A secondary contradiction may also reside between the focal IT practitioner(s) (subject(s)) and those in the community approached.

This leaves the focal IT practitioners in an unenviable position. It chimes with critical incidents already presented. In the server resets incident (Section 8.2.4.6) indeed, the DBA made do continually, performing the repetitive server reboot practice for an extensive period; subsequent

change(s) to/of the tool(s)/resource(s) rendered it redundant. Similarly, the lack of a testing environment (Section 8.2.4.7) saw an IT Support Officer make do with inferior tool(s)/resource(s) for an extended timeframe; likewise, change(s) to/of the tool(s)/resource(s) eventually ruled this redundant.

As established, the ticketing system featured in the present incident was only recently introduced. With the prospect of any subsequent change(s) to/of the tool(s)/resource(s) dashed, it is likely the IT practitioners will have to make do with it for the foreseeable future. Although the cited state of affairs is certainly less than ideal, making do is significant: it is judged to contribute to allowing the IT provision activity to continue in at least some capacity. This manifestation of bricolage represents means towards congruence.

8.2.4.9 2-factor authentication

Making do may be necessary for the foreseeable future at another academic institution. This comes to light as an IT Service Manager speaks of their university's locally-developed 2FA (Two Factor Authentication) system. Logged as a critical incident, its initial introduction would have represented change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) of any IT user activity utilising it. It clearly serves the object of IT provision activity: the safe and continued provision of IT products and services (Section 6.2.3.2, Chapter 6).

As it transpires, however, the 2FA system is not absolutely ideal:

“the system was written in-house, it was to accommodate... either you[‘ll] use your mobile phone or you use your token, but many people want both, because they w, they’ll leave the token locked away in a desk drawer a[nd] they’ll... want to use their mobile phone if they’re at home and accessing their email, so, er[m], it [laughs] wasn’t written in that way, it was written to use one or the other...”

“many have [inaudible] sort of said, oh no, I want both, ‘cause I’ve forgot to bring my mobile phone into work, or something like that.”

IT Service Manager, Interviewee 22, University F

The 2FA system was designed to work with either an IT user's phone or a token. But as the IT practitioner discloses, there is an appetite to use both. From the perspective of an IT user's activity, this might be understood as a secondary contradiction between the functionality of the 2FA system (tool(s)/resource(s)) and the preferred manner of usage (rule(s)/norm(s)). One way

or another, IT users appear to have engaged in means of information behaviour, alerting IT practitioner(s) (Section 7.2.3, Chapter 7) to this.

The IT Service Manager explains:

“one of the things that we allow people to do is register a mobile phone to use as their... token, er[m] or they can have a physical hardware token to, to get the, the six digit number from, and [laughs] one o... you c’, you’ve got to register the hardware token before you can register the mobile phone if you want to use both. The system was written so you would use one or the other.”

“Not both [both laugh]. So, [so] that’s become the work, the work round, as[,] oh well if you’ve registered your mobile phone you just have to take that off now and then re-register it, you know, after you’ve done your token”

“you can register a token and then register a mobile phone but you can’t do it the other way around, you can’t register a mobile phone and then register a token. So, [inaudible] so we’ve, we’ve had to work around that, and it’s just a small bug in a, in a software, an in-house software, [inaudible: but it’s] getting round fixing that [laughs]”

IT Service Manager, Interviewee 22, University F

The interviewee summarises the 2FA tool-related issue as a "small bug". IT practitioner(s) and IT user(s) are interpreted to make do with it in general. Fortunately, there is somewhat of a solution. As understood, IT users wishing to utilise both their phone and a token can, but it is vital they “register” the token first; if they have registered the phone already, they must disassociate it and only "re-register it" after the token. Next to IT users getting the sequence correct initially and those with no desire to use both, this subset necessarily executes additional configuration i.e. change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7).

With the word “just”, the interviewee appears to imply this can be done easily. It is, nevertheless, read to be burdensome. Like IT users accessing attachments in the meeting requests incident (Section 8.2.4.2), these IT users are felt to be making do with a laborious method. Notably, the IT practitioner uses the word “work around”. In that the 2FA tool-related issue persists, this is judged to be reasonable. It is clear, however, that reference to other heterogeneous means towards congruence (Facet A, Figure 7) lends a fuller theoretical explanation.

Curiously, the interviewee recognises risk(s) that could accompany an effort to "address" the actual issue outright:

“The problem we’ve got is that if you try and address it, you’ve got the, you could actually potentially, take out the whole of the software for everybody, erm [laughs], [so,] so it’s one of these... it may get done eventually, but it probably won’t get done [laughs], so, er[m]... it’s not on the high priority list, we just think it’s quirky now, and we work [a]round it”

IT Service Manager, Interviewee 22, University F

Rather than make more substantial change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7), the preference is apparently to hold back. Among challenges to and/or associated with congruence efforts, unrealised, potential risk(s) are looked at in Chapter 9. In general, IT practitioner(s) and IT user(s) thus make do with the 2FA tool as it is -for the foreseeable. Whilst the solution is itself imperfect, some IT users make do with the laborious method -which itself involves additional configuration i.e. change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7)- so as to work around (Section 7.2.7, Chapter 7) the 2FA tool-related issue and achieve their object(s) irrespective i.e. attain congruence. This also avoids the unrealised, potential risk(s) as recognised.

8.2.4.10 Retired academic

Together with other heterogenous means towards congruence, complimentary evidence conveys both the making do and (re-) combination manifestations of bricolage. A Senior IT Support Advisor refers to a retired staff member IT user who would often experience email-associated issues at home. On the occasion recalled, in this critical incident, such tool(s)/resource(s)-related issue(s) inhibited and/or prevented his activity. From the same viewpoint, it is seen as a secondary contradiction between the tool(s)/resource(s) and whatever exactly his email-oriented object was.

The retired staff member IT user alerted IT (Section 7.2.3, Chapter 7) by telephone. But unfortunately, and like the lack of a testing environment (Section 8.2.4.7), the IT practitioner admits the IT provision activity at the university (Figure 5, Section 6.2, Chapter 6) was at that time not equipped with “any sort of remote support tools”. As such, s/he necessarily settled with a PC and telephone, each of which were available. Their use in practice is considered conduct adherent with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7).

Yet in this instance, the application and the ostensibly mundane pairing are further felt to exhibit traces of bricolage. Working without the ideal remote support tool(s), the Senior IT Support Advisor was, in effect, making do. (Re-) combination of some sort is also recognisable. The IT practitioner applied the two tools in tandem, in a manner which sought to emulate the

functionality of remote support tool(s). The retired staff member IT user employed equivalent tools at his end.

The Senior IT Support Advisor issued verbal instructions, i.e. engaged in IB (Section 7.2.3, Chapter 7), and the retired staff member executed them. The IT practitioner performed identical step(s) independently. With real remote support tool(s), the IT practitioner would have controlled the IT user's cursor and so the role of the latter would have been comparably passive and/or altogether unnecessary. Clearly then, the PC/telephone combination was functionally inferior. It meant the IT user had to assume labour; towards congruence, they worked together (Section 7.2.4, Chapter 7).

The Senior IT Support Advisor offers an impression of the interaction:

"I sort of started tryna describe to him over the phone, how to access things, so I'm like "open Internet Explorer" –"what is that?""

"er "do you have Google Chrome?" –"I don't know what that is". So at first it was sort of going "do you have the blue E?", "do you have the circle with different colours?"

Senior IT Support Advisor, Interviewee 6, University A

The pair engaged in IB, but when the IT practitioner referred to the Internet Explorer (IE) and Google Chrome web browsers, the IT user did not know what either was. This demonstrated a deficit in the staff member IT user's IT literacy. Among challenges to and/or associated with congruence efforts (Facet C, Figure 7), comprehension and/or understanding is looked at in Chapter 9. The IT practitioner was perceivably prompted to describe each of the web browsers' icons.

Although this Senior IT Support Advisor spoke of the training undertaken at their belonging university (Section 6.2.3.5, Chapter 6), his/her descriptions of a "blue E" and "the circle with different colours" appear unrefined; they lack the formality typical of a training syllabus. Rather, the IT practitioner is interpreted to have improvised. It resembles the instance in the UK ambulance study, wherein paramedics offered an improvised explanation to the community (Allen et al., 2013) (Section 2.4, Chapter 2).

The staff member IT user did apparently manage to access a web browser:

“And then he’d open it up, and then I was like right if you type the address in, and I’ll give him the address, [university email URL anonymised] and he types it in, and I’m expecting it to load the page but in fact it brings him to the Google search page, so I then go into the Google search page, and at this point I’m sort of thinking, it, we’re struggling a bit here, just to be able to do the standard action”

Senior IT Support Advisor, Interviewee 6, University A

The Senior IT Support Advisor had an evident expectation of how the software would or *should* perform, but it behaved differently. Between the lines, s/he did not seem to appreciate why. On the part of the IT practitioner this time, this reflects a challenge of comprehension and/or understanding (Facet C, Figure 7). The situation certainly supplied “the unforeseen” and “the unexpected”, both of which are linked to improvisation (Weick, 1998: 544) (Chapter 4).

The determined IT practitioner then went online, with the specific purpose of looking for “free remote support tools”. S/he isolated one suitable program in particular, but exercised due diligence by carefully considering the legalities associated with its use in the circumstances. It was a “free trial” and could only be used once. It was also necessary for the IT practitioner to direct the staff member IT user to a specific web address. Eventually, however, it was successfully up and running.

Inasmuch as this remote support tool/software was not officially commissioned, “some degree of innovation” is discerned in the IT practitioner’s efforts; “all improvisation” indeed, “involves” as much “because improvisation involves the creation of action outside current plans and routines” (Moorman and Miner, 1998a: 4) (Chapter 4). The “Improvisation Dynamics Model” is also relevant (McGann and Lyytinen, 2010: 1) (Section 4.7, Chapter 4). Interested in “user improvisation”, McGann and Lyytinen (2010: 3) foregrounded “improvisation triggers” including “missed”, “evolving” or “unmet requirements”. These pertain to “existing IT functionality or process design” (McGann and Lyytinen, 2010: 3). By contrast, an outright absence of remote support tool(s) influenced the Senior IT Support Advisor to improvise.

It is unclear whether it was necessary to install anything on the staff member’s PC. For the IT practitioner installing the remote support tool/software on theirs, however, it brought change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7). The staff member and IT practitioner were forced to make do with its single-use limitation. This acknowledged, making do contributed to enabling them to work around (Section 7.2.7, Chapter 7) the tool(s)/resource(s)-related issue(s). That is, the absence of real remote support tool(s) and the functionally inferior PC/telephone combination.

Up and running as suggested, the Senior IT Support Advisor realised to his/her “horror” that the staff member IT user was using Windows XP, a relatively old operating system (OS), and that his web browser was also outdated. This only allowed access to a functionally-restricted “lite” version of Microsoft Office 365. Whilst the IT practitioner expresses dismay, s/he had in actuality attained an improved comprehension and/or understanding of the tool(s)/resource(s)-related issue(s) the staff member initially alerted IT to.

With this, the Senior IT Support Advisor became better placed to assist. By IB (Section 7.2.3, Chapter 7), s/he explained to the staff member that it would be necessary for him to purchase new tool(s)/resource(s). It also appears to have influenced the IT practitioner to consult an alternative web browser him/herself; s/he learned that if the IT user were to install Google Chrome on his PC, it would enable him access to the “full version” of Office 365. That is, change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) of his activity would mean he could use it to work around (Section 7.2.7, Chapter 7) the enduring tool(s)/resource(s)-related issue(s) with the web browser used beforehand.

The Senior IT Support Advisor remembers:

“I think at this point as well, everyone was on the phone, so there wasn’t really anyone to ask. So, with that we did manage to get him into his email”

Senior IT Support Advisor, Interviewee 6, University A

In that “there wasn’t really anyone to ask”, the “we” is taken to denote just the IT practitioner and staff member IT user. The Senior IT Support Advisor’s conduct echoes that of the Service Desk Manager in the meeting requests incident (Section 8.2.4.2). There, the Service Desk Manager’s “little look” uncovered a solution: a method via which IT users could work around enduring tool(s)/resource(s)-related issue(s) and access attachments irrespective. Like the Service Desk Manager, the Senior IT Support Advisor’s conduct may also have been improvisational.

The staff member IT user could continue to access email without restriction, i.e. achieve his email-oriented object. From the perspective of his activity then, congruence can be contended. From the perspective of the IT provision activity, congruence is also claimed inasmuch as it was achieving its object: the safe and continued provision of IT products and services (Section 6.2.3.2,

Chapter 6). Beyond the occasion specifically recited, the Senior IT Support Advisor gives a flavour of what followed.

The retired staff member subsequently alerted IT (Section 7.2.3, Chapter 7) by telephone multiple times, although it is unclear exactly what these calls concerned. Curiously, he would request that they again use the remote support tool/software. But given its single-use limitation had been exhausted, this would not have been possible. Whilst the interviewee does not divulge the nature of any further assistance, the IT practitioner(s) -and in some sense the IT user- would have somehow had to make do without the "free trial".

The Senior IT Support Advisor also clarifies that the IT user's original web browser (Internet Explorer) could not be updated until the OS (Windows XP) was. He is thought to have upgraded to Windows 7, making change(s) to/of his activity's tool(s)/resource(s) (Section 7.2.5, Chapter 7). This apparently entailed "a whole other host of problems, so then setting everything up... and getting him used to it". Like with the lack of a testing environment (Section 8.2.4.7), IT ultimately obtained the ideal remote support tool(s). The change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) of the IT activity eliminated the need to make do without, and augmented its ability to achieve the object.

8.2.4.11 Data centre outage

Developing the discussion, bricolage and improvisation are shown to be significant in markedly more severe and widespread disruption. As argued however (Section 8.2.3), alertness to these two means alone lends only a limited appreciation. Empirical evidence again indicates bricolage and/or improvisation are drawn on together with other heterogeneous and interacting means (Facet A, Figure 7) in greater congruence efforts. Sensitivity to these allows an elevated theoretical understanding.

A Head of Digital Architecture speaks of a setback in recent years:

"Going back a couple of years in July 20XX we had a major data centre outage which meant we had no IT for about 40 hours."

Head of Digital Architecture, Interviewee 13, University B

Conveying context, the interviewee recalls how the trouble unfolded on a Sunday evening as a sporting event was underway in the city. Although his/her then job title is unclear, this IT

practitioner was conclusively “in charge at the time”. S/he initially “called round and got a load of people in at 6am on the Monday”. This was IB, in which IT practitioner(s) comprehend and/or explain issue(s) and/or requirement(s) with other IT practitioner(s) (Section 7.2.3, Chapter 7). Its perceptible promptness and unsociable timing also give reason to think it was improvisational (Chapter 4).

He expands on the impact and those affected:

“the whole thing was just a wreck so we had loads of wrecked equipment, stuff that didn’t come up and stuff that didn’t work stuff where bits of it were blown”

“staff email worked that was about it.”

“It was everyone. So it was absolutely everyone, so all the student facing systems were down, all the staff facing systems bar email were down, all of the external, things like the university website which tells people where to visit and how to do things were down. The phones worked.”

Head of Digital Architecture, Interviewee 13, University B

From the perspective of the IT provision activity (Figure 5, Section 6.2, Chapter 6), the outage can be looked at in light of contradictions. Ill or non-functioning data centre-associated tool(s)/resource(s) harboured a primary contradiction. In terms of secondary contradictions, the tool(s)/resource(s) acted out of the ordinary i.e. opposing the rule(s)/norm(s); they were also at odds the object: the safe and continued provision of IT products and services (Section 6.2.3.2, Chapter 6). In this critical incident, the object of the IT provision activity was inhibited and/or altogether prevented.

Similar points can be made in relation to the scores of IT users affected in the greater university community. From the standpoint of *their* activities, any IT tool(s)/resource(s) that relied on the data centre in order to function would struggle or fail to accommodate -or, contradict- ordinary way(s) of working i.e. the rule(s)/norm(s); this/these IT tool(s)/resource(s) would also have been out of kilter with -i.e. contradictory to- any object requiring its/their use. This critical incident also inhibited and/or prevented their respective continued activities.

The Head of Digital Architecture notes “a lot of kit [was] trashed”. With the limited selection of functional components remaining, it is read to have been necessary to make do. Whilst the exact identity of the gathered personnel is unclear, the congruence effort was discernibly collaborative i.e. it involved working together (Section 7.2.4, Chapter 7). The interviewee mentions a “network

team”, a “server team” and “infrastructure teams”. Of these, the contribution of those comprising the infrastructure teams is pertinent.

Particularly, their use of “hot swap” functionality:

“some of it was resolved by the guys who worked in the infrastructure teams dragging out and rebuilding and cannibalising some broken equipment so we had three broken switches which we cannibalised into one.”

“It’s all what we call hot swap... equipment, hot equipment, hot swap.”

“you can pull out a part from a switch, from a running switch and the switch keeps running so you can poke things around, they are called hot swap.”

Head of Digital Architecture, Interviewee 13, University B

“Hot swap” functionality was obviously integrated into certain hardware beforehand, at the point of design. It thus concretises the CHAT assumption, that “tools and artefacts are... the outcome of previous work” (Nicolini, 2013: 104-105). It also exemplifies Jarzabkowski and Pinch’s (2013: 583) observation, made in respect of Actor Network Theory (ANT), that “materials are inscribed with particular purposes by designers and these purposes prescribe the possibilities of the materials”. Hot swap apparently anticipates a future desire and/or requirement to separate and amalgamate.

When the IT provision activity earlier acquired this/these tool(s)/resource(s), it also obtained the ability to execute its hot swap functionality. Its use in this instance then, is not judged to have been improvised; instead, it simply amounted to adherence with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) tied to the tool(s)/resource(s). Simultaneously, it reflected (re-) combination of some sort: a manifestation of bricolage. Except that notably, the components were put to use afresh in configurations of the same and/or a similar kind. Fortunately, this appears to have had the intended effect.

Another interesting aspect of the congruence effort pertains to storage:

“We had a major bit of (a) problem with a lot of the storage because all the storage in universities tends to be in single component arrays, so our storage array packed up completely and we couldn’t do anything with it”

“So all the storage sits in big boxes and you can use one or the other, you can use the live one or you can use the back up one and they should manage data between them to make sure it’s all up to date. Our plan was that when the first

one went down because the other data centre hadn't been affected was we just fail everything over to use the backup array."

"So the fail over process for storage wouldn't work which meant that all that happened was the live one would keep saying no I'm the live one, I'm the live one and we couldn't get the back up one to say, I am the live one."

Head of Digital Architecture, Interviewee 13, University B

As with the hot swap tool(s)/resource(s), the "storage array" was already in place in the activity of IT provision. If understood correctly, then at this earlier time the IT provision activity also attained the ability to perform a/the "fail over process". Clearly if the "fail over process" is typically performed in contingencies such as in the data centre outage, then this attempt adhered with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) connected to this/these tool(s)/resource(s). Indeed, the interviewee portrays it as the "plan". Unfortunately, however, it "wouldn't work".

In terms of contradictions in the IT provision activity, a primary contradiction inhabited the tool(s)/resource(s) ("storage array"). A secondary contradiction resided between the same tool(s)/resource(s) and the rule(s) and/or norm(s) ("plan"). Secondary contradictions are also identifiable between the IT practitioners (subject(s)) -and both the tool(s)/resource(s) they were unable to use, and the rule(s)/norm(s) with which they were unable to adhere. Both the non-functioning tool(s)/resource(s) and the rule(s) and/or norm(s) (unactionable "plan") moreover, were at odds with the object.

The IT practitioners subsequently worked around (Section 7.2.7, Chapter 7) the tool(s)/resource(s) and rule(s)/norm(s) issues. They sought help from the "manufacturer", Dell. The Head of Digital Architecture advises that like "all our equipment", its "maintenance" is paid for. Rather than improvisation, turning to Dell adhered with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7). It can also be seen as network bricolage. Whilst the congruence effort was already collaborative, IT were now working together with an external party (Section 7.2.5, Chapter 7).

The IT practitioner expands on events over at Dell:

"and they couldn't swap it over either, which caused us some problems and that was the biggest delay was just waiting for them to get to the point where they could say, yes we will fail you over. What actually happened was that one of their engineers figured out that they could manually recover the lost data on the live array and they decided that they would rather do that than try and fail it over to the back up one."

Staff at Dell were themselves unable to "swap it over". Fortunately, "one of their engineers" learned of another way. But like the IT-afforded solution for accessing attachments in the meeting requests incident (Section 8.2.4.2), "manually recovering the data" is read to have been burdensome. Making do with this method, however, apparently allowed them to work around (Section 7.2.7, Chapter 7) the tool(s)/resource(s) and rule(s)/norm(s) issues and arrive at a satisfactory outcome. They communicated this to university IT. In that the IT provision activity was again able to achieve its object, congruence was instilled; presuming the activities of IT users were able to continue, congruence was conferred.

8.2.4.12 Routine power testing

Complimentary findings exhibit especially intriguing interaction between network bricolage and other heterogeneous means towards congruence (Facet A, Figure 7). A Library Systems and Support Manager explains "power testing" is conducted "every five years". Although responsibility is unclear, it can be considered conduct adherent with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7), undertaken in the interest of the object of IT provision activity (Section 6.2.3.2, Chapter 6) -and ultimately, anyone using the library and its facilities. A recent such exercise ended unexpectedly.

A number of displays/screens, which convey information to e.g. library users, "haven't come back on". From the standpoint of the IT provision activity (Figure 5, Section 6.2, Chapter 6), contradictions are interpreted. A primary contradiction exists in the faltering tool(s)/resource(s). Secondary contradictions reside between the tool(s)/resource(s) and the rule(s)/norm(s) they failed to facilitate, and between the tool(s)/resource(s) and object. Whilst less severe and widespread than the data centre outage (Section 8.2.4.11), this critical incident meant the IT provision activity was inhibited and/or prevented.

The interviewee suggests "priority has not been crazy" due to "the time of year" (Summer). Still, the faltering displays/screens potentially affected anyone who *was* using the library and its facilities. From the perspective of any library IT user activity/activities, contradictions can again be discerned. As examples, a primary contradiction in the tool(s)/resource(s), and a secondary contradiction between the tool(s)/resource(s) and any object involving its/their utilisation. For such IT user(s), this critical incident also inhibited/prevented their continued activity/activities.

IT practitioner(s) did not know why the displays/screens were not functioning. Among other challenges to congruence efforts (Facet C, Figure 7), comprehension and/or understanding is looked at in Chapter 9. Interestingly and as the Library Systems and Support Manager further concedes, this was by no means the only challenge they faced. In particularly candid comments below, the interviewee reveals another challenge relating to comprehension and/or understanding:

“Actually it highlighted something so, we weren’t even sure who supported them because they’re kind of, so I have taken on this team and the guys in the team didn’t quite know where the matrix of support was. So is it us? Is it central IT?”

“Is it media services?”

Library Systems and Support Manager, Interviewee 15, University C

Like the “storage array” looked after by Dell in the data centre outage incident (Section 8.2.4.11), the interviewee indicates a specific party is responsible for the upkeep of the displays/screens. Differently, however, the IT practitioner(s) here were apparently unclear as to the exact designation of responsibility. This lack of clarity would clearly inhibit and/or altogether prevent any attempt to seek assistance. Despite this, the Library Systems and Support Manager manages to frame the realisation positively.

In fact, s/he spots opportunity:

“we do have some documentation and one of my kind of team goals is to create almost like a service catalogue. So what we want to do is, we just want to know all of the systems and services that we support, the vendor and who to contact in case of X, Y, Z. So basically come up with a (a?) like quite a few, like, support matrices. They come (under a?) great word [inaudible] RACI or RACI er, so you’ve got er who is responsible, who is accountable, who to consult with if there’s change or who to inform er if there’s an issue.”

Library Systems and Support Manager, Interviewee 15, University C

The Library Systems and Support Manager believes the “library systems team” benefits from such a provision already. By contrast, the “library support team... don’t have it as much”. Their “documentation” is “quite sporadic”; “some” is stored on “shared drives” and “some” exists “in people’s heads”. “One of” the interviewee’s “team goals” is to build and introduce something along the lines of a “service catalogue”. This would add to i.e. bring about change(s) to/of the

tool(s)/resource(s) (Section 7.2.5, Chapter 7) available in the IT provision activity (Figure 5, Section 6.2, Chapter 6).

A delicate point, however, is that neither its making nor use will engender either new and/or revised responsibilities. Instead, the novel tool(s)/resource(s) will merely identify existing arrangements. The change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) thereby aid(s) network bricolage. Moreover, and in that IT practitioner(s) will be *newly* consulting this/these tool(s)/resource(s), both change(s) to/of -and subsequent adherence to/with- the activity's rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) can be reasoned.

With respect to the critical incident under focus, the interviewee says "someone from my team has basically done some digging around. So she has done some calling around IT services, around media services". Owing to this IB (Section 7.2.3, Chapter 7), they have come to learn "day to day support" is their own responsibility, "but [that] there is not much we can do apart from contact the vendor". In keeping with the ambition, s/he has "asked the guys to document" this. At the time of the interview -and as part of the broader congruence effort- they were "in the process of contacting the vendor".

8.2.4.13 A "proactive" approach (II)

The final evidence presented in this chapter reflects work to actually establish and/or develop relations similar or equivalent to the "contact networks" in "network bricolage" (Baker et al., 2003: 265) [italics omitted] (Chapter 3). Although not referred to explicitly, this is perceptible in the "proactive" approach introduced when discussing IB as means (Section 7.2.3.4.5, Chapter 7). To remind, an IT Service Manager suggested that at their university, IT are likely "pre-empted" about a "problem" or "issue"; they "would be really proactive", attempting to "inform the users" beforehand.

The interviewee mentioned the "building" of "relationships" and gathering of "information". The ability of IT to broadcast pertinent information to IT users "before something occurs", was read to be elevated or enabled by liaising with "estates departments"; therein, IT practitioner(s) firstly comprehend and/or explain issue(s) and/or requirement(s). Two different forms of IB were therefore discerned. Yet, theoretical understanding is raised by reference to "network bricolage": "dependence on pre-existing contact networks as the means at hand" (Baker et al., 2003: 265) [italics omitted] (Chapter 3).

The IT practitioner(s) establish and/or develop relations like or equal to a network; drawing on it, they undertake network bricolage. This *facilitates* the IB in which IT practitioner(s) initially comprehend and/or explain issue(s) and/or requirement(s). Noted earlier, pertinent information is then broadcast to IT users, whom may therefore be able to pursue other heterogeneous means that permit their activities to continue. Whilst network bricolage is significant then, it again features among multiple, heterogeneous and interacting means (Facet A, Figure 7) in a larger congruence effort.

8.2.5 Succinct summary: Bricolage and improvisation, final two means towards congruence

Answering RQ 2 (Section 5.2, Chapter 5), this section recognised bricolage and improvisation as means towards congruence. As such, it also added to the response to RQ 1 and completed Facet A (Figure 7). In contrast to the first five (Chapter 7), both concepts/phenomena were formally and extensively assessed in advance. Section 8.2.2 recounted the constituent content of the literature review, as pertains to bricolage (Chapter 3) and improvisation (Chapter 4). Section 8.2.3 then expanded on the manifestation of the pair as means towards congruence.

Employing empirical evidence, Section 8.2.4 then illustrated. The critical incidents were theoretically insightful and diverse. Successively, they entailed: another look at the inaccessible results episode (Section 8.2.4.1); a meeting requests matter (Section 8.2.4.2); an open day (Section 8.2.4.3); a revisit of the compromised account process (Section 8.2.4.4); a laptop spillage (Section 8.2.4.5); server resetting (Section 8.2.4.6); an absent testing environment (Section 8.2.4.7); a substandard ticketing system (Section 8.2.4.8); a 2-factor authentication affair (Section 8.2.4.9); a retired academic with IT issue(s) (Section 8.2.4.10); a data centre outage event (Section 8.2.4.11); power testing (Section 8.2.4.12); and a return to the “proactive” approach (Section 8.2.4.13).

8.3 Summary and conclusion

Above was the third of four chapters to present and discuss the study’s findings. Aligning with Figure 7, it answered RQ 2 (Section 5.2, Chapter 5), which asked specifically about the role(s) of bricolage and improvisation in respect of how congruence is reached in practice. Looked at together (Section 8.2), both qualified as means towards congruence. The chapter thereby extended the response to RQ 1 (Chapter 7). It also finalised Facet A of the trifold conceptualisation (Figure 7).

Laid out carefully, empirical evidence illustrated. Although certainly significant, bricolage and improvisation -neither alone nor together- endowed a full theoretical account. Instead, it was often beneficial to cite other means (Facet A, Figure 7). To reiterate, IT practitioners typically draw on multiple heterogeneous and interacting means in what are interpreted as greater congruence efforts. To a lesser extent and effect, other people e.g. non-IT staff and IT users may also assume means towards congruence. Following Figure 7, attention now advances to Facet B: Forms of interaction.

9 Findings and discussion: Interaction and (RQ 3) Challenges

Findings and discussion	{ - Activity of IT provision in academia (RQ 1) How congruence is reached in practice (RQ 2) The role(s) of bricolage and improvisation > Interaction and (RQ. 3) Challenges

9.1 Introduction

This is the last of four chapters to present and discuss the study's findings. Previously providing answers to RQs 1 and 2 (Section 5.2, Chapter 5), Chapters 7 and 8 discerned seven heterogeneous means towards congruence (Facet A, Figure 7). However, each alone fell short of exhaustive explanation; it was often worthwhile referring to other(s). IT practitioners typically engage in multiple heterogeneous and interacting means in greater congruence efforts. To a lesser extent and effect, other people e.g. non-IT staff and IT users may also pursue means towards congruence.

In keeping with Figure 7, the final instalment builds on these insights in two distinct yet interrelated ways. Foremost, Section 9.2 addresses the interaction of heterogeneous means towards congruence: Facet B (Figure 7). Two forms, serial and parallel, are explained and illustrated together. Section 9.3 then advances to RQ 3 (Section 5.2, Chapter 5), concerned with what influences/mediates efforts towards congruence in practice i.e. challenge(s) to means towards congruence. In turn, it discusses challenges to and/or associated with congruence efforts in six areas: Facet C. Lastly, Section 9.4 summarises and concludes the chapter.

Research question	Chapter	Content	Theoretical contribution/ tri-fold conceptualisation
RQ 1 How is congruence reached in practice?	7. Findings and discussion: (RQ 1) How congruence is reached in practice	-Information behaviour -Working together -Change(s) to/of tool(s) and/or resource(s) -Conduct relative to rule(s) and/or norm(s) -Workarounds	Facet A Heterogeneous means towards congruence
↓ RQ 2 What role(s) do(es) bricolage and improvisation play towards this?	8. Findings and discussion: (RQ 2) The role(s) of bricolage and improvisation	-Bricolage and/or improvisation	
↓ RQ 3 What influences/mediates efforts towards congruence in practice?	9. Findings and discussion: Interaction and (RQ 3) Challenges	-Serial and/or parallel -Tool(s) and/or resource(s) -Comprehension and/or understanding -Social conflict -Labour -Adherence to rule(s) and/or norm(s) -Unrealised, potential risk(s)	Facet B Forms of interaction Facet C Areas of challenge

Figure 7. From research questions to theoretical contribution (repeated)

9.2 Interaction of heterogeneous means towards congruence

9.2.1 Introduction

Discerning the seven heterogeneous means towards congruence (Facet A, Figure 7), it became apparent each individually fell short of exhaustive explanation. Rather, IT practitioners typically pursue multiple heterogeneous and interacting means in overarching congruence efforts. To a lesser extent and effect, other people may also assume means towards congruence. This section attends to interaction: Facet B (Figure 7). Section 9.2.2 expounds two theoretical forms, serial and parallel. Whilst not explicated earlier, interaction is in fact apparent in much of the empirical evidence already introduced.

Section 9.2.3 illustrates the two forms of interaction, mobilising a limited selection of empirical examples. Section 9.2.3.1 begins by looking more closely than before, at one IT practitioner's promotion of ownership at his/her respective university. Following this, choice critical incidents are revisited. These include: the Open Day (II) (Section 9.2.3.2); the "major incident process" (II) (Section 9.2.3.3); and the essay submission software (III) (Section 9.2.3.4). Section 9.2.4 then summarises succinctly.

9.2.2 Explaining interaction: Serial and/or parallel

To this point, the study has presented seven heterogeneous means towards congruence (Facet A, Figure 7). These were characterised as intentional way(s) in which activity/activities is/are influenced to continue; invoking CHAT vocabulary (Chapter 2), they were read as intentional, stabilising, goal-driven action(s) via which activity/activities -inclusive of incumbent object- is/are influenced to continue (Section 7.2.2, Chapter 7). Yet, empirical evidence (Chapters 7-8) indicated each individually stopped shy of exhaustive explanation.

In practice, IT practitioners tend to pursue multiple heterogeneous and interacting means in greater congruence efforts. To a lesser extent and effect, other people e.g. IT users and non-IT staff were also shown to possibly pursue means towards congruence. Accordingly, any theoretical account recognising only one of the means is criticised as likely incomplete, overly reductionist -or at worst, disingenuous. In outstanding need of address, this section attends theoretically to the apparent interaction of heterogeneous means. It thereby elevates the answers to RQs 1 and 2 (Section 5.2, Chapter 5), presented in Chapters 7 and 8, and further, constitutes Facet B (Figure 7).

Ideas integral to CHAT are relevant. Namely, those relating goal-driven actions to object-oriented activity (Kaptelinin and Nardi, 2006). If stripped of context, an action might be wrongly equated to the ultimate end or even appear senseless (Kaptelinin and Nardi, 2006). Indeed whereas “some actions are *directly* related to the object”, others serve an equally legitimate “auxiliary” purpose (Kaptelinin and Nardi, 2006: 63) [italics added]. Regardless of discernible relevance to congruence, the heterogeneous means (Facet A, Figure 7) have a common concern with congruence.

Beyond the CHAT literature, the contention that congruence may come from the presence and/or interaction of heterogeneous means, chimes with the idea of emergence, popularised by e.g. complexity theory³ (Gupta and Anish, 2009; Byrne and Callaghan, 2014) and critical realist philosophy (Bhaskar, 1998; Bhaskar, 2008; Collier, 1994). Illuminated in the methods chapter, existing academic literature and its theoretical ideas were of influence, and this continued throughout (Section 5.12.6, Chapter 5). This was noted to echo assumptions of abductive reasoning (Section 5.12.6, Chapter 5). Past literature was consulted from the beginning (Section 5.12.3, Chapter 5). It was helpful to also gaze back at select scholarship, and the opportunity was taken to newly consult wider academic literature (Section 5.12.6, Chapter 5).

Whether or not the student researcher looked back to it, Lyytinen and Newman (2008) and with overlap, ideas conveyed by Professor Mike Newman (Section 2.6, Chapter 2) were influential to accounting theoretically for the interaction of heterogeneous means. In “explaining information systems change” with their PSIC model, Lyytinen and Newman (2008: 589-592) assess “horizontal and temporal interactions” [italics omitted]. One figure begins with antecedent conditions on the left, and from left to right, horizontally and chronologically, shows multiple “events” in “S-T form” -i.e. Leavitt’s diamond (Lyytinen and Newman, 2008: 602). Similar is evident in the CHAT literature, e.g. Engeström’s (2000b) study of children’s healthcare in Finland illustrates multiple successive actions with corresponding activity systems.

Those applying the PSIC model separate “events into parallel work system and building system events” (Lyytinen and Newman, 2008: 601). The figure visualises “events” at/in the “Building System” and below that, the “Work System” (Lyytinen and Newman, 2008: 602). It shows successive events, with the diamond, some apparently occurring simultaneously at different

³ Dr. Alistair Norman pointed out the relevance of complexity theory during the 12-month transfer assessment.

levels and systems. Lyytinen and Newman (2008: 592) conduct “vertical analysis”, identifying “interdependencies between”. The figure identifies “dynamic interactions within and between the... system levels” (Lyytinen and Newman, 2008: 604), the latter represented by vertical arrows. All of these aspects feature in a single figure comprising the larger IS change.

Lyytinen and Newman’s (2008) ideas influenced the perceived importance of antecedent conditions to means. Their language was influential, the word “interaction” used to address the association of means and “concurrent” signalling simultaneous pursuit. They influenced the idea that multiple, heterogeneous means may be theorised as occurring i.e. interacting successively i.e. chronologically, represented from left to right, horizontally *and/or* as occurring i.e. interacting simultaneously or thereabouts, viewed vertically -and possibly at/in different activity systems, and/or pursued by different subject(s)/community member(s), in a greater congruence effort. They influenced the idea that means may attempt to and/or have effect(s) (Section 2.6, Chapter 2; Section 7.2.2, Chapter 7) in the same and/or other activity system(s) -at the same time or later. With Engeström (2000b), Lyytinen and Newman (2008) influenced the idea that as appropriate, this can be visualised as multiple activity systems. This influence fed through as the student researcher analysed the data and presented the findings (Chapters 6-9).

Beyond this, an article reviewed early on was Baker and Nelson’s (2005) study showing bricolage in entrepreneurship (Section 3.3, Chapter 3). Despite an awareness of the work, it is unclear exactly when the student researcher paid attention to a particular point within it. Specifically, the admission that they only “serendipitously discovered Lévi-Strauss’s concept of bricolage as a good characterization of” some findings (Baker and Nelson, 2005: 337). This contrasts with the present study. Notwithstanding, there is similarity.

As the study progressed, the student researcher realised potential in certain ideas, to explain theoretically the apparent interaction of heterogeneous means towards congruence. Whilst not necessarily the only influence, the student researcher recalled and/or reconsulted another of their papers. To remind, Baker and Nelson (2003: 1-2) examined “attempts by small, resource-constrained businesses to accomplish a variety of tasks” (Section 3.3, Chapter 3). They identify “two patterns of bricolage”: “parallel” and “serial” (Baker and Nelson, 2003) (Section 3.3, Chapter 3).

Transcending the literature review and certainly absent from Baker and Nelson's (2003) work, Figure 8 visualises these:

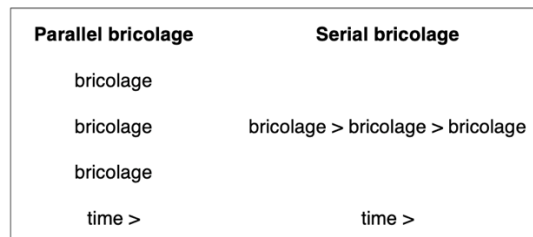


Figure 8. Parallel and Serial bricolage patterns/arrangements

(Interpreted from Baker and Nelson, 2003)

Despite the distinction, each arrangement captures how multiple instances of bricolage can associate (Section 3.3, Chapter 3). As interpreted, those exhibiting parallel bricolage carried out multiple “projects” -inclusive of and/or equivalent to bricolage- concurrently (Baker and Nelson, 2003) (Section 3.3, Chapter 3). Differentially, those undertaking serial bricolage “worked primarily on one or a very few projects [-inclusive of and/or equivalent to bricolage-] at any given time”; outcomes “were combined with other resources at hand to provide the inputs for the next in a series of interconnected bricolage episodes” (Baker and Nelson, 2003) (Section 3.3, Chapter 3).

These ideas are optimally attuned to Baker and Nelson's (2003) findings, and although from an empirically distant domain were perceived to offer a prospective theoretical foundation. The conception's capacity to cater for the interaction of means is understandably limited, and so adaptation is appropriate. Adding to observations in the methods chapter (Section 5.12.6, Chapter 6), and only in retrospect, this can be appreciated as characteristic of qualitative researchers adhering to abduction. Namely, that “they go beyond the data and pre-existing theoretical knowledge by modifying, elaborating upon, or rejecting theory if needed, or putting old ideas together in new ways to examine, understand, and explain the data” (Kennedy, 2018: 5).

Foregrounded by Figure 8, an immediate restriction stems from its exclusive concern with homogenous entities: each pattern identifies associations of bricolage only. For present purposes, where empirically and theoretically appropriate, the first of three adaptations extends each pattern or arrangement to accommodate the entire breadth of heterogeneous means (Facet A, Figure 7) that may interact in greater congruence efforts.

A second shortcoming of Baker and Nelson's (2003) ideas relates to attribution. More precisely, they seem to only explain the bricolage of one person at a time. To Baker and Nelson's (2003) credit however, considering the undertakings i.e. the bricolage patterns of individual entrepreneurs enabled invaluable comparison of business owners. Moreover, they also appear to have approached the analogue endeavours of employees separately, which allowed insightful contrasts with these subordinate staff members.

In the present study and although it need not always hold true, empirical evidence indicates that the heterogeneous means (Facet A, Figure 7) comprising greater, overarching congruence efforts may be attributable to multiple people. These people are, in effect, working together (Section 7.2.4, Chapter 7). Accounting for as much, the second adaptation broadens attribution. Each pattern or arrangement is extended to accommodate multi-person attribution, where empirically and theoretically applicable.

Lastly and although Baker and Nelson (2003) do contrast the bricolage patterns, they stop shy of assessing how the two might themselves interact. Whilst not necessarily the case, empirical evidence indicates greater, overarching congruence efforts may exhibit serial *and* parallel patterns/arrangements. Accordingly, the third and final adaptation addresses this by acknowledging both, where empirically and theoretically appropriate. Below, empirical evidence already introduced gives licence to these adaptations.

9.2.3 Empirical evidence

9.2.3.1 "Own problems"

Although neither form of interaction was referred to explicitly before, serial and/or parallel engagement can be interpreted in empirical evidence introduced already. Insights relating to serial means are apparent in a claim touched on earlier, when presenting working together as means towards congruence (Section 7.2.4, Chapter 7). An IT Support Manager suggested IT practitioners "supporting the IT support office" at their university "own problems". Beyond what was written previously, this came in response to a question about the procedure when receiving a query -and whether responsibility would be assumed outright to begin with. Working together was evidenced nonetheless.

In light of the prospect of interacting means, the promotion of ownership is examined more closely:

“we always do own problems as soon as somebody comes to us, even if it’s not an IT problem”

“we’ve got six people working on the IT, supporting the IT support office”

“we rarely pass them onto each other unless it’s something that a person’s got more knowledge about. We do sometimes pass them onto second level support though”

IT Support Manager, Interviewee 21, University E

The tendency to “own problems” does not deter nor prevent an individual IT practitioner from undertaking multiple heterogeneous means serially. But it would curtail or stop serial pursuits involving multiple IT practitioners. By contrast, the suggestion that they “sometimes pass them onto second level support” indicates serial engagement in means by multiple IT practitioners. In any case, IT practitioner(s) in the scenario outlined are obviously alerted to problem(s) by “somebody” i.e. IT user(s), whose means of IB (Section 7.2.3, Chapter 7) precede their own serially within a greater congruence effort.

9.2.3.2 Open day (II)

Whilst not explicated earlier, serial and/or parallel pursuit of heterogeneous means is recognisable in many -if not all- of the critical incidents appraised already. Identifying interaction augments theoretical understanding. A standout example was introduced when presenting bricolage and improvisation as means towards congruence (Section 8.2.4.3, Chapter 8). A Campus IT Support Team Leader retraced the lead-up to an Open day. It was necessary to “prepare some computer labs”, and IT practitioner(s) would ordinarily use the university network to distribute software to PCs.

This was acknowledged as adherence to rule(s) and/or norm(s) (Section 7.2.6, Chapter 7), engendering change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7). It can newly be clarified that the IT practitioner(s) would have assumed these heterogeneous means simultaneously, i.e. in parallel. In this instance, however, the interviewee explained “one of the switches for that floor failed”. Although network IT specialists were attending to it, the Campus IT Support Team Leader safeguarded from any “unexpected problem” they might have encountered by approaching it from another angle concurrently.

The focal group were noted to have engaged various heterogeneous means. At or around the same time as the network IT specialists endeavoured, these were pursued in parallel. The Campus IT Support Team Leader knew of other network connectivity, but it was in “an admin office” occupied by administrative staff. Early on, s/he offered them an explanation exhibiting IB (Section 7.2.3, Chapter 7) and improvisation (Section 8.2, Chapter 8). That is, to newly emphasise, in parallel. The administrative staff then handed over the room.

The improvised IB perceptibly paved the way for subsequent, serially engaged means. IT practitioner(s) utilised the room’s connectivity, considered earlier as change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) of the IT provision activity. IT practitioners were read to have made do (Section 8.2, Chapter 8) with it, so as to work around (Section 7.2.7, Chapter 7) the faltering switch and update the software on the PCs i.e. make change(s) to/of these tool(s)/resource(s) (Section 7.2.5, Chapter 7). Within the greater congruence effort, these heterogeneous means were executed in parallel.

9.2.3.3 Major incident process (II)

Evidence of interacting means is also apparent in one university’s “major incident process”. When discussing change(s) to/of tool(s) and/or resource(s) as means towards congruence, a Senior IT Support Advisor imagined a hypothetical “university-wide” issue, e.g. a failure of Desktop Anywhere -a remote computing facility- when students need to revise (Section 7.2.5.4.1, Chapter 7). This was previously acknowledged as a critical incident from the perspective of a student IT user activity.

Further remarks regarding the “major incident process” attract interest:

“so with this we’d log a major incident call, with this it would automatically email all the er IT user reps, and also everyone in IT to say right “this is happening”, so everyone can jump on it and investigate.”

“If it warranted it, we do have the capability to ask the comms team to actually send all IT emails, all staff emails, all student emails. That’s normally when it’s an absolutely massive issue, that we would resort to that.”

Senior IT Support Advisor, Interviewee 6, University A

“Log[ging] a major incident call”, IT practitioner(s) adhere to rule(s) and/or norm(s) (Section 7.2.6, Chapter 7). It “automatically email[s]... IT user reps, and also everyone in IT” -IB in the form of information broadcasting (Section 7.2.3, Chapter 7). Once aware, the IT practitioners

subsequently and serially “investigate”. Whatever the means, “everyone in IT” would work towards congruence in parallel. IT practitioner(s) could also request assistance from “the comms team”, i.e. IB explaining issue(s) and/or requirement(s); their broadcast(s) (Section 7.2.3, Chapter 7) would follow, serially. Yet most likely, it/they would happen *whilst* the incident endures, parallel to the means of IT practitioner(s).

The Senior IT Support Advisor also suggested that for an instance in which “all the phones and network” failed, IT are “testing” an “emergency network” allowing them to “text” other IT and/or non-IT university staff e.g. “head of departments”. This was noted to enable IB (Section 7.2.3, Chapter 7). Beyond previous points, s/he reasons: “then they could cascade the information down as well”. That is, themselves -afterwards and in serial- engage in IB, broadcasting information (Section 7.2.3, Chapter 7). This is also interpreted as likely to occur in parallel to the means pursued by other(s) e.g. IT practitioner(s).

The IT practitioner also explains that “actual major incidents” would be “assigned to a specific team, that would investigate it”. In addition, s/he expounds:

“we’ll have a major incident manager, so while we’re doing the communications, he’ll sort of go back and forth, between the teams, getting the information what we need to provide. Er, but also going, if it’s, I don’t know if it’s 3 teams or having to check it, he sort of coordinates between them all.”

Senior IT Support Advisor, Interviewee 6, University A

Another Senior IT Support Advisor from the same university also refers to “major incident managers”, explaining they:

“will actually be in the rota... [and] would come in erm daily and tell the service desk “look, I’m the major incident manager today, and so if anything like this happens I’ll be around”. They’re almost the conduit between all the different things like service desk, all the resolving teams that need to get involved in order to, you know, fix this major incident, so they run around, communicating with each of these, you know teams in order to make sure that we resolve things in as quick as, you know as possible time that we can”

Senior IT Support Advisor, Interviewee 2, University A

A “major incident manager” is apparently designated each day as a precaution. In a “major incident”, their work is undertaken in parallel to that of others. S/he “coordinates between” multiple “teams”. They are “almost the conduit between... [e.g. the] service desk... [and] all the resolving teams”. IB (Section 7.2.3, Chapter 7) would obviously be important for “communicating

with each". By these means, the major incident manager is interpreted to support the parallel inputs of potentially disparate IT groups comprising the university IT community (Chapter 6).

9.2.3.4 Essay submission software (III)

Lastly and although again not expressly identified beforehand, interaction is observable in the "essay submission software" episode. This critical incident demonstrated IB (Section 7.2.3.4.7, Chapter 7) and working together (Section 7.2.4.4.3, Chapter 7) as means towards congruence. Familiar and additional aspects illustrate the interaction of heterogeneous means. To reiterate briefly, the "Turn it in" tool had ceased to function, and affected students were unable to achieve their object(s).

The interviewed IT Support Advisor apparently came up with the proposal that students direct their work to the university's administrative staff. Although s/he does not specify to whom this was proposed, it was argued that it would have been necessary for IT practitioner(s) to communicate as much to IT user(s) e.g. by means of IB, such that they could benefit. Working together played out insofar as administrative staff newly assumed the labour involved with anonymising and forwarding work on.

Circumventing the tool-related issue(s), it was a workaround. The means contributed to allowing affected students to achieve their object(s) whilst the tool-related issue(s) persisted. To emphasise interaction, it is clear that the IT practitioner(s) would have communicated the proposal to a student i.e. engaged in IB initially and that the administrative staff would have carried out the anonymisation and forwarding -i.e. picked up the novel labour- latterly and serially.

Undisclosed up to now, additional details attract interest:

"on that day, there was not an issue that we as a university had, it was actually an issue that Turn it in had themselves"

"it's not an issue that we could necessarily fix, in that we just don't obviously have access to... their stuff."

"I think that towards the end of the shift, luckily Turn it in started working again"

"luckily enough the issue got fixed before the end of the shift"

IT Support Advisor, Interviewee 8, University A

Despite the heterogeneous means undertaken within the university, its IT practitioner(s) were not "necessarily" able to "fix" the "issue" because it resided externally with the IT product(s) and/or service(s) provider. To the provider, any untoward issue(s) associated with "Turn it in" would surely be of utmost concern. On this basis, it is felt likely that this external party effected change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) relied on in student IT user activities. If so, they are interpreted to have pursued these means in parallel to those exhibited inside the academic institution.

It was acknowledged previously that when "Turn it in" returned to life, affected students would have been able to submit their work in the default way. IT practitioners' advice i.e. IB and administrative staff's labour were therefore surplus to requirement. Yet if the IT product(s) and/or service(s) provider was somewhat or fully responsible for the software's restoration, a fuller theoretical account can accommodate. In respect of interaction, the means suspected of - and attributed to- the external provider, eliminated any need for those witnessed within the university.

Once "Turn it in" was operational, IT practitioner(s) were noted to have broadcast information by email; essentially, it made IT users aware that they could achieve their object(s) as ordinarily. Means drawn on earlier were considered to have contributed to enabling the information broadcast to IT users. Specifically, IT user alerts to IT i.e. IB and IT practitioner(s) adhering to rule(s) and/or norm(s) in collating their details. In terms of interaction, it is likely these earlier means were engaged at or approximately at the same time i.e. in parallel. Clearer is that the information broadcasting followed serially.

9.2.4 Succinct summary: Interaction

When previously distinguishing seven heterogeneous means towards congruence (Facet A, Figure 7; Chapters 7 and 8), IT practitioners were found to typically engage in multiple heterogeneous and interacting means in greater congruence efforts. To a lesser extent and effect, other people e.g. non-IT staff and IT users may also pursue means towards congruence. The outgoing section addressed the interaction explicitly, furnishing Facet B (Figure 7). Section 9.2.2 firstly explained two theoretical forms, serial and parallel.

Section 9.2.3 then demonstrated with select empirical examples. Section 9.2.3.1 delved more deeply than before, into one IT practitioner's promotion of ownership at his/her academic institution. Certain critical incidents were then returned to. These comprised: the Open Day (II)

(Section 9.2.3.2); the “major incident process” (II) (Section 9.2.3.3); and the essay submission software (III) (Section 9.2.3.4). Not explicated earlier, this illuminated interaction in empirical evidence already appraised. Next, Section 9.3 progresses to the final research question, RQ 3 (Section 5.2, Chapter 5).

9.3 Challenges to and/or associated with congruence efforts

9.3.1 Introduction

Established already, IT practitioners typically pursue multiple heterogeneous and interacting means in overarching congruence efforts (Facets A, B, Figure 7). To a lesser extent and effect, other people may also undertake means towards congruence. Yet, congruence is not guaranteed. Empirical evidence indicates there can be challenges. Following Figure 7, this section responds to RQ 3 (Section 4.9, Chapter 4; Section 5.2, Chapter 5), which asked what influences/mediates efforts towards congruence in practice i.e. about challenge(s) to means towards congruence. Challenges to and/or associated with overarching congruence efforts are presented: Facet C (Figure 7).

Section 9.3.2 initially characterises the challenges and spells out their significance. One-by-one, six areas are explored: tool(s) and/or resource(s) (Section 9.3.3); comprehension and/or understanding (Section 9.3.4); social conflict (Section 9.3.5); labour (Section 9.3.6); adherence to rule(s) and/or norm(s) (Section 9.3.7); and unrealised, potential risk(s) (Section 9.3.8). Non-exhaustive indications are offered as to the manifestation of each area i.e. how they actually play out or otherwise pose a challenge. Select empirical evidence illustrates. All areas are succinctly summarised. Section 9.3.9 then gives a more general succinct summary.

9.3.2 Challenges: Character and significance

RQ 3 asked “What influences/mediates efforts towards congruence in practice?” (Section 4.9, Chapter 4; Section 5.2). Elaborated in the methods chapter (Section 5.12.5.2, Chapter 5), when the question was posed the student researcher did not necessarily have either supporting empirical evidence and/or the theoretical appreciation of potentially multiple means comprising greater congruence efforts (Chapter 7; 8; Section 9.2, Chapter 9). In spite of the wording, it appears to have asked about negative influence(s)/mediator(s) on i.e. challenge(s) to individual means towards congruence.

Empirical evidence indeed indicates that there may be a challenge to at least some of the individual means. Of this, a modest amount reflects that the means of improvisation and bricolage can be challenged. In the course of careful and extensive analysis (Section 5.12.5.2, Chapter 5), however, the student researcher came to judge that it is not always accurate to consider a challenge as being straightforwardly and/or directly to the means. Rather, a challenge and means can associate differently.

Although there may be merit in assessing challenge(s) in respect of individual means, to do so in isolation risks missing out on the fuller picture. Indeed, as established, IT practitioners typically draw on multiple heterogeneous and interacting means in greater congruence efforts (Facets A, B, Figure 7). To a lesser extent and effect, other people e.g. IT users and non-IT staff may also pursue means towards congruence. In answering RQ 3, it is felt most appropriate to consider challenges to and/or associated with overarching congruence efforts. This constitutes Facet C (Figure 7).

Characteristically, challenges can vary in severity; they do not necessarily altogether thwart congruence efforts. CHAT apparatus may aid theoretical explanation of challenge(s) (Section 5.5.3, Chapter 5) to and/or associated with congruence efforts. Challenges can surely be interpreted in almost any area imaginable. This, then, begs the question of why the six areas of challenge illuminated are significant. This can be substantiated on grounds similar to the seven heterogeneous means towards congruence (Section 7.2.2, Chapter 7).

Semi-structured interview participants “introduce[d] issues” they felt were “relevant” to the themes (Oates, 2005: 188) (Section 5.11.3, Chapter 5). In keeping with interpretivism -to which “researcher interpretations are key to [the] contribution” (Saunders et al., 2015: 136)- the student researcher’s qualitative analysis (Section 5.12, Chapter 5) and interpretation were essential to the development and end form of the six areas of challenge and Challenges list in general (Facet C, Figure 7; Appendix M).

9.3.3 Tool(s) and/or resource(s)

9.3.3.1 Introduction

In accordance with Figure 7, the first area to be presented and discussed is that of tool(s) and/or resource(s). Section 9.3.3.2 gives a brief, non-exhaustive indication of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.3.3 then illustrates with

empirical evidence. One-by-one, critical incidents entail: a return to the retired academic experiencing IT issue(s) (Section 9.3.3.3.1); a problem printing in colour (Section 9.3.3.3.2); and another look at the Denial of Service (DoS) (Section 9.3.3.3.3). Section 9.3.3.4 then summarises succinctly.

9.3.3.2 Manifesting as a challenge

This section offers a brief, non-exhaustive indication of how a challenge to and/or associated with a congruence effort may manifest in the area of tool(s) and/or resource(s). Change(s) to/or tool(s) and/or resource(s) were presented and discussed earlier as means towards congruence (Section 7.2.5, Chapter 7). It is a matter of intrigue then, that a challenge can unfold in this area. Although some instances might be most appropriately considered to concern tool(s) -and others resource(s)- there is not necessarily a clear-cut distinction between the two. Indeed, a tool may be regarded simultaneously as a resource and vice versa. A limited selection of empirical evidence illustrates.

9.3.3.3 Empirical evidence

9.3.3.3.1 *Retired academic (II)*

Although not identified explicitly earlier, challenge(s) to and/or associated with congruence efforts in the area of tool(s) and/or resource(s) are discernible in empirical evidence already introduced. When discussing bricolage and improvisation as means towards congruence, a Senior IT Support Advisor recalled a critical incident wherein a retired staff member IT user with email-associated issues at home (Section 8.2.4.10, Chapter 8) had telephone i.e. alerted IT (Section 7.2.3, Chapter 7). The IT practitioner knew the IT provision activity lacked “remote support tools”. This absence is newly noted as a challenge.

Despite this, the IT practitioner and staff member IT user engaged in multiple heterogeneous means (Facet A, Figure 7), which are newly emphasised to have interacted (Facet B, Figure 7) in a greater congruence effort. The IT practitioner, for example, adhered with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) by using a PC and telephone. Their application and pairing were also judged to exhibit traces of bricolage (Chapter 8). That is, to newly point out, in parallel (Section 9.2, Chapter 9). The IT practitioner attempted to emulate remote support tool(s) and the retired staff member IT user drew on equivalent tools at home.

Notwithstanding, they were acknowledged to have encountered issues. Pertinent at present, real remote support tool(s) would have enabled the IT practitioner to direct the IT user's cursor. Yet, the PC/telephone combination did not. It was therefore interpreted as functionally inferior. This is newly clarified to have represented a challenge concerning the tool(s) and/or resource(s) that *were* available. Still, and as articulated at length (Section 8.2.4.10, Chapter 8), this was not the end of the affair.

The IT practitioner and IT user pursued other heterogeneous means. For example, by IB (Section 7.2.3, Chapter 7) the Senior IT Support Advisor instructed the staff member verbally; executing them, s/he assumed labour. They worked together (Section 7.2.4, Chapter 7) and achieved congruence, in what is underlined as an overarching congruence effort. Ultimately, IT acquired remote support tool(s): change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) of the IT activity, elevating its ability to attain congruence. This is newly suggested to have occurred subsequently and serially (Section 9.2, Chapter 9).

9.3.3.3.2 Unable to print colour

In complimentary evidence, a Client side IT Technician relives a critical incident involving a "colleague" presumed to be another university IT practitioner. S/he "had installed a print driver", effecting change(s) to/of the tool(s) and/or resource(s) (Section 7.2.5, Chapter 7). However, s/he was unable to "print colour". From the angle of their activity, it is seen as a secondary contradiction in that the tool(s)/resource(s) was/were misaligned with the object of printing colour. It was also a challenge in the area of tool(s) and/or resource(s).

The interviewee attended, attempting e.g. to reinstall the same driver and restart the computer. S/he also divulges "we have like a list of drivers that we usually choose from, and usually one of them works, but in this case none of 'em worked". Apparently adhering to rule(s)/norm(s), the IT practitioner worked from the list of tool(s)/resource(s) (Section 7.2.6, Chapter 7); this involved installing multiple drivers i.e. making change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7). The heterogeneous means were pursued in parallel (Section 9.2, Chapter 9). Unfortunately, none of the drivers were suitable.

This presented a clear challenge in the area of tool(s) and/or resource(s). Also, the Client side IT Technician could not fathom the issue(s), indicating a challenge of comprehension and/or understanding. As challenge(s) to and/or associated with congruence efforts, this area is explored below (Section 9.3.4). In addition, it is interpreted as a challenge concerning adherence

to rule(s) and/or norm(s). Challenge(s) to and/or associated with congruence efforts in this area are also looked at later (Section 9.3.7).

The IT practitioner remembers "thinking outside of the box", apparently asking him/herself "why isn't it working?" and "find[ing] a separate driver that actually would work". S/he is thereby taken to have improvised (Chapter 8). This driver was then obviously installed: change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7) carried out serially (Section 9.2, Chapter 9). It seems to have enabled colour printing, i.e. allowing attainment of the colleague's object and therefore endowing their activity with congruence.

Asked why the earlier drivers did not work, the IT practitioner admits the "folder" containing them has not been maintained -and e.g. that it would be more appropriate to keep only "one current version". Addressing this could be considered subsequent, serially sought (Section 9.2, Chapter 9) change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7). It would reduce or eliminate the chances of a repeat performance, and hopefully allow congruence to be achieved more efficiently in future such contingencies.

9.3.3.3.3 *Denial of Service (DoS) (II)*

Lastly and whilst not foregrounded earlier, challenge(s) to and/or associated with congruence efforts in the area of tool(s) and/or resource(s) feature in other empirical evidence already introduced. When presenting IB as means towards congruence (Section 7.2.3.4.8, Chapter 7), a Senior Support IT Advisor recalled when the IT Service Desk was inundated by ostensibly unrelated IT user alerts. IT practitioners had difficulty understanding. A third-party service provider, JANET, later acknowledged widespread Denial of Service (DoS) on social media, affording university IT practitioners a clearer comprehension.

Beyond what was written previously, further aspects of the critical incident attract interest. Multiple university IT groups were giving the matter attention, including the "network team". The IT practitioner explains "they monitor the er network" and "they have sort of things [i.e. tool(s)/resource(s)] that normally would flag up these problems". However, on this occasion, "it wasn't showing up, everything was green". S/he emphasises "we're getting all these reports and it can't be possible that there's nothing wrong".

The network team adhered to rule(s)/norm(s) (Section 7.2.6, Chapter 7) in consulting tool(s)/resource(s) to monitor the network. Yet, this was inadequate and/or inaccurate: a

challenge in the area of tool(s) and/or resource(s). It was also a challenge concerning adherence to rule(s) and/or norm(s). As challenge(s) to and/or associated with congruence efforts, this area is explored below (Section 9.3.7). Additionally, it did not improve IT practitioners' comprehension and/or understanding. Challenge(s) to and/or associated with congruence efforts in this area are examined next (Section 9.3.4).

9.3.3.4 Succinct Summary: Tool(s) and/or resource(s)

Following Figure 7, tool(s) and/or resource(s) was the first area to be presented and discussed. Section 9.3.3.2 gave a short, non-exhaustive impression of how such a challenge to and/or associated with a congruence effort may manifest. Drawing on empirical evidence, Section 9.3.3.3 then illustrated. In turn, choice critical incidents included: another look at the retired academic with IT issue(s) (Section 9.3.3.3.1); a problem printing colour (Section 9.3.3.3.2); and a return to the Denial of Service (DoS) (Section 9.3.3.3.3).

9.3.4 Comprehension and/or understanding

9.3.4.1 Introduction

Dropping down Figure 7, the second area presented and discussed is comprehension and/or understanding. Section 9.3.4.2 offers a brief, non-exhaustive impression of how such a challenge to and/or associated with a congruence effort might manifest. Select empirical evidence then illustrates (Section 9.3.4.3). The critical incident involving "Dropbox reimbursement" is firstly revisited (Section 9.3.4.3.1). Following this, a critical incident regarding the development and delivery of an undergraduate admissions database is introduced (Section 9.3.4.3.2). Section 9.3.4.4 then summarises succinctly.

9.3.4.2 Manifesting as a challenge

This section offers a short, non-exhaustive indication of how a challenge to and/or associated with a congruence effort may manifest in the area of comprehension and/or understanding. Thus far, the findings and discussion chapters (Chapter 7-9) have acknowledged in passing that challenges can concern comprehension and/or understanding. To address this explicitly, a challenge to and/or associated with a congruence effort may indeed play out or unfold in this identifiable area. The instances unearthed pertain to a variety of issues; curiously, they can be experienced by e.g. IT practitioner(s) and/or IT user(s) alike. A limited selection of empirical evidence serves to illustrate.

9.3.4.3 Empirical evidence

9.3.4.3.1 *Dropbox reimbursement (III)*

Although not identified earlier, a challenge to and/or associated with a congruence effort in the area of comprehension and/or understanding is discernible in empirical evidence introduced already. Specifically, in the “Dropbox reimbursement” incident exhibiting IB (Section 7.2.3.4.3) and workarounds (Section 7.2.7.4.2) as means towards congruence. As a reminder, an IT Service Desk Manager recounted how an academic IT user alerted IT to request reimbursement for a Dropbox. IT practitioner(s) initially refused, and the issue was then "escalated" to the interviewee.

The IT Service Desk Manager's input can newly be seen to have taken place subsequently and serially (Section 9.2, Chapter 9). This IT practitioner's approach involved a "discussion" with the academic IT user: s/he pursued IB to accurately comprehend and/or explain the IT user's issue(s) and/or requirement(s). It foregrounded a "fundamental business need". Not noted beforehand but pertinent at present, the interviewee explains that the task is in separating a mere desire or preference from a "business need".

This is interpreted as a challenge of comprehension and/or understanding, experienced by the IT Service Desk Manager. Yet fortunately, it did not stop the congruence effort. Rather, the IT practitioner appears to have overcome the challenge precisely by engaging in means of IB. As elaborated (Section 7.2.3.4.3), s/he ultimately judged that the Dropbox ought to be reimbursed after all. The reimbursement was inferred to have worked around a university rule -means which contributed towards congruence (Section 7.2.7.4.2) in the greater congruence effort.

9.3.4.3.2 *Undergraduate admissions database*

As suggested, challenges in the area of comprehension and/or understanding can also be experienced by IT user(s). In an exemplary critical incident, a Faculty Database Manager for a university's business school was tasked with developing an “undergraduate admissions database in about a month”. This can be considered change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7) used by the “undergraduate admissions” staff. It intended to allow the admissions activity to continue, representing means towards congruence.

Yet apparently once delivered, these IT users issued the IT practitioner “requests” using the “Service Now” system, a “support tool”. That is, the undergraduate admissions staff IT users engaged in subsequent and serial (Section 9.2, Chapter 9) IB (Section 7.2.3, Chapter 7). Although the Faculty Database Manager cannot recall it exactly, s/he admits “there was one thing that wasn’t quite right”. This in itself, reveals a challenge to and/or associated with the congruence effort in the area of tool(s) and/or resource(s) (Section 9.3.3, Chapter 9).

The IT practitioner also discloses, “they didn’t quite know how to do [stutters] something that, they thought it was a real problem but it wasn’t”. On the part of the IT users, this indicates a challenge of comprehension and/or understanding. The Faculty Database Manager “just had to explain to them about [stutters] more thoroughly on how to do something”. That is, by way of further, serial (Section 9.2, Chapter 9) IB (Section 7.2.3, Chapter 7). It is not clear whether IT addressed the genuine issue(s). However, asked about the then current state of play, the interviewee replied, “it’s fine”.

9.3.4.4 Succinct summary: Comprehension and/or understanding

Consistent with Figure 7, comprehension and/or understanding was the second area to be presented and discussed. Section 9.3.4.2 afforded a brief, non-exhaustive impression of how such a challenge to and/or associated with a congruence effort might manifest. Choice empirical evidence then acted to illustrate (Section 9.3.4.3). Firstly, the critical incident entailing reimbursement of a Dropbox was returned to (Section 9.3.4.3.1). After this, a critical incident covering the development and delivery of an “undergraduate admissions database” was assessed (Section 9.3.4.3.2).

9.3.5 Social conflict

9.3.5.1 Introduction

As per Figure 7, social conflict is the third area to be examined. Section 9.3.5.2 provides a brief, non-exhaustive impression of how a challenge in this area -to and/or associated with a congruence effort- may manifest. Section 9.3.5.3 then illustrates, employing choice empirical evidence. Successively, critical incidents include a return to the “Change password” account (Section 9.3.5.3.1); a server upgrade (Section 9.3.5.3.2); and another look at the “Data Centre Outage” (Section 9.3.5.3.3). Section 9.3.5.4 summarises succinctly.

9.3.5.2 Manifesting as a challenge

This section offers a short, non-exhaustive indication of how a challenge to and/or associated with a congruence effort may manifest in the area of social conflict. Evidence indicates instances have to do with a diversity of issue(s). Social conflict can possibly exhibit between the IT practitioner(s) and IT user(s) of a university. It can condition relations among IT practitioners within a university. In one critical incident, moreover, it unfolds between university IT practitioner(s) and an altogether external party. Select empirical evidence illustrates.

9.3.5.3 Empirical evidence

9.3.5.3.1 *Change passwords (II)*

The opening account was introduced earlier, when presenting conduct relative to rule(s) and/or norm(s) as means towards congruence (Section 7.2.6, Chapter 7). A Service Desk Manager explained IT users must newly change their passwords at regular intervals (Section 7.2.6.4.6, Chapter 7). IT was acknowledged to email reminders i.e. IB broadcasts (Section 7.2.3, Chapter 7). Since the change(s) to the rule(s) and/or norm(s), IT users adhere. That is, to newly recognise, subsequently and serially (Section 9.2, Chapter 9).

Adherence to the novel rule(s) and/or norm(s) was noted to effect change(s) to/of their tool(s) and/or resource(s) (Section 7.2.5); these means can now be understood to occur in parallel (Section 9.2, Chapter 9). Beyond prior points, the IT practitioner divulges that one IT user emailed a "complaint" to IT. Apparently after the change(s) to/or the rule(s) and/or norm(s), the IT user engaged in serial (Section 9.2, Chapter 9) IB, alerting IT to a grievance (Section 7.2.3, Chapter 7). S/he argued it would be helpful if the email reminders included a hyperlink to where the password could be changed. The complaint was a challenge of social conflict between the IT user and IT practitioner(s).

Subsequently and in serial (Section 9.2, Chapter 9), the Service Desk Manager pursued IB to comprehend and/or explain the IT user's issue(s) and/or requirement(s) (Section 7.2.3, Chapter 7). S/he clarified that although the "information" is integrated, it is not presented "as a clickable link" -consistent with IT advice "not to follow any links on an unsolicited email". The IT practitioner reflects, "sometimes it's - in fact more often than not it's just a misunderstanding". His/her IB is thus read to have aimed at easing the social conflict and at aiding the IT user's comprehension and/or understanding (Section 9.3.4).

9.3.5.3.2 *Server maintenance*

Indicated above, social conflict can also exhibit among university IT practitioners. This is apparent in an IT Support Advisor's server maintenance account. As background, s/he recalls that another group of university IT practitioners had emailed IT users about their upcoming work. That is, they engaged in IB to broadcast information (Section 7.2.3, Chapter 7) serially prior (Section 9.2, Chapter 9) to commencing with change(s) to/of the tool(s) and/or resource(s) (Section 7.2.5, Chapter 7) used by IT users in their activities.

For the IT provision activity, the maintenance was in the interest of the safe and continued provision of IT products and services i.e. the object (Section 6.2.3.2, Chapter 6). Although the IB broadcast was well-intended, it occurred months in advance. The interviewee reasons that "unless it's been like a week, or two weeks before that people are not necessarily gonna remember it. I mean I even forgot, and I worked there". This implies a challenge of comprehension and/or understanding (Section 9.3.4).

When the maintenance began, it brought issue(s) relating to the server and the IT user data it stored: a challenge of tool(s) and/or resource(s) (Section 9.3.3). For the IT users, it was a critical incident inhibiting and/or preventing continued activity/activities. The interviewee also stresses sarcastically, that "they [(the "responsible" IT group)] would start it very conveniently on Friday at 6 o'clock, when all the second line support teams were out and we were the only group of people that could kind of help them [(IT users)] with". This signals a challenge of labour, an area explored below (Section 9.3.6).

The IT Support Advisor recalls, "So we, after about like the second week, we got really annoyed". Pertinent at present, this conveys a challenge of social conflict among university IT practitioners. By IB, the interviewee's IT group suggested to those doing the maintenance, that they repeat the IB broadcast. Unfortunately, s/he suspects they refused: further evidence of social conflict. The interviewee's group then -subsequently and serially (Section 9.2, Chapter 9)- pursued further IB, expressing "well at least let us know which group of users is going to be affected, so that we can send out the email". Yet, "they wouldn't do that necessarily" either -again, further evidence of social conflict.

The interviewee's IT practitioner group themselves hoped to engage in subsequent, serial (Section 9.2, Chapter 9) means of IB, so as to broadcast relevant information to IT users. However, if the IT group undertaking the maintenance refused to provide them with the requisite

information, then this presented a significant challenge. From the perspective of the IT provision activity system to which the interviewed IT Support Advisor belonged -thought to be the IT Service Desk- continued activity was inhibited and/or prevented. To them, it was a critical incident.

Luckily, they learned of a “workaround... I think in week 2 or 3”. In parallel (Section 9.2, Chapter 9) to the other IT group’s maintenance, the IT Support Advisor and colleagues engaged in IB via telephone or email to explain the workaround (Section 7.2.7, Chapter 7). There was “some risk involved”. As an area of challenge, unrealised, potential risk(s) are examined below (Section 9.3.8). This admitted, the workaround enabled IT user activities to continue in the interim i.e. instilling congruence.

Longer term and when the maintenance was eventually complete, IT users could resume their activities as ordinarily. The workaround was no longer necessary. Although this incident shows social conflict, it also illuminates other challenge(s) to and/or associated with the overarching congruence effort (Facet C, Figure 7). Notwithstanding, it is evident that at different times of the greater congruence effort, heterogeneous and interacting means (Facets A, B, Figure 7) worked towards and achieved congruence.

9.3.5.3.3 Data centre outage (II)

Lastly and as indicated, social conflict can unfold between university IT practitioner(s) and an external party. Although not identified beforehand, this is apparent in the Head of Digital Architecture’s depiction of a data centre outage, introduced when presenting and discussing bricolage and improvisation as means towards congruence (Section 8.2.4.11, Chapter 8). The earlier account was extensive. The critical incident saw severe and widespread disruption. It inhibited and/or altogether prevented the object of the IT provision activity, as well as the ongoing activities of swathes of IT users.

IT practitioners pursued multiple heterogeneous means, e.g. attempting a/the “fail over process” adherent with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) linked to the “storage array”. But it “wouldn’t work”. They were noted to have subsequently worked around (Section 7.2.7, Chapter 7) and sought help from Dell, the “manufacturer”. This can now be understood to have followed serially (Section 9.2, Chapter 9). Drawing on Dell was acknowledged as adherence with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) and network bricolage (Chapter 8). It can newly

be clarified that these means were pursued in parallel (Section 9.2, Chapter 9) to the workaround. Dell assisted.

Beyond earlier observations, it intrigues that at one point Dell exercised IB with university IT (Section 7.2.3, Chapter 7) to the effect, “we have got another important job do you mind if we stop fixing your stuff and go and do that instead (laughs) no!”. This was a challenge of social conflict between university IT practitioner(s) and an external party. Following this, serially (Section 9.2, Chapter 9), university IT engaged in IB with a senior Dell representative; s/he advised that “they shouldn’t have asked you that”. Whilst it is unclear whether university IT practitioners’ IB was effective, their activity was eventually able to achieve its object once again (Section 8.2.4.11, Chapter 8).

9.3.5.4 Succinct summary: Social conflict

In accordance with Figure 7, social conflict was the third area to be presented and discussed. Section 9.3.5.2 gave a brief, non-exhaustive indication of how such a challenge to and/or associated with a congruence effort may manifest. Employing empirical evidence, Section 9.3.5.3 then served to illustrate. One-by-one, critical incidents comprised another look at the “Change password” account (Section 9.3.5.3.1); a server upgrade scenario (Section 9.3.5.3.2); and a revisit of the “Data Centre Outage” (Section 9.3.5.3.3).

9.3.6 Labour

9.3.6.1 Introduction

Following Figure 7, the area of labour is the fourth to be explored. Section 9.3.6.2 imparts a brief, non-exhaustive impression of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.6.3 illustrates with a limited selection of empirical evidence. In turn, critical incidents comprise: a return to the “Server maintenance” episode (9.3.6.3.1); PCs without Endnote software (Section 9.3.6.3.2); and an event involving Eduroam (Section 9.3.6.3.3). Section 9.3.6.4 then summarises succinctly.

9.3.6.2 Manifesting as a challenge

This section offers a brief, non-exhaustive indication of how a challenge to and/or associated with a congruence effort may manifest in the area of labour. As means towards congruence, working together was presented and discussed earlier (Section 7.2.4, Chapter 7). It therefore

attracts interest that a challenge to and/or associated with a congruence effort may present in the area of labour. Instances play out differently. Those capable of carrying out labour might be absent, presenting a challenge. A challenge may relate to workload. The division of labour within a university may be a challenge. Labour may be divided exterior to an academic institution, thereby presenting a challenge. Choice empirical evidence illustrates.

9.3.6.3 Empirical evidence

9.3.6.3.1 *Server maintenance (II)*

A challenge to and/or associated with a congruence effort in the area of labour is perceptible in empirical evidence already introduced. When presenting and discussing social conflict as an area of challenge, an IT Support Advisor spoke about server maintenance (Section 9.3.5.3.2). To briefly reiterate, another group of university IT practitioners had engaged in IB, to broadcast information (Section 7.2.3, Chapter 7) serially prior (Section 9.2, Chapter 9) to carrying out change(s) to/of the tool(s) and/or resource(s) (Section 7.2.5, Chapter 7) used by IT users in their activities.

The IT Support Advisor explained that whilst the IB broadcast was well-intended, "people" may have forgotten: an implied challenge of comprehension and/or understanding (Section 9.3.4). When underway, the maintenance brought issue(s) relating to the server and the IT user data it stored: a challenge of tool(s) and/or resource(s) (Section 9.3.3). For IT users, it was a critical incident. The interviewee also remarked sarcastically, "they [(the "responsible" IT group)] would start it very conveniently on Friday at 6 o'clock, when all the second line support teams were out and we were the only group of people that could kind of help them [(IT users)] with".

This was registered, in passing, to signal a challenge in the area of labour. At present, it attracts closer consideration. Beyond what was written previously, it is inferred from the interviewee's remarks that "second line support teams" with the ability to "help" IT users were absent -and that as such, the IT Support Advisor's group (thought to be the IT Service Desk) were burdened by a workload that would more appropriately have been shared e.g. by working together (Section 7.2.4, Chapter 7). As acknowledged earlier, the interviewee offers further insights (Section 9.3.5.3.2).

Specifically, s/he recalled "So we, after about like the second week, we got really annoyed". This was taken to convey a challenge of social conflict among university IT practitioners. Revisiting

these comments from the angle of labour is of value in that it endows an elevated theoretical understanding. Adding to points made previously, the challenges in the areas of labour and social conflict are argued to have compounded. More precisely -and at least to some extent- the former explains the latter. That is, the challenge of labour accounts for some of the challenge of social conflict.

The earlier account (Section 9.3.5.3.2) isolated additional evidence of social conflict. More optimistically -in parallel to the other IT group's maintenance- the IT Support Advisor and colleagues were noted to have assumed means which enabled IT user activities to continue in the interim. It was recognised that when the maintenance was finished, IT users were able to continue their activities as ordinarily. It was emphasised that at different points of the overarching congruence effort, heterogeneous and interacting means (Facets A, B, Figure 7) worked towards and achieved congruence.

9.3.6.3.2 *PCs without endnote*

As indicated, a challenge to and/or associated with a congruence effort can manifest differently. Within a university, the division of labour may be a challenge. This is apparent in respect of an "Endnote issue". An IT Support Officer recounts, "we've recently installed these computers using a basic image of Windows that doesn't contain all the software" i.e. made change(s) to/or tool(s) and/or resource(s) (Section 7.2.5, Chapter 7) of IT user activities. But if an IT user required certain software e.g. Endnote, their activity would be inhibited and/or prevented. It would be a critical incident. Installation calls for subsequent, serial (Section 9.2, Chapter 9) change(s) to/or tool(s) and/or resource(s) (Section 7.2.5, Chapter 7).

However, the interviewee explains:

"In order for the software to be installed we have to request it from the Central IT – and library IT. And then the Central IT people, they deploy the software like EndNote onto the computers."

"The system is rather slow so they can only do it very slowly; maybe one cluster at a time for – or even slower than that. So it's been about three weeks now and EndNote isn't installed. (laughs)"

IT Support Officer, Interviewee 12, University B

Responsibility for "deploy[ing]" Endnote resides with "Central IT... and library IT". This is interpreted as a challenge of labour. The interviewed IT practitioner and colleagues (the focal IT group) necessarily adhere with rule(s)/norm(s) (Section 7.2.6, Chapter 7), which involve IB

(Section 7.2.3, Chapter 7) in parallel (Section 9.2, Chapter 9). Their "request" makes the greater congruence effort collaborative (Section 7.2.4 Chapter 7), beyond the focal IT group. Serially (Section 9.2, Chapter 9), Central and library IT then adhere to rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) which, in parallel (Section 9.2, Chapter 9), effect the appropriate change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7).

Although these heterogeneous means enable use of the software in IT user activities and afford congruence, "the system is rather slow". This hints at challenges in the areas of adherence to rule(s) and/or norm(s), explored next (Section 9.3.7), and perhaps tool(s) and/or resource(s) (Section 9.3.3). Asked about the interim period, the IT Support Officer clarifies "there are other computer labs that they can go to, so we would refer them to those". The focal IT group would engage IB (Section 7.2.3, Chapter 7) to inform IT user(s) of other tool(s)/resource(s). Turning to these, IT users would be able to work around the tool-associated technical issue (Section 7.2.7, Chapter 7) and enjoy congruence sooner. If Central and library IT were still at work, then these means would be undertaken concurrently i.e. in parallel (Section 9.2, Chapter 9).

9.3.6.3.3 *Eduroam*

Lastly and as indicated above, labour divided exterior to an academic institution may present a challenge. This was the case during a "Eduroam network" outage, as recounted by an IT Support Manager. The interviewee explains it was felt by a large number of UK universities. At his/her own academic institution, it is interpreted as a critical incident for IT practitioners and IT users. From their standpoints indeed, it inhibited and/or prevented achievement of any object mediated by the network: a tool. Change(s) to/of tool(s)/resource(s) (Section 7.2.5) might have resolved it, had that been possible for university IT practitioners.

However, the IT Support Manager suggests it was addressed by Janus:

"they supply eduroam to the institutes and there wasn't any involvement from us at all because it wasn't even in [the city] that it happened, so they actually fixed the issue, we just had to keep speaking to them, we were in effect like a customer of theirs and we were ringing them and asking them for updates"

"...at the time it was just a case of us contacting them and then trying to pass the information out as much as we could and just to try and find out how long it was going to be down and things like that so, but we didn't have any, we couldn't have any involvement in the fix because it wasn't anything that we actually..."

IT Support Manager, Interviewee 21, University E

A "fix" needed labour undertaken exterior to the university. This presented a challenge. University IT could only do so much whilst the issue endured. For example, they engaged in IB with Janus (Section 7.2.3, Chapter 7); this informed subsequent, serial (Section 9.2, Chapter 9) IB with IT users (Section 7.2.3, Chapter 7). This meant e.g. that where appropriate, IT users could pursue further, serial (Section 9.2, Chapter 9) means towards congruence. IT practitioners "didn't have any media at all to send out communications", and so "were [also] sticking hand-written posters up". This was apparently improvised (Chapter 8) IB, broadcasting information (Section 7.2.3, Chapter 7) to IT users whilst the issue endured.

9.3.6.4 Succinct summary: Labour

In keeping with Figure 7, labour was the fourth area to be presented and discussed. Section 9.3.6.2 lent a brief, non-exhaustive impression of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.6.3 then mobilised select empirical evidence, so as to illustrate. Looked at successively, the critical incidents included: a revisit of the "Server maintenance" account (9.3.6.3.1); PCs lacking Endnote software (Section 9.3.6.3.2); and an instance pertaining to Eduroam (Section 9.3.6.3.3).

9.3.7 Adherence to rule(s) and/or norm(s)

9.3.7.1 Introduction

In further accordance with Figure 7, the fifth area of challenge to be presented and discussed is adherence to rule(s) and/or norm(s). Section 9.3.7.2 gives a brief, non-exhaustive indication of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.7.3 illustrates with choice empirical evidence. Critical incidents introduced earlier are revisited. One-by-one, these are: the data centre outage (Section 9.3.7.3.1); the compromised account process (Section 9.3.7.3.2); and the new printing facility (Section 9.3.7.3.3). Section 9.3.7.4 summarises succinctly.

9.3.7.2 Manifesting as a challenge

This section provides a brief, non-exhaustive indication of how a challenge to and/or associated with a congruence effort may manifest in the area of adherence to rule(s) and/or norm(s). Conduct relative to rule(s) and/or norm(s) was presented and discussed as means towards congruence (Section 7.2.6, Chapter 7). It therefore provokes curiosity that a challenge may

unfold in the area of adherence to rule(s) and/or norm(s). Instances vary. Adherence to a norm may be inhibited and/or prevented. Yet, even if adherence to rule(s) and/or norm(s) is possible, there may still be a challenge. Adherence to rule(s) and/or norm(s) may be restrictive in some way. Empirical evidence illustrates.

9.3.7.3 Empirical evidence

9.3.7.3.1 *Data centre outage (III)*

As indicated, adherence to a norm may be inhibited and/or prevented. This is apparent in evidence already introduced. In particular, during the data centre outage exhibiting improvisation, bricolage and other heterogeneous and interacting means (Section 8.2.4.11, Chapter 8), and a challenge in the area of social conflict (Section 9.3.5.3.3). A Head of Digital Architecture relived "a major data centre outage which meant we had no IT for about 40 hours". The critical incident witnessed severe and widespread disruption. The activities of both IT provision and IT users were adversely affected.

IT practitioners were acknowledged to have attempted a/the "fail over process", in adherence with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) linked to the "storage array". Unfortunately, however, it "wouldn't work". This is newly recognised as a challenge in the area of adherence to rule(s) and/or norm(s): adherence to a norm was inhibited and/or prevented. Despite this, IT practitioners persevered. Elaborated previously, they then serially (Section 9.2, Chapter 9) worked around (Section 7.2.7, Chapter 7) by seeking help from the "manufacturer", Dell. In parallel (Section 9.2, Chapter 9), this was read as adherence with rule(s) and/or norm(s) (Section 7.2.6, Chapter 7) and network bricolage (Chapter 8).

Dell staff were also unable to "swap it over". There was also a noted challenge of social conflict (Section 9.3.5) between university IT practitioner(s) and an external party. Thankfully, "one of their engineers" learned of a different way. It was interpreted as burdensome. Yet, making do (Chapter 8) with it allowed them to work around (Section 7.2.7, Chapter 7). To newly posit, in parallel (Section 9.2, Chapter 9). They conveyed the outcome to university IT. Congruence was instilled in the IT provision activity and presuming IT user activities could continue, it carried. The challenges were overcome by multiple heterogeneous and interacting means (Facets A, B, Figure 7) in an overarching congruence effort.

9.3.7.3.2 *Compromised account process (IV)*

Acknowledged above, there may still be a challenge even if adherence to rule(s) and/or norm(s) is possible. Whilst not identified explicitly earlier, as much is apparent in a Senior IT Support Advisor's exposition of their university's "'compromised account" process". This was introduced when presenting means of change(s) to/of tool(s) and/or resource(s) (Section 7.2.5.4.4, Chapter 7). It also conveyed conduct relative to rule(s) and/or norm(s) (Section 7.2.6.4.4, Chapter 7). Especially insightful, it was further discussed in light of bricolage, improvisation and other heterogeneous means (Section 8.2.4.4, Chapter 8).

As a brief reminder, the interviewed IT practitioner relayed that if an IT user's account is thought to be "compromised", IT practitioner(s) temporarily "disable" it. Although this might seem counterintuitive, the change(s) to/of tool(s) and/or resource(s) were noted as means towards congruence (Section 7.2.5.4.4, Chapter 7). It was further registered as rule(s) and/or norm(s), to which IT practitioner(s) adhere as means towards congruence (7.2.6.4.4, Chapter 7). To newly illuminate, these means are pursued in parallel (Section 9.2, Chapter 9).

Any IT user activity requiring the account was recognised to be temporarily prevented (Section 8.2.4.4, Chapter 8). It was also acknowledged that when an IT user learns more, they can become dissatisfied: from the angle of the IT provision activity, a secondary contradiction between the community (IT user) - subject(s) (IT practitioner(s)) (Section 7.2.5.4.4, Chapter 7). Re-visiting this evidence with an emphasis on challenge(s) to and/or associated with congruence effort(s) augments the theoretical account. Whilst IT practitioner(s) are able to adhere to the rule(s) and/or norm(s), there remains a challenge in that it restricts the IT user's activity.

In addition, and if understood correctly, a "compromised" account may be usable in some capacity. But when IT practitioners "disable" it, they prevent its use outright. IT practitioners' adherence to the rule(s)/norm(s) can thus introduce a challenge of tool(s)/resource(s) (Section 9.3.3) and startle one of social conflict (Section 9.3.5). The Senior IT Support Advisor previously recalled a critical incident wherein a student IT user "started getting a bit upset" -as well as the means undertaken in response (Section 8.2.4.4, Chapter 8). Relatedly, it is reasonable to suppose that the "'compromised account" process" -once complete- would overcome the tool(s)/resource(s) challenge by re-enabling use of the account.

9.3.7.3.3 *New printing facility (II)*

The final example also conveys how adherence to rule(s) and/or norm(s) can be restrictive. Although not identified explicitly beforehand, this is perceptible in respect of a new printing facility, discussed when presenting workarounds as means towards congruence (Section 7.2.7.4.3, Chapter 7). To reiterate in brief, an IT Support Officer spoke of a recently adopted printing facility i.e. change(s) to/of tool(s) and/or resource(s) (Section 7.2.5, Chapter 7). It ushered in a novel way of obtaining and replenishing ink i.e. change(s) to rule(s) and/or norm(s) (Section 7.2.6, Chapter 7). To newly point out, in parallel (Section 9.2).

The scenario of an unusable printer was recognised to represent a critical incident for an affected IT user. Articulated in full earlier, university IT practitioner(s) adhere to the new rule(s) and/or norm(s) (Section 7.2.6, Chapter 7). That is, to clarify, subsequently are serially (Section 9.2). A standout detail is that whilst the university IT practitioners are capable of installing the ink cartridge i.e. making change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7), they do not. “We’re not really supposed to”, the interviewee exclaimed; instead, “the technicians would come”. This was understood to mean that the technicians work together with the university IT practitioners in taking up all of the labour (Section 7.2.4, Chapter 7) of installing the ink cartridge i.e. the change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7).

Returning to this evidence with an eye on challenge(s) to and/or associated with congruence effort(s) elevates the theoretical account. University IT practitioners are apparently able to adhere to the new rule(s) and/or norm(s), yet there is still a challenge in that it is restrictive. Their adherence to the rule(s) and/or norm(s) inhibits/prevents them from installing the ink cartridge i.e. effecting change(s) to/of tool(s)/resource(s) (Section 7.2.5, Chapter 7). Also, that responsibility for its installation resides exterior to the academic institution indicates a compounding challenge in the area of labour (Section 9.3.6).

Involvement of the technicians takes time and is read to be something of a rigmarole: adherence to the rule(s) and/or norm(s) is again emphasised as a challenge. Cognisance of this informs a greater appreciation of why other means might be undertaken. For example and as elaborated earlier (Section 7.2.7.4.3, Chapter 7), “in the worst case” the IT Support Officer would work together with IT user(s) (Section 7.2.4, Chapter 7), using his/her own printer; from the perspective of the IT user activity, this reflects change(s) to/of tool(s) and/or resource(s) (Section 7.2.5, Chapter 7), enabling them to work around the tool-related issue(s). To newly identify,

these means are pursued in parallel (Section 9.2). The challenges are -in effect- overcome by heterogeneous and interacting means in an overarching congruence effort.

9.3.7.4 Succinct summary: Adherence to rule(s) and/or norm(s)

Consistent with Figure 7, adherence to rule(s) and/or norm(s) was the fifth area of challenge to be presented and discussed. Section 9.3.7.2 provided a brief, non-exhaustive indication of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.7.3 drew on a selection of empirical evidence, so as to illustrate. Critical incidents introduced already were returned to. Successively, these were: the data centre outage (Section 9.3.7.3.1); the compromised account process (Section 9.3.7.3.2); and the new printing facility (Section 9.3.7.3.3).

9.3.8 Unrealised, potential risk(s)

9.3.8.1 Introduction

Aligning with Figure 7, the sixth and last area of challenge to be explored is unrealised, potential risk(s). Section 9.3.8.2 instils a brief, non-exhaustive impression of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.8.3 employs empirical evidence to illustrate. Two critical incidents introduced earlier are revisited. The first is the 2-factor authentication account (Section 9.3.8.3.1) and the second is the suspect bag scenario (Section 9.3.8.3.2). Section 9.3.8.4 then summarises succinctly.

9.3.8.2 Manifesting as a challenge

This section offers a short, non-exhaustive indication of how a challenge to and/or associated with a congruence effort may manifest in the area of unrealised, potential risk(s). Unlike the other areas of challenge, risk(s) are unrealised and potential. Unrealised, potential risk(s) can surely relate to almost anything imaginable. Instances vary in nature. Two notable kinds of unrealised, potential risk(s) are e.g. those pertaining to information technology (IT) and/or to people. A limited selection of empirical evidence illustrates.

9.3.8.3 Empirical evidence

9.3.8.3.1 2-factor authentication (II)

The first example was introduced when earlier presenting bricolage and improvisation as means towards congruence. Logged as a critical incident, an IT Service Manager spoke of his/her university's locally-developed 2FA (Two Factor Authentication) system (Section 8.2.4.9, Chapter 8). To offer a brief reminder, its introduction represented change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7) of any IT user activity using it. As articulated, however, the 2FA system is less than ideal. The IT practitioner summed up the issue as a "small bug". It was interpreted that IT practitioner(s) and IT user(s) make do with this generally. It can also newly be considered a challenge in the area of tool(s) and/or resource(s) (Section 9.3.3).

Thankfully, and albeit imperfect, the IT Service Manager communicated that there is a solution of sorts. Some IT users make do with a laborious method, which sees them carry out additional configuration i.e. change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7); it allows them to work around (Section 7.2.7, Chapter 7) the 2FA tool-related issue. To newly illuminate, these heterogeneous means are pursued in parallel (Section 9.2, Chapter 9). The IT practitioner also highlighted why the actual issue is not attended to outright.

S/he explained:

"The problem we've got is that if you try and address it, you've got the, you could actually potentially, take out the whole of the software for everybody, erm [laughs], [so,] so it's one of these... it may get done eventually, but it probably won't get done [laughs], so, er[m]... it's not on the high priority list, we just think it's quirky now, and we work [a]round it"

IT Service Manager, Interviewee 22, University F

The interviewee referred to risk(s) that could come with an effort to "address it" i.e. make more substantial change(s) to/of the tool(s)/resource(s) (Section 7.2.5, Chapter 7). That is, to newly identify, subsequently and serially (Section 9.2, Chapter 9). It was noted that the preference is to hold back. Looking closer, the unrealised, potential risk(s) pertain to IT -and by extension- the people using it: IT users. This deeper understanding bestows a greater appreciation of the rationale behind the decision. The heterogeneous and interacting means opted for avoid the risk(s) and allow both IT user and IT provision activities to continue, i.e. instil congruence.

9.3.8.3.2 *Cluster: suspect bag (II)*

The second critical incident was also introduced earlier, when presenting conduct relative to rule(s) and/or norm(s) as means towards congruence (Section 7.2.6, Chapter 7). To offer a brief reminder, an IT Support Advisor suggested students using university computer clusters can forget

e.g. bags upon departing. IT practitioner(s) would, in the past, e.g. examine the content and deliver any "valuables" to security. This was read as rule(s) and/or norm(s) with which IT practitioner(s) would adhere. It was acknowledged to involve working together with the non-IT university community (Section 7.2.4, Chapter 7), and means of IB (Section 7.2.3, Chapter 7) were noted to facilitate.

In light of the idea that multiple heterogeneous means can interact (Facet B, Section 9.2, Chapter 9), an elevated theoretical account is possible. With this way of working, the IT practitioner(s) would have e.g. examined the bag in adherence with rule(s) and/or norm(s); in the event that valuables were identified, they would then, serially, have continued in accordance with the rule(s) and/or norm(s) by delivering the bag to security. At this point, the heterogeneous means of adherence with rule(s) and/or norm(s), working together and IB would have been exercised at approximately the same time. That is, in parallel.

However, the IT Support Advisor foregrounded the "threat" of terrorism in the UK. S/he disclosed, "we [IT practitioner(s)] don't wanna necessarily touch the bag anymore". Considered more carefully than before, the threat is recognised as unrealised, potential risk(s) pertaining to people e.g. IT practitioner(s) and/or IT user(s). Explicit understanding of its nature informs an empathetic view of the relatively recent change(s) to the rule(s)/norm(s) -which are newly adhered to. Expounded earlier, the more cautious approach is in the interest of the object of IT provision activity: safe and continued provision of IT products and services for IT users (Section 6.2.3.2, Chapter 6). It eschews the unrealised, potential risk(s).

9.3.8.4 Succinct summary: Unrealised, potential risk(s)

Following Figure 7, the sixth and final area of challenge to be presented and discussed was unrealised, potential risk(s). Section 9.3.8.2 gave a brief, non-exhaustive indication of how such a challenge to and/or associated with a congruence effort may manifest. Section 9.3.8.3 illustrated with empirical evidence. Two critical incidents already introduced were returned to. These were the 2-factor authentication account (Section 9.3.8.3.1), followed by the suspect bag scenario (Section 9.3.8.3.2).

9.3.9 Succinct summary: Challenges

Having established that IT practitioners tend to assume multiple heterogeneous and interacting means in greater congruence efforts (Facets A, B, Figure 7) and that -to a lesser extent and effect-

other people may also pursue means towards congruence, this section presented challenges. In accordance with Figure 7, it responded to RQ 3 (Section 4.9, Chapter 4; Section 5.2, Chapter 5) by discussing challenges to and/or associated with greater congruence efforts: Facet C (Figure 7). Section 9.3.2 characterised the challenges and specified their significance.

Six areas were then looked at in turn: tool(s) and/or resource(s) (Section 9.3.3); comprehension and/or understanding (Section 9.3.4); social conflict (Section 9.3.5); labour (Section 9.3.6); adherence to rule(s) and/or norm(s) (Section 9.3.7); and unrealised, potential risk(s) (Section 9.3.8). Non-exhaustive impressions were provided, as to the manifestation of each area. Choice empirical evidence illustrated. It was discernible that there can be multiple, compounding challenges. All areas of challenge were summarised succinctly.

9.4 Summary and conclusion

The outgoing chapter was the last of four to present and discuss the study's findings. It built on the understanding that IT practitioners typically pursue multiple heterogeneous and interacting means in greater congruence efforts, and that other people -to a lesser extent and effect- may also assume means towards congruence. Following Figure 7, it did so in two distinct yet interrelated ways. Section 9.2 attended explicitly to the interaction of heterogeneous means towards congruence: Facet B (Figure 7). Two forms, serial and parallel, were explained and illustrated together.

Section 9.3 then progressed to RQ 3 (Section 4.9, Chapter 4; Section 5.2, Chapter 5). One-by-one, it presented challenges to and/or associated with overarching congruence efforts in six areas: Facet C (Figure 7). From the discussion of empirical evidence, it became apparent that there can be multiple, compounding challenges. This section -more than any other- illuminated how and why the three facets can interconnect. Together, Facets A, B and C constitute a tri-fold conceptualisation: the study's theoretical contribution (Figure 7).

10 Conclusion

10.1 Introduction

This final chapter closes the research and thesis. Section 10.2 briefly recalls the background; within the Cultural Historical Activity Theory (CHAT) tradition and among the small number of articles on congruence, two (Allen et al., 2013; Karanasios and Allen, 2014) are recognised as especially influential. Section 10.3 reiterates the study's purpose and research questions (RQs). Section 10.4 then recounts the approach. Following this, Section 10.5 presents the theoretical contribution. Its three interconnected facets (Facets A, B and C) are discussed in turn (Sections 10.5.2-10.5.4, respectively) and constitute a tri-fold conceptualisation (Section 10.5.5).

Once articulated in full, Section 10.6 contemplates the contribution to academia. Foremost, Section 10.6.2 integrates the study's theoretical contribution into the broader CHAT tradition. Section 10.6.3 then assesses the contribution to the bricolage and improvisation literatures. The contribution to other academic literature is illuminated by Section 10.6.4. Beyond this, Section 10.7 perceives value to practice. Section 10.8 then acknowledges limitations and proposes avenues for future research. To end, Section 10.9 summarises and concludes.

10.2 Background

This section briefly recalls the background.

Cultural Historical Activity Theory (CHAT) has a considerable history (e.g. see Leontiev, 1977; 1981; Engeström, 1987; 2001; Nardi, 2005; Kaptelinin and Nardi, 2006; 2012; Kaptelinin, 2014; Bakhurst, 1991; 2009; Wilson, 2006b). Its "immediate conceptual origins... can be found in Russian/Soviet psychology of the 1920s and 1930s" (Kaptelinin and Nardi, 2012: 12). In Engeström's (1996, cited by Engeström, 2001: 134 assessment, "activity theory has evolved through three generations of research". The "first" is credited to Vygotsky and the "second" to Leont'ev (Engeström, 2001: 134).

Yrjö Engeström, a "Finnish educational researcher" (Kaptelinin, 2014), promoted his work as "the third generation of activity theory" (Engeström, 2001: 135; originally Engeström, 1987). According to Engeström (2000: 960), "activity systems are in constant movement and internally contradictory". Contradictions "generate disturbances and conflicts, but also innovative attempts to change the activity"; "expansive transformations" are a "possibility" (Engeström, 2001: 137).

An instance of this “is accomplished when the object and motive of the activity are reconceptualized to embrace a radically wider horizon of possibilities than in the previous mode of the activity” (Engeström, 2001: 137).

Allen et al. (2013) added to these ideas. They “initially define a contradiction straightforwardly “as a tension, contrast, denial, or opposition between two propositions”” (Allen et al., 2013: 840, citing Murphy and Rodriguez-Manzanares, 2008a: 1063). “Contradictions”, in respect of an “activity system”, label “a misfit within elements, between them, between different activities, or between different developmental phases of a single activity....[and so] manifest themselves as problems, ruptures, breakdowns, and clashes” (Allen et al., 2013: 840, citing Kuutti, 1999: 34). Whilst accepting the idea of “contradictions leading to change”, they urge attention to “congruencies, which foster reproduction rather than change” (Allen et al., 2013: 841).

Allen et al. (2013: 841) present empirical work, which “illustrate[s] and develop[s] the notion of congruencies as stabilizing forces within activity systems”. Subsequent studies have examined congruence in various empirical settings (Allen et al., 2013; Karanasios and Allen, 2014; Detlor, 2017; Forsgren and Byström, 2018). Yet, the corpus of works remains small, and the concept of congruence, undeveloped. Nevertheless, it was possible to “identify knowledge gap[s]” and formulate “interesting research questions” (Wong, 2014). Two articles were particularly influential (Allen et al., 2013; Karanasios and Allen, 2014).

From Allen et al. (2013), it was read that congruence may be worked towards intentionally and that improvisation is of significance. From Karanasios and Allen (2014) and supervisory discussion, making do and bricolage became of interest. These were not explored previously, and so taken as theoretical gaps/deficits in understanding. In critically appraising the extant academic literatures on improvisation and bricolage, it was judged “that with respect to both improvisation and bricolage, there is only a finite comprehension of potential situational factors that might represent aids or hindrances to ongoing efforts” (Goddard, 2015: 23). This was also regarded as a theoretical gap/deficit in understanding.

10.3 Purpose and research questions (RQs)

This section reiterates the study's purpose and research questions (RQs).

Perusal of existing literature and supervisory discussion of it informed the present study's purpose and research questions (RQs). The purpose was to further theoretical understanding of

congruence, a relatively recent and as yet undeveloped CHAT concept. It explored intentional ways in which activity is influenced to continue i.e. means towards congruence. Heightened attention was given to the role(s) of bricolage and/or improvisation towards this. It further focused on what influences/mediates efforts towards congruence in practice.

Connecting to the study's purpose, three research questions (RQs) were formulated. These were refined, to:

RQ 1. How is congruence reached in practice?

RQ 2. What role(s) do(es) bricolage and improvisation play towards this?

RQ 3. What influences/mediates efforts towards congruence in practice?

10.4 As approached

This section recounts the approach.

The approach of the present study is best appreciated in light of its interlinked methodological characteristics. It was interpretive and qualitative. A practice theory, activity theory (Nicolini, 2013), was applied. Critical Incident technique, a "methodology" (Flanagan, 1954) (CIT) was also an influence. Empirical work was undertaken in the setting of IT provision in UK academia. UK universities indeed, tend to offer a host of information technology (IT) product(s) and/or service(s) to their respective user populations. IT is utilised often and can be relied on. Unfortunately, however, critical incidents may occur.

IT practitioners were the target sample. Where available, their first-hand interpretive, subjective, qualitative insights aided in answering the RQs, thus serving the purpose. From the recruitment process, the resultant sample was an aggregate of 22 IT practitioners from 6 UK universities. Via the semi-structured interview method, qualitative data were gathered/collected. Interviews were audio recorded and transcribed. Qualitative data analysis was rigorous; retrospectively, traces of abductive reasoning were discerned. The theoretical contribution eventuated.

10.5 Theoretical contribution

10.5.1 Introduction

This section showcases the eventuating theoretical contribution. Its three comprising facets are discussed in turn. Section 10.5.2 provides Facet A: Heterogeneous means towards congruence. Section 10.5.3 then furnishes Facet B: Forms of interaction. Following this, Section 10.5.4 conveys Facet C: Areas of challenge. Section 10.5.5 subsequently emphasises that together, Facets A, B and C amount to a tri-fold conceptualisation: the study's theoretical contribution. Lastly, Section 10.5.6 summarises succinctly.

10.5.2 Facet A: Heterogeneous means towards congruence

Facet A provides heterogeneous means towards congruence (Figure 9). The means towards congruence are intentional way(s) in which activity/activities is/are influenced to continue. With CHAT vocabulary (Chapter 2), they can be interpreted as intentional, stabilising, goal-driven action(s) via which activity/activities -inclusive of incumbent object(s)- is/are influenced to continue. In all, there are seven: information behaviour (IB); working together; change(s) to/of tool(s) and/or resource(s); conduct relative to rule(s) and/or norm(s); workarounds; bricolage; and improvisation. One-by-one, each is elaborated.

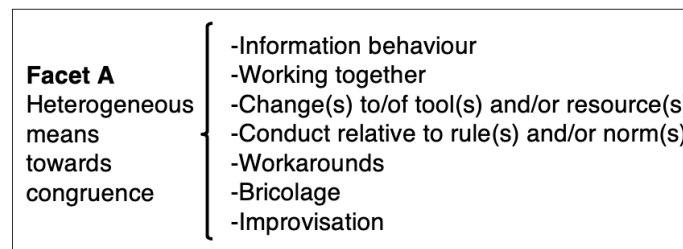


Figure 9. Facet A: Heterogeneous means towards congruence

In accordance with Figure 9, information behaviour (IB) is the first to be explored. As means towards congruence, IB is found to manifest in three ways. In one way, IB plays out as IT user alerts to IT; instances may/may not indicate limited comprehension and/or understanding. In another way, IB manifests as IT practitioner(s) comprehending and/or explaining issue(s) and/or requirement(s); this can occur among IT practitioner(s) or between IT practitioner(s) and other(s). Differently still, IT practitioner(s) may engage in information broadcasting before, during or after issue(s); it may even be attributed to other(s).

Consistent with Figure 9, working together is now considered. Whilst one particular IT Support Manager (Interviewee 21, University E) notably insisted IT practitioners "supporting the IT support office" at their university "own problems", working together represents means towards congruence. It varies in its manifestation. It can involve people internal to a university: IT

practitioner(s), the non-IT community and/or even IT user(s) themselves. Working together may also involve third parties external to the university e.g. IT providers.

Following Figure 9, change(s) to/of tool(s) and/or resource(s) is now presented. As means towards congruence, instances of this can differ. The change(s) can vary in locale i.e. affect different activity system(s). In addition, and although some change(s) are relatively short-lived, they can also and/or instead leave a longer-term impression. Whilst it might seem counterproductive at first glance, some change(s) to/of tool(s) and/or resource(s) are even found to involve backtracking on/disabling of functionality.

Keeping with Figure 9, conduct relative to rule(s) and/or norm(s) is now examined. As means towards congruence, conduct relative to rule(s) and/or norm(s) manifests in two broad ways: adherence and/or change(s). IT practitioners are found to adhere to/with externally imposed rule(s). They also adhere to/with norms. Perhaps implicit, internal university rules are also interpreted. The non-IT community also adheres to/with rule(s) and/or norm(s). Change(s) to/of rule(s) and/or norm(s) can affect different people and/or groups in the greater university community.

Dropping down Figure 9, workarounds are now assessed. As means towards congruence, workarounds differ in their manifestation. It is typically possible to identify attribution; the creator(s) and enactor(s) of a workaround can be different. Then, there is the shape or form of the workaround i.e. what working around entailed/entails. Additionally, there are *what* was/is worked around and/or rationale as to *why*. Workarounds also apparently vary by effect(s) and/or efficacy. Instances can also differ in terms of temporality.

As per Figure 9, bricolage is now presented. As means towards congruence, bricolage is interpreted to manifest in three ways. These are: making do; (re-) combination of some sort; and network bricolage. Network bricolage can involve drawing on an established contact within the respective university or exterior to it. Analysis was sensitive to any apparent trace. The three manifestations can each be attributed to university IT practitioners. IT users are also found to engage in bricolage, by making do and (re-) combination of some sort.

Lastly and again following Figure 9, improvisation is now discussed. As means towards congruence, IT practitioners were found to improvise. Interestingly, IT practitioners and IT users can each benefit. Although seven heterogeneous means towards congruence were discerned, each alone was found to fall short of exhaustive explanation; it was often worth referring to

other(s). IT practitioners typically engage in multiple heterogeneous and interacting means in greater, overarching congruence efforts. To a lesser extent and effect, other people e.g. non-IT staff and IT users may also pursue means towards congruence.

10.5.3 Facet B: Forms of interaction

Facet B furnishes forms of interaction (Figure 10). That is, attending theoretically to the interaction of multiple heterogeneous means towards congruence.

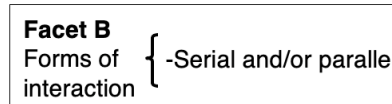


Figure 10. Facet B: Forms of interaction

Figure 10 foregrounds two forms of interaction i.e. patterns/arrangements: serial and parallel. Serial interaction explains means undertaken serially, i.e. one after another. Parallel interaction accounts for means engaged at or approximately at the same time. Each form accommodates multi-person attribution, where empirically and theoretically applicable. Empirical evidence indicated greater congruence efforts can exhibit both serial and parallel forms of interaction. Whilst IT practitioners typically assume multiple heterogeneous and interacting means in overarching congruence efforts -and, to a lesser extent and effect, other people may also pursue means towards congruence- congruence is not guaranteed.

10.5.4 Facet C: Areas of challenge

Facet C conveys areas of challenge (Figure 11). Challenges to and/or associated with overarching congruence efforts can vary in severity; they do not necessarily thwart congruence efforts. CHAT vocabulary may aid theoretical explanation of challenge(s) (Section 5.5.3, Chapter 5) to and/or associated with congruence efforts. In all, six areas are unearthed: tool(s) and/or resource(s); comprehension and/or understanding; social conflict; labour; adherence to rule(s) and/or norm(s); and unrealised, potential risk(s). In this order, each is expanded.

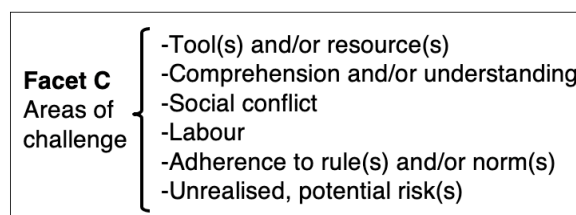


Figure 11. Facet C: Areas of challenge

As per Figure 11, the first area to be presented is tool(s) and/or resource(s). Recalling that change(s) to/of tool(s) and/or resource(s) were identified as means towards congruence, it startles curiosity that a challenge may manifest in this area. Whilst some instances may most appropriately be considered to concern tool(s) -and others, resource(s)- there is not necessarily a clear-cut distinction between the two. Indeed, a resource might simultaneously be regarded as a tool and vice versa.

Following Figure 11, comprehension and/or understanding is now explored. Instances of challenge in this area are found to relate to a variety of issues. Empirical evidence indicates they can be experienced by e.g. IT practitioner(s) and/or IT user(s) alike. Consistent with Figure 11, social conflict is now considered. Instances pertain to a diversity of issues. Social conflict can exhibit between the IT practitioner(s) and IT user(s) of a university. It may condition relations among IT practitioners within a university. It can also possibly occur between university IT practitioner(s) and an external party.

Keeping with Figure 11, the area of labour is now discussed. Insofar as working together was illuminated as means towards congruence, it is especially interesting that a challenge may manifest in this area. Empirical evidence indicated that instances differ. It may be that those capable of carrying out labour are absent. Differently, it could pertain to workload. Within an academic institution, the division of labour might present a challenge. It may be that labour is divided exterior to a university and that this poses a challenge.

Dropping down Figure 11, adherence to rule(s) and/or norm(s) is now examined. In that conduct relative to rule(s) and/or norm(s) was presented as means towards congruence, it sparks curiosity that a challenge may manifest in the area of adherence to rule(s) and/or norm(s). Instances vary. Adherence to a norm may be inhibited and/or prevented. Even if adherence to rule(s) and/or norm(s) is possible, there may still be a challenge. Adherence to rule(s) and/or norm(s) may, in some way, be restrictive.

Lastly and again in accordance with Figure 11, the area of unrealised, potential risk(s) is now assessed. In contrast to the other areas established, risk(s) are unrealised and potential. Instances can surely relate to almost anything imaginable. They vary in nature. Two particularly notable kinds are e.g. those that have to do with information technology (IT) and/or people. From the discussion of empirical evidence, it became apparent that there can be multiple, compounding challenges.

10.5.5 A tri-fold conceptualisation

In all and as suggested, Facets A, B and C constitute a tri-fold conceptualisation: the study's theoretical contribution (Figure 12).

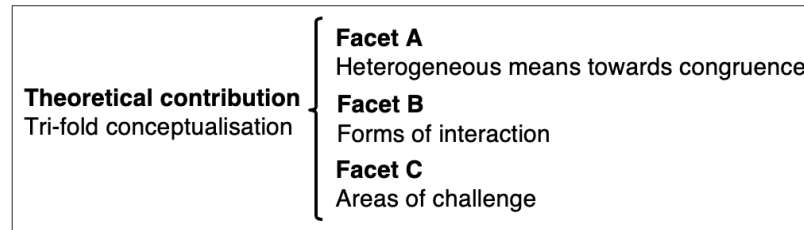


Figure 12. A tri-fold conceptualisation

Findings (Chapters 6-9) illustrated how and why the three Facets (Facet A, B and C) can associate. This is now communicated concisely. IT practitioners pursue means towards congruence (Facet A). Typically, they undertake multiple heterogeneous and interacting means (Facet B) in greater congruence efforts. To a lesser extent and effect, other people may also engage means towards congruence. Yet, congruence is not guaranteed. There can be challenges (Facet C); these do not necessarily altogether thwart congruence efforts. Additional means (Facet A) may be assumed, which interact (Facet B) in an overarching congruence effort. Generally, the empirical evidence indicated that challenges (Facet C) can be overcome.

10.5.6 Succinct summary

This section presented the eventuating theoretical contribution. Its three constituent facets were discussed, one after another. Section 10.5.2 put forward Facet A: Heterogeneous means towards congruence. Section 10.5.3 then bestowed Facet B: Forms of interaction. Further to this, Section 10.5.4 offered Facet C: Areas of challenge. Section 10.5.5 went on to emphasise that in all, Facets A, B and C constitute a tri-fold conceptualisation: the study's theoretical contribution. It represents a contribution to academia.

10.6 Contribution to academia

10.6.1 Introduction

This section contemplates the contribution to academia. Section 10.6.2 begins by offering a brief reminder of extant ideas in the Cultural Historical Activity Theory (CHAT) tradition. In particular, those associated with “the third generation of activity theory” (Engeström, 2001: 135; originally

Engeström, 1987). This enables the present study's theoretical contribution to be effectively placed therein. Section 10.6.3 considers the contribution to the bricolage and improvisation literatures. Section 10.6.4 then illuminates the contribution to other academic literature. Following this, Section 10.6.5 summarises succinctly.

10.6.2 CHAT tradition

So as to effectively integrate the theoretical contribution into the broader Cultural Historical Activity Theory (CHAT) tradition, it is helpful to initially recount established ideas. Specifically, those intrinsic to “the third generation of activity theory” (Engeström, 2001: 135; originally Engeström, 1987) (Chapters 1, 2, Section 10.2). For Engeström (2001: 136), “a collective, artifact-mediated and object-oriented activity system, seen in its network relations to other activity systems, is taken as the prime unit of analysis”. “Activity systems”, Engeström (2000b: 960) contended, “are in constant movement and internally contradictory”.

Contradictions were noted to “generate disturbances and conflicts, but also innovative attempts to change the activity” (Engeström, 2001: 137). These are obviously intentional. “Expansive transformations” are a “possibility” (Engeström, 2001: 137). Such is achieved “when the object and motive of the activity are reconceptualized to embrace a radically wider horizon of possibilities than in the previous mode of the activity” (Engeström, 2001: 137). Engeström (2000b: 970) conducted empirical work in children’s healthcare in Finland. Whilst “the cycle of expansion” was not “completed”, he presented the “actions of an expansive learning cycle” i.e. an “expansive cycle of learning actions” (Engeström, 2000b: 969-970).

Similar to when Allen et al. (2013) introduced the concept of congruence, the present study's theoretical contribution does not intend to replace existing CHAT ideas. Rather, it appends to them. The tri-fold conceptualisation (Figure 12) offers “explanation” (Gregor, 2006: 620) [italics omitted]. It affords concepts/vocabulary able to explain theoretically, the intricacies of congruence efforts. Its three interconnected facets explain: heterogeneous means towards congruence i.e. intentional, stabilising, goal-driven action(s) via which activity/activities - inclusive of incumbent object(s)- is/are influenced to continue (Facet A); forms of interaction (Facet B); and areas of challenge (Facet C).

10.6.3 Bricolage and improvisation

The study also contributes theoretically to the bricolage (Chapter 3) and improvisation (Chapter 4) academic literatures. The findings and discussion established each to qualify as means towards congruence (Chapter 8). Empirical evidence offered abundant and nuanced theoretical insights, including e.g. interaction between the two concepts/phenomena. Whilst certainly significant, bricolage and improvisation -neither alone nor together- endowed a full theoretical account. Rather, bricolage and/or improvisation were drawn on together with other heterogeneous and interacting means in overarching congruence efforts.

10.6.4 Other academic literature

The study also contributes theoretically to other academic literature. Although extant interest in information behaviour (IB) is extensive (Section 7.2.3, Chapter 7), the findings and discussion newly noted IB as means towards congruence. Three manifestations were distinguished: IT user alerts to IT; IT practitioner(s) comprehend and/or explain issue(s) and/or requirement(s); and information broadcasting. Like bricolage and improvisation, IB was undertaken together with other heterogeneous and interacting means in greater congruence efforts. The exposition also corroborated the argued analytic utility of CHAT to IB research (Wilson, 2006).

The study further contributes theoretical understanding of workarounds. In their study of Information Systems Evolution (ISE), McGann and Lyytinen (2008: 4) positioned workarounds as just “types” of improvisation [*italics omitted*] (Section 4.7, Chapter 4). As elaborated, the present study's findings and discussion challenged this assumption (Chapter, 8). Contributing to the existing workarounds literature, workarounds were recognised as means towards congruence (Section 7.2.7, Chapter 7). Again, however, they were pursued together with other heterogeneous and interacting means in overarching congruence efforts.

Beyond this, the study contributes a wealth of insights applicable to the empirical setting of IT provision in UK universities. The extensive content of the findings and discussion chapters (Chapters 6-9) adds to any existing body of associated academic literature. Standout insights include e.g. those about the general work of IT provision activity in UK academia, the kinds of critical incidents that can occur and the means by which these may be attended to. Insights may also be of interest to researchers themselves contemplating fieldwork in the same and/or a similar empirical setting.

10.6.5 Succinct summary

This section conveyed the present study's contribution to academia. Section 10.6.2 started by recalling extant ideas in the Cultural Historical Activity Theory (CHAT) tradition, specifically, those tied to "the third generation of activity theory" (Engeström, 2001: 135; originally Engeström, 1987). Doing so allowed the present study's theoretical contribution to be integrated accurately. In Section 10.6.3, attention turned to the contribution to the bricolage and improvisation literatures. Further to this, Section 10.6.4 highlighted the contribution to other academic literature.

10.7 Value to practice

This section perceives value to practice.

The study is also of possible value to practice. Its findings and discussion (Chapter 6-9) convey many rich insights, relevant most immediately to IT provision in UK academia and people working in this setting e.g. IT managers and other IT practitioners. Reading through, some of these people may recognise empirical evidence to resonate with their own experience(s); the study could thus serve to instil some level of assurance that their own experience(s) are not unique and/unusual. Others discerning little or no similarity, stand to learn a lot.

The study's findings and discussion (Chapter 6-9) are especially informative, presenting its theoretical contribution: a tri-fold conceptualisation (Figure 12) progressively. Of its three interrelated facets (Facets A, B and C), Facet A foregrounded heterogeneous means towards congruence; bricolage and improvisation qualified (Figure 9). Each of these concepts were of interest from relatively early on in the study and so the student researcher spent time carefully reviewing the existing academic literatures (Chapters 3 and 4, respectively).

Among the past works reviewed, it is assistive to briefly recall Adrot's (2011) empirical study of the 2003 French heat wave (Section 4.5, Chapter 4). "Bricolage and improvisation practices" were noted to have been "widespread" (Adrot, 2011: 6). Yet, staff using email were aware of its "traceability" and so to "prevent criticism" steered away from "mentioning controversial content, which limited discursive exchanges" about as much (Adrot, 2011: 6). Clearly if IT provision in UK academia is to realise any value from bricolage and/or improvisation, then IT practitioners cannot be similarly apprehensive to admit their existence. Nor indeed, to actually engage in bricolage and/or improvisation.

From the findings and discussion (Chapter 6-9), IT managers must properly appreciate the roles of bricolage and/or improvisation as means towards congruence. They must grasp that means towards congruence are intentional way(s) in which activity/activities is/are influenced to continue. They must appreciate that IT practitioners tend to pursue multiple heterogeneous and interacting means (Facets A and B) in greater congruence efforts. With this prerequisite understanding, IT managers may be influenced to offer support; this could even anticipate areas of challenge (Facet C).

Insights in the findings and discussion (Chapter 6-9) may also be of value to other settings, of varying proximity to IT provision in UK academia. Closely related, non-UK universities also offer IT to their respective users. IT is also provided exterior to universities; public sector settings include e.g. healthcare and public transport, whereas private sector includes e.g. hospitality and leisure. Even in the absence of any concern for IT provision, there are more distant settings in which continued activity/activities is/are similarly imperative. Those working in the identified settings, especially management, could learn from the insights yielded in IT provision in UK academia -and possibly improve their own practice(s) as a consequence.

10.8 Limitations and future research

This section acknowledges limitations and proposes avenues for future research.

The study's empirical work was carried out in the setting of IT provision in UK academia (Section 5.7, Chapter 5). As reflected by the findings and discussion (Chapter 6-9), a wealth of empirical evidence was returned. Many insights were applicable to the purpose and RQs (Section 5.2, Chapter 5; Section 10.3). Although insights may well be of value to other settings of varying proximity to IT provision in UK academia (Section 10.7), they should not be assumed to straightforwardly generalise elsewhere.

Additionally and although well-substantiated, limitations relate to the use of interviews (Section 5.11, Chapter 5). Relevant to the present study, Oates (2006: 198) specifies "disadvantages of interviews". Concentrating "on what interviewees *say* they do or think, rather than what might really be the case", interviews "can be misleading" (Oates, 2006: 198) [*italics in original*]. Participants are aware "they are speaking for the record" and might perceive "a type recorder or video recorder inhibiting", therefore possibly bestowing a "false impression" (Oates, 2006: 198).

Pertinent reflections are also found in McGann and Lyytinen's (2008) study of Information Systems Evolution (ISE), which employed multiple methods. Beyond the earlier review (Section 4.7, Chapter 4), they admit when discussing "limitations" that "while studying improvisation events, we were forced to rely on users' accounts of their improvisations and their ability to identify them"; "limited recollections, difficult-to-understand terminology, and a tendency towards self-representation could have caused inaccuracies in our data" (McGann and Lyytinen, 2008: 13). These "disadvantages" (Oates, 2006: 198) and "limitations" (McGann and Lyytinen, 2008: 13) apply to the present study's sole use of interviews.

Triangulation could have been beneficial. That is, "the use of more than one method or source of data in the study of a social phenomenon so that "findings may be cross-checked" (Bryman and Bell, 2011: 720). To "triangulate" is to utilise e.g. "multiple types and sources of data, [and] variant methods of collection" (Tracy, 2012: 63). Whilst concerns were raised earlier regarding observation as a data collection method (Section 5.11, Chapter 5), these assumed its exclusive use. In that observation involves "watching and paying attention to what people actually do, rather than what they report they do" (Oates, 2006: 36), it would have triangulated with interviews advantageously.

The present study's limitations may imply avenues for future research. Moreover, potential researchers may themselves look at the findings and discussion (Chapter 6-9) in a similar way to the student researcher when reviewing extant literature (Section 1.2, Chapter 1; Chapters 2-4; 10.2). Keen-eyed scholars may "identify knowledge gap[s]" and prepare "interesting research questions" (Wong, 2014). Most generally, these can be expected to concern the tri-fold conceptualisation (Figure 12), its three constituent facet(s) (Figures 9-11) or aspect(s) thereof.

Within the findings and discussion (Chapter 6-9) there are also more specific, nuanced insights, with less empirical support. Examples include: that means may be time-limited in character or rendered redundant; that the theoretical status of means may change (improvisation shifting to conduct relative to rule(s) and/or norm(s)); and that means can have a negative effect. These elementary insights point to possibly fruitful research topics. Research might also usefully examine ways in which challenges could be mitigated and/or eradicated.

For future fieldwork also interested in IT provision, a move to a private sector setting may be especially worthwhile. An interviewed IT Officer discerned a disparity between his/her current "workload" -and the heightened expectations when previously working in a corporate culture. Just how this might relate to -e.g. influence- the tri-fold conceptualisation (Figure 12) prompts

curiosity. Future research may lack any concern for IT provision; it should not be presumed that insights from other activities in other contexts would even resemble those returned by the present study. Irrespective, explanation is encouraged.

10.9 Summary and conclusion

This closing chapter ended the research and thesis. The background was recounted briefly by Section 10.2. Within the CHAT tradition, two articles on congruence (Allen et al., 2013; Karanasios and Allen, 2014) were noted to have been especially influential. Section 10.3 reiterated the study's purpose and research questions (RQs). Section 10.4 recalled the approach. Section 10.5 then presented the theoretical contribution; one-by-one, its three interconnected facets (Facets A, B and C) were discussed (Sections 10.5.2-10.5.4, respectively). Together, they constitute a tri-fold conceptualisation (Section 10.5.5).

Delineated fully, Section 10.6 appraised the contribution to academia. Initially, Section 10.6.2 placed the study's theoretical contribution into the broader CHAT tradition. After this, Section 10.6.3 considered the contribution to the bricolage and improvisation literatures. Section 10.6.4. then highlighted the contribution to other academic literature. Section 10.7, moreover, perceived value to practice. Before summarising and concluding, Section 10.8 accepted limitations and put forward avenues for future research.

References

- Adrot, A. 2011. Crisis response, organizational improvisation and the dispassionate communicative genre during the 2003 French heat wave. *16th International Conference of the Association Information and Management 2011, AIM 2011*.
- Adrot, A. and Mourmant, G. 2009. Technological Support To Improvisation During crisis: An Image Theory Based Approach. In: *MCIS 2009 Proceedings*. Paper 113. pp.1275-1286.
- Ajzen, I. 1991. The Theory of Planned Behavior. *Organizational Behaviour and Human Decision Processes*. **50**(2), pp.179-211.
- Akgün, A.E., Lynn, G.S. and Yılmaz, C. 2006. Learning process in new product development teams and effects on product success: A socio-cognitive perspective. *Industrial Marketing Management*. **35**(2), pp.210-224.
- Allen, D. 2011. Information Behavior and Decision Making in Time-Constrained Practice: A Dual-Processing Perspective. *Journal of the American Society for Information Science and Technology*. **62**(11), pp.2165-2181.
- Allen, D., Karanasios, S. and Slavova, M. 2011. Working with Activity Theory: Context, Technology, and Information Behavior. *Journal of the American Society for Information Science and Technology*. **62**(4), pp.776-788.
- Allen, D. K., Brown, A., Karanasios, S. and Norman, A. 2013. How should technology-mediated organizational change be explained? A comparison of the contributions of critical realism and activity theory. *MIS Quarterly*. **37**(3), pp.835-854.
- Allen, D. K., Karanasios, S. and Norman, A. 2014. Information sharing and interoperability: the case of major incident management. *European Journal of Information Systems*. **23**(4), pp.418-432.
- Allen, D. K., Wilson, T.D., Norman, A.W.T. and Knight, C. 2008. Information on the move: the use of mobile information systems by UK police forces. *Information Research*. **13**(4).
- Alter, S. 2013. Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. *Journal of the Association for Information Systems*. **14**(2), pp.72- 121.
- Alter, S. 2014. Theory of Workarounds. *Communications of the Association for Information Systems*. **34**(1), pp. 1041-1066.

- Azad, B. and King, N. 2012. Institutionalized computer workaround practices in a Mediterranean country: an examination of two organizations. *European Journal of Information Systems*. **21**(4), pp.358-372.
- Azad, B. and King, N. 2017. Rethinking How Computer Workarounds Emerge: A Phenomenological Perspective. In: *Ninth International Symposium on Process Organization Studies*. 20-24 June 2017, June 22, 2017, Helona Resort, Kos, Greece. pp.1-31.
- Baker, T., Miner, A.S. and Eesley, D.T. 2003. Improvising firms: bricolage, account giving and improvisational competencies in the founding process. *Research policy*. **32**(2), pp.255-276.
- Baker, T. and Nelson, R.E. 2003. Making Do With What's At Hand: Bricolage in two Contexts. In: *Academy of Management Annual Meeting Proceedings*. pp.D1-D6.
- Baker, T. and Nelson, R.E. 2005. Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage. *Administrative Science Quarterly*. **50**(3), pp.329-366.
- Bakhurst, D. 1991. *Consciousness and revolution in Soviet philosophy: From the Bolsheviks to Evald Ilyenkov*. Cambridge University Press.
- Bakhurst, D. 2009. Reflections on activity theory. *Educational Review*. **61**(2), pp.197-210.
- Bechky, B. A. and Okhuysen, G.A. 2011. Expecting the unexpected? How SWAT officers and film crews handle surprises. *Academy of Management Journal*. **54**(2), pp.239-261.
- Behrens, S. 2009. Shadow Systems: The Good, The Bad and The Ugly. *Communications of the ACM*. **52**(2), pp.124- 129.
- Benton, T. and Craib, I. 2011. *Philosophy of Social Science: The Philosophical Foundations of Social Thought*. Second edition. Houndmills, Basingstoke, Hampshire: Palgrave Macmillan.
- Berliner, P. 1994. *Thinking in jazz: The infinite art of improvisation*. Chicago; London: University of Chicago Press.
- Berniker, E. 1998. Working the Jazz Metaphor: Musings Driving down I-5 Past Midnight. *Organization Science*. **9**(5), pp.583-585.

- Bhaskar, R. 1998. *The possibility of naturalism: a philosophical critique of the contemporary human sciences*. London; New York: Routledge.
- Bhaskar, R. 2008. *A realist theory of science*. London: Verso.
- Boudreau, M. and Robey, D. 2005. Enacting Integrated Information Technology: A Human Agency Perspective. *Organization Science*. **16**(1), pp.3-18.
- Boxenbaum, E. and Rouleau, L. 2011. New knowledge products as bricolage: metaphors and scripts in organizational theory. *Academy of Management Review*. **36**(2), pp. 272-296.
- Boyatzis, R. E. 1998. *Transforming Qualitative Information: Thematic analysis and code development*. Thousand Oaks, California; London: Sage Publications.
- Brinkmann, S. 2014. Doing Without Data. *Qualitative Inquiry*. **20**(6), pp. 720-725.
- Brown, S. L. and Eisenhardt, K. M. 1997. The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*. **42**(1), pp.1-34.
- Bryman, A. and Bell, E. 2011. *Business Research Methods*. Third edition. Oxford: Oxford University Press.
- Button, G., Mason, D. and Sharrock, W. 2003. Disempowerment and resistance in the print industry? Reactions to surveillance-capable technology. *New Technology, Work and Employment*. **18**(1), pp.50-61.
- By Any Means with Charley Boorman: An expedition from Ireland to Sydney*. 2008 [DVD]. Russ Malkin. dir. United Kingdom: Universal Pictures UK
- Byrne, D. and Callaghan, G. 2014. *Complexity Theory and the Social Sciences: The state of the art*. London; New York: Routledge.
- Campbell, D. 2012. Public Managers in Integrated Services Collaboratives: What Works Is Workarounds. *Public Administration Review*. **72**(5), pp.721-730.
- Capper, P. and Williams, B. 2004. Enhancing Evaluation Using System Concepts. In: *American Evaluation Association*. November 2004. <http://users.actrix.co.nz/bobwill/activity.doc>

- Case, D. O. and Given, L. M. 2016. *Looking for information: A Survey of Research on Information Seeking, Needs, and Behavior*. Fourth edition. Bingley, UK: Emerald.
- Case, D. O. and O'Connor, L. G. 2016. What's the Use? Measuring the Frequency of Studies of Information Outcomes. *Journal of the Association for Information Science & Technology*. **67**(3), pp.649-661.
- Chelariu, C., Johnston, W. J. and Young, L. 2002. Learning to improvise, improvising to learn: A process of responding to complex environments. *Journal of Business Research*. **55**(2), pp.141-147.
- Cherwell. 2018. *The Essential Guide to ITIL Framework and Processes*. [Online]. [Accessed 18.09.2018]. Available from: <https://www.cherwell.com/library/essential-guides/essential-guide-to-til-framework-and-processes/>
- Ciborra, C. 1994. The grassroots of IT and strategy. In: Ciborra, C. and Jelassi, T. eds. *Strategic Information Systems: a European perspective*. Chichester: Wiley, pp.3-24.
- Ciborra, C. U. 1996a. Mission Critical: Challenges for Groupware in a Pharmaceutical Company. In: Ciborra, C. U. ed. *Groupware and Teamwork: Invisible Aid or Technical Hindrance?* Chichester; New York: Wiley, pp.91-120.
- Ciborra, C. U. 1996b. The Platform Organization: Recombining Strategies, Structures, and Surprises. *Organization Science*. **7**(2), pp.103-118.
- Ciborra, C. 1999a. A Theory of Information Systems Based on Improvisation. In: Currie, W. and Galliers, R. eds. *Rethinking Management Information Systems: an interdisciplinary perspective*. Oxford: Oxford University Press.
- Ciborra, C. U. 1999b. Notes on improvisation and time in organizations. *Accounting, management and Information Technologies*. **9**(2), pp.77-94.
- Ciborra, C. and Hanseth, O. 2001. Introduction. In: Ciborra, C. ed. *From Control to Drift: The Dynamics of Corporate Information Infrastructures*. Oxford: Oxford University Press, pp.1-11.
- Collier, A. 1994. *Critical realism: An Introduction to Roy Bhaskar's Philosophy*. London: Verso.

- Corley, K. G. and Gioia, D. A. 2011. Building Theory about Theory Building: What Constitutes a Theoretical Contribution? *Academy of Management Review*. **36**(1), pp.12-32.
- Creswell, J. W. 2013. *Qualitative Inquiry & Research Design: Choosing Among Five Approaches*. Los Angeles, California; London: SAGE Publications.
- Cross, R., Rebele, R. and Grant, A. 2016. Collaborative Overload (cover story). *Harvard Business Review*. **94**(1), pp.74-79.
- Crossan, M. M. 1998. Improvisation in Action. *Organization Science*. **9**(5), pp.593-599.
- Crossan, M. M., Lane, H. W., White, R. E. and Klus, L. 1996. The Improvising Organization: Where Planning Meets Opportunity. *Organizational Dynamics*. **24**(4), pp.20-35.
- Cunha, M. P., J. V. Cunha, K. Kamoche 1999. Organizational improvisation: What, when, how, and why. *International Journal of Management Reviews*. **1**(3), pp. 299-341.
- Daniels, H. 2004. Activity Theory, Discourse and Bernstein. *Educational Review*. **56**(2), pp. 121-132.
- Davison, R. M. and Ou, C. X. J. 2013. Sharing knowledge in technology deficient environments: Individual workarounds amid corporate restrictions. In: *Proceedings of the 21st European Conference on Information Systems, Utrecht, Netherlands*. Pp. 1-12.
- de Vargas Pinto, A., Maçada, A. C. G. and Mallmann, G. L. 2018. Workaround behaviour in information systems research. *Revista de Gestão*. **25**(4), pp.430-446.
- Denzin, N. K. and Lincoln, Y. S. 2000. Introduction: The Discipline and Practice of Qualitative Research. In: Denzin, N. K. and Lincoln, Y. S. eds. *Handbook of Qualitative Research*. Second Edition. United States: Sage Publications, pp.1-28.
- Detlor, B. 2017. *Digital Storytelling and City Cultural Organizations: A Case Study Investigation of the "Love Your City, Share Your Stories" Digital Storytelling Initiative in Hamilton, Canada*. MDTRC Working Paper No. 101, April 2017. pp. 1-88.
- Detlor, B., Hupfer, M. E. and Smith, D. H. 2016. Digital Storytelling and Memory Institutions: A Case Study Using Activity Theory. *Proceedings of the Association for Information Science and Technology, 14-18 October 2016, Copenhagen, Denmark*. pp.1-6.

- Deuze, M. 2006. Participation, Remediation, Bricolage: Considering Principal Components of a Digital Culture. *The Information Society*. **22**(2), pp.63-75.
- Di Domenico, M., Haugh, H. and Tracey, P. 2010. Social Bricolage: Theorizing Social Value Creation in Social Enterprises. *Entrepreneurship Theory and Practice*. **34**(4), pp.681- 703.
- Duberley, J., Johnson, P., Cassell, C. 2012. Philosophies underpinning qualitative research. In: Symon, G., Cassell, C. ed(s). *Qualitative organizational research: core methods and current challenges*. London, California, New Delhi, Singapore: SAGE publications, pp. 15-34.
- Duymedjian, R. and Rüling, C. 2010. Towards a Foundation of Bricolage in Organization and Management Theory. *Organization Studies*. **31**(2), pp.133-151.
- Edwards, A. and Daniels, H. 2004. Editorial: Using Sociocultural and Activity Theory in Educational Research. *Educational Review*. **56**(2), pp.107-111.
- Eisenhardt, K. M. 1989. Agency Theory: An Assessment and Review. *Academy of management Review*. **14**(1), pp.57-74.
- Eisenhardt, K. M. and Tabrizi, B. N. 1995. Accelerating Adaptive Processes: Product Innovation in the Global Computer Industry. *Administrative Science Quarterly*. **40**(1), pp.84-110.
- Engeström, Y. 1987. *Learning by Expanding: An Activity-theoretical Approach to Developmental Research*. Helsinki: Orienta-Konsultit.
- Engeström, Y. 1999. Activity theory and individual and social transformation. In: Engeström, Y., Miettinen, R. and Punamäki-Gitai, R. eds. *Perspectives on Activity Theory*. Second edition. Cambridge: Cambridge University Press, pp.19-38.
- Engeström, Y. 2000a. Activity Theory and the Social Construction of Knowledge: A Story of Four Umpires. *Organization*. **7**(2), pp.301-310.
- Engeström, Y. 2000b. Activity theory as a framework for analyzing and redesigning work. *Ergonomics*. **43**(7), pp.960-974.
- Engeström, Y. 2001. Expansive Learning at Work: toward an activity theoretical reconceptualization. *Journal of Education and Work*. **14**(1), pp.133-156.

- Engeström, Y. 2003. The horizontal dimension of expansive learning: Weaving a texture of cognitive trails in the terrain of health care in Helsinki. In: *2003 the international symposium 'New Challenges to Research on Learning', 21-23 March 21-23 2003, University of Helsinki, Finland.*
- Engeström, Y. and Miettinen, R. 1999. Introduction. In: Engeström, Y., Miettinen, R. and Punamäki-Gitai, R. eds. *Perspectives on Activity Theory*. Second edition. Cambridge: Cambridge University Press, pp.1-16.
- Eriksson, P., Kovalainen, A. 2008. *Qualitative Methods in Business Research*. London, California, New Delhi, Singapore: SAGE Publications.
- Feldman, M. and Worline, M. 2016. The Practicality of Practice Theory. *Academy of Management Learning & Education*. **15**(2), pp.304-324.
- Feldman, M. S. and Orlikowski, W. J. 2011. Theorizing Practice and Practicing Theory. *Organization Science*. **22**(5), pp.1240-1253.
- Ferneley, E. H. and Sobreperez, P. 2006. Resist, comply or workaround? An examination of different facets of user engagement with information systems. *European Journal of Information Systems*. **15**(4), pp.345-356.
- Fisher, K. E. 2009. Information Behavior. *Annual Review of Information Science and Technology*. **43**(1), pp. 1-73.
- Flanagan, J. C. 1954. The critical incident technique. *Psychological bulletin*. **51**(4), pp. 327- 358.
- Flick, U. 2009. *An introduction to qualitative research*. Fourth Edition. London: SAGE.
- Forsgren, E. and Byström, K. 2018. Multiple social media in the workplace: Contradictions and congruencies. *Information Systems Journal*. **28**(3), pp. 442-464.
- Garreau, L. and Adrot, A. 2009. Sense as a bridge between crisis and improvisation: how people make sense of a crisis to improvise ?. Université Paris-Dauphine, Open Access publications from Université Paris-Dauphine.
- Garud, R. and Karnøe, P. 2003. Bricolage versus breakthrough: distributed and embedded agency in technology entrepreneurship. *Research policy*. **32**(2), pp. 277-300.

- Gay, G. and Hembrooke, H. 2004. *Activity-centered design: an ecological approach to designing smart tools and usable systems*. Cambridge, Mass; London: MIT.
- Gibbs, G. 2007. *Analysing qualitative data*. Los Angeles, California; London: SAGE.
- Glaser, B. G. and Strauss, A. L. 1967. *The discovery of grounded theory: strategies for qualitative research*. New York: Aldine de Gruyter.
- Goddard, K. L. (2015) Means toward congruency in the RNLI: An Activity Theoretical approach. Provisional PhD transfer (Summer/Autumn 2015), University of Leeds, Leeds University Business School.
- Goddard, K. L., Allen, D. K., Karanasios, S. (2016) Using activity theory to examine bricolage in practice. In: *European Group for Organizational Studies 2016, EGOS Colloquium. Organizing in the Shadow of Power, 7-9 July 2016, Naples, Italy*.
- Gomm, R. 2009. *Key concepts in social research methods*. Basingstoke: Palgrave Macmillan.
- Gregor, S. 2006. The nature of theory in information systems. *MIS Quarterly*. **3**(30), pp. 611-642.
- Grover, V. and Segars, A. H. 2005. An empirical evaluation of stages of strategic information systems planning: patterns of process design and effectiveness. *Information & Management*. **42**(5), pp. 761-779.
- Gupta, A. and Anish, S. 2009. Insights from complexity theory: understanding organizations better. *IIMB Management Review*.
- Hakkarainen, P. 2004. Editor's Introduction: Challenges of Activity Theory. *Journal of Russian and East European Psychology*. **42**(2), pp. 3-11.
- Hammond, M. and Wellington, J. J. 2013. *Research Methods: The Key Concepts*. London: Routledge.
- Ibrahim, N. H. and Allen, D. 2012. Information Sharing and Trust During Major Incidents: Findings From the Oil Industry. *Journal of the American Society for Information Science and Technology*. **63**(10), pp. 1916-1928.
- Heeks, R. 2006. Health information systems: Failure, success and improvisation. *International Journal of Medical Informatics*. **75**(2), pp. 125-137.

- Holzman, L. 2006. What Kind of Theory is Activity Theory?: Introduction. *Theory & Psychology*. **16**(1), pp. 5-11.
- Ilie, V. 2013. Psychological Reactance And User Workarounds. A Study In The Context Of Electronic Medical Records Implementations. In: *Proceedings of the 21st European Conference on Information Systems*, pp. 1-7. United States.
- Investopedia. 2021. *Marxism: What It Is and Comparison to Communism, Socialism, and Capitalism*. [Online]. [Accessed 2nd September 2022]. Available from: <https://www.investopedia.com/terms/m/marxism.asp>
- Jarzabkowski, P. and Pinch, T. 2013. Sociomateriality is 'the New Black': accomplishing repurposing, reinscripting and repairing in context. *M@n@gement*. **16**(5), pp. 579-592.
- Kajamaa, A. and Engeström, Y. 2014. Where Is The Glue: Mending Disrupted Routines As Source Of Stability And Change In Hospital Surgery. In: *30th EGOS Colloquium, Sub-theme 61: Activity Theory and Organizations, 3rd – 5th July 3rd 2014, Rotterdam*, pp. 1-31.
- Kamoche, K. and Cunha, M. P. e. 2001. Minimal Structures: From Jazz Improvisation to Product Innovation. *Organization studies*. **22**(5), pp. 733-764.
- Kaptelinin, V. 2014. 16. *Activity Theory*. Interaction Design Foundation [Online] Available from: https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/activity-theory?srltid=AfmBOopl5ti9SU0e_7zrBQgZtG396H0knEA6CVKOvYPWW5XX1go6Bhsr [Accessed 30.04.2025]
- Kaptelinin, V., Kuutti, K. and Bannon, L. 1995. Activity Theory: Basic Concepts and Applications. A summary of a tutorial given at the East West HCI 95 Conference. In: International Conference on Human-Computer Interaction, July 1995, Berlin Heidelberg. Springer, pp. 189-201.
- Kaptelinin, V. and Nardi, B. A. 2006. *Acting with Technology: Activity Theory and Interaction Design*. Cambridge, Mass: MIT Press.
- Kaptelinin, V. and Nardi, B. 2012. Activity Theory in HCI: Fundamentals and Reflections. In: San Rafael, California: Morgan & Claypool Publishers. In: *Synthesis Lectures on Human-Centered Informatics*. **5**(1), pp. 1-105.

- Karanasios, S. 2014. Framing ICT4D Research Using Activity Theory: A Match Between the ICT4D Field and Theory? [IFIP Special Issue] *Information Technologies & International Development*, **10**(2), pp. 1-17.
- Karanasios, S. and Allen, D. 2013. ICT for development in the context of the closure of Chernobyl nuclear power plant: an activity theory perspective. *Information Systems Journal*. **23**(4), pp. 287-306.
- Karanasios, S. and Allen, D. 2014. Mobile technology in mobile work: contradictions and congruencies in activity systems. *European Journal of Information Systems*. **23**(5), pp. 529- 542.
- Karanasios, S. and Allen, D. 2018. Activity theory in Information Systems Research. *Information Systems Journal*. **28**(3), pp. 439-441.
- Kennedy, B. L. 2018. Chapter 4. Deduction, Induction, and Abduction. In: Flick, U. ed. *The SAGE Handbook of Qualitative Data Collection*. London: SAGE Publications Ltd, pp. 1-22. [Online]. [Accessed 02.06.2022]. Available from: <https://methods.sagepub.com/book/the-sage-handbook-of-qualitative-data-collection/i569.xml>
- Kincheloe, J. L. 2001. Describing the Bricolage: Conceptualizing a New Rigor in Qualitative Research. *Qualitative Inquiry*. **7**(6), pp.679- 692.
- Kincheloe, J. L. 2005. On to the Next Level: Continuing the Conceptualization of the Bricolage. *Qualitative Inquiry*. **11**(3), pp. 323-350.
- Klag, M. and Langley, A. 2013. Approaching the Conceptual Leap in Qualitative Research. *International Journal of Management Reviews*. **15**(2), pp. 149-166.
- Kobayashi, M., Fussell, S. R., Xiao, Y. and Seagull, F. J. 2005. Work Coordination, Workflow, and Workarounds in a Medical Context. In: *CHI '05 Extended Abstracts on Human Factors in Computing Systems. ACM, 2nd-7th April 2005, Portland, Oregon, USA*, pp. 1561-1564.
- Kozulin, A. 1986. The Concept of Activity in Soviet Psychology: Vygotsky, His Disciples and Critics. *American psychologist*. **41**(3), p. 264-274.

- Kuutti, K. 1995. Activity theory as a potential framework for human-computer interaction research. In: Nardi, B. ed. *Context and Consciousness: Activity Theory and Human-Computer Interaction*. Cambridge, Massachusetts; London: MIT Press. pp. 17-44.
- Lankshear, G. and Mason, D. 2001. Technology and ethical dilemmas in a medical setting: Privacy, professional autonomy, life and death. *Ethics and Information Technology*. **3**(3), pp. 223-233.
- Lanzara, G. F. 1999. Between transient constructs and persistent structures: designing systems in action. *Journal of Strategic Information Systems*. **8**(4), pp. 331-349.
- Legislation.gov.uk. 2018. *Data Protection Act 2018*. [Online]. [Accessed 18.09.2018]. Available from: <http://www.legislation.gov.uk/ukpga/2018/12/contents/enacted>
- Leonardi, P. M. and Barley, S. R. 2008. Materiality and change: Challenges to building better theory about technology and organizing. *Information and Organization*. **18**(3), pp. 159-176.
- Leonardi, P. M. and Barley, S. R. 2010. What's Under Construction Here? Social Action, Materiality, and Power in Constructivist Studies of Technology and Organizing. *Academy of Management Annals*. **4**(1), pp. 1-51.
- Leontiev, A. N. 1977. Activity and Consciousness. In *Philosophy in the USSR, Problems of Dialectical Materialism*, pp. 1-26. Moscow: Progress Publishers. [Online] [Accessed 30/03/2022]. Available from: <https://www.marxists.org/archive/leontev/works/activity-consciousness.pdf>
- Leontiev, A. N. 1981. *The Development of Mind*. Moscow: Progress Publishers. [Online] [Accessed 30/03/2022]. Available from: <https://www.marxists.org/admin/books/activity-theory/leontyev/development-mind.pdf>
- Lévi-Strauss, C. 1972. *The savage mind. Second edition*. London: Weidenfield & Nicolson.
- Li, N., Zhao, H. H., Walter, S. L., Zhang, X.-A. and Yu, J. 2015. Achieving More With Less: Extra Milers' Behavioral Influences in Teams. *The Journal of applied psychology*. **100**(4), pp.1025-1039.

- Lipscomb, M. 2012. Abductive reasoning and qualitative research. *Nursing Philosophy*. **13**(4), pp. 244-256.
- LUBS, 2018. *Adaptation Information Management Technology*. [Online]. [Accessed 30/10/2018]. Available from: <https://business.leeds.ac.uk/research-and-innovation/research-centres/aimtech/>
- Lyytinen, K. and Newman, M. 2008. Explaining information systems change: a punctuated socio-technical change model. *European Journal of Information Systems*. **17**(6), pp. 589- 613.
- Magni, M., Maruping, L. M., Hoegl, M. and Proserpio, L. 2013. Managing the Unexpected Across Space: Improvisation, Dispersion, and Performance in NPD Teams. The *Journal of Product Innovation Management*. **30**(5), pp. 1009-1026.
- Magni, M., Proserpio, L., Hoegl, M. and Provera, B. 2009. The role of team behavioral integration and cohesion in shaping individual improvisation. *Research Policy*. **38**(6), pp. 1044-1053.
- Malaurent, J. and Avison, D. 2016. Reconciling global and local needs: a canonical action research project to deal with workarounds. *Information Systems Journal*. **26**(3), pp. 227-257.
- Markus, M. L. and Robey, D. 1988. Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science*. **34**(5), pp. 583-598.
- Mason, J., 2018. *Qualitative Researching*. Third Edition. London: SAGE Publications.
- Mateus, S. and Sarkar, S. 2024. Bricolage – a systematic review, conceptualization, and research agenda. *Entrepreneurship & Regional Development*. **36**(7-8), pp. 833-854.
- McGann, S. T. and Lyytinen, K. 2008. The Improvisation Effect: A Case Study of User Improvisation and Its Effects on Information System Evolution. In: *ICIS 2008 Proceedings, 2008, Paris*. Paper 209, pp. 1-14.
- McGann, S. T. and Lyytinen, K. 2010. Unpacking the Dynamics of IS User Improvisation: A Research Framework. In: *43rd Hawaii International Conference on System Sciences*. Institute of Electrical and Electronics Engineers, 2010. pp. 1-10.
- Mendonça, D. 2007. Decision support for improvisation in response to extreme events: Learning from the response to the 2001 World Trade Center attack. *Decision Support Systems*. **43**(3), pp. 952-967.

- Mendonca, D., Beroggi, G. E. G. and Wallace, W. A. 2003. Evaluating Support for Improvisation in Simulated Emergency Scenarios. In: *Proceedings of the 36th Hawaii International Conference on System Sciences (HISCC'03)*. Institute of Electrical and Electronics Engineers.
- Mendonça, D., Jefferson, T. and Harrauld, J. 2007. Collaborative Adhocracies and Mix-and- Match Technologies in Emergency Management. *Communications of the ACM*. **50**(3), pp. 44-49.
- Mendonça, D. J. and Wallace, W. I 2007. A Cognitive Model of Improvisation in Emergency Management. *IEEE Transactions on Systems, Man and Cybernetics, Part A: Systems and Humans*. **37**(4), pp. 547-561.
- Miettinen, R. 2006. Epistemology of Transformative Material Activity: John Dewey's Pragmatism and Cultural-Historical Activity Theory. *Journal for the Theory of Social Behaviour*. **36**(4), pp. 389-408.
- Miettinen, R., Paavola, S. and Pohjola, P. 2012. From Habituality to Change: Contribution of Activity Theory and Pragmatism to Practice Theories. *Journal for the Theory of Social Behaviour*. **42**(3), pp. 345-360.
- Miettinen, R., Samra-Fredericks, D. and Yanow, D. 2009. Re-Turn to Practice: An Introductory Essay. *Organization Studies*. **30**(12), pp. 1309-1327.
- Miner, A. S., Bassoff, P. and Moorman, C. 2001. Organizational Improvisation and Learning: A Field Study. *Administrative Science Quarterly*. **46**(2), pp. 304-337.
- Mintzberg, H. 1979. An Emerging Strategy of "Direct" Research. *Administrative Science Quarterly*. **24**(4), pp. 582-589.
- Mintzberg, H. 1987. Crafting Strategy. *Harvard Business Review*. **65**(5), pp.66-75.
- Mintzberg, H. 1994. The Fall and Rise of Strategic Planning. *Harvard business review*. **72**(1), pp. 107-114.
- Mintzberg, H. and Waters, J. A. 1985. Of Strategies, Deliberate and Emergent. *Strategic Management Journal*. **6**(3), pp. 257-272.

- Mirvis, P. H. 1998. Variations on a Theme—Practice Improvisation. *Organization Science*. **9**(5), pp. 586-592.
- Mishra, J. L., Allen, D. K. and Pearman, A. D. 2011a. Activity Theory as a Methodological and Analytical Framework for Information Practices in Emergency Management. *Proceedings of the 8th International ISCRAM Conference, May 2001, Lisbon, Portugal*. pp. 1-9.
- Mishra, J. L., Allen, D. K. and Pearman, A. D. 2011b. Information Sharing during Multi- Agency Major Incidents. *Proceedings of the American Society for Information Science and Technology*. **48**(1), pp. 1-10.
- Mishra, J., Allen, D. and Pearman, A. 2015. Information Seeking, Use, and Decision Making. *Journal of the Association for Information Science and Technology*. **66**(4), pp. 662-673.
- Monares, Á., Ochoa, S. F., Pino, J. A., Herskovic, V., Rodriguez-Covili, J. and Neyem, A. 2011. Mobile computing in urban emergency situations: Improving the support to firefighters in the field. *Expert Systems with Applications*. **38**(2), pp. 1255-1267.
- Moorman, C. and Miner, A. S. 1998a. The Convergence of Planning and Execution: Improvisation in New Product Development. *The Journal of Marketing*. **63**(3), pp. 1-20.
- Moorman, C. and Miner, A. S. 1998b. Organizational Improvisation and Organizational Memory. *The Academy of Management Review*. **23**(4), pp. 698-723.
- Neuman, L. W. 2013. *Social Research Methods: Qualitative and Quantitative approaches*. Seventh Edition. Edinburgh Gate, Harlow, Essex, England, UK: Pearson Education Limited.
- Nicolini, D. 2013. *Practice Theory, Work, and Organization: An Introduction*. UK: Oxford University Press.
- Njenga, K. and Brown, I. 2012. Conceptualising improvisation in information systems security. *European Journal of Information Systems*. **21**(6), pp. 592-607.
- Oates, B. J. 2006. *Researching Information Systems and Computing*. London: SAGE.
- Orlikowski, W. J. 1996. Improvising Organizational Transformation Over Time: A Situated Change Perspective. *Information Systems Research*. **7**(1), pp. 63-92.

- Orlikowski, W. J. 2007. Sociomaterial Practices: Exploring Technology at Work. *Organization Studies*. **28**(9), pp. 1435-1448.
- Orlikowski, W.J. 2009. The Sociomateriality of Organizational Life: Considering Technology in Management Research. *Cambridge Journal of Economics*. **34**(1), pp. 125-141.
- Orlikowski, W. J. 2010. Practice in research: phenomenon, perspective and philosophy. In: Golsorkhi, D., Rouleau, L., Seidl, D., Vaara, E. ed. *Cambridge Handbook of Strategy as Practice*. [Kindle DX e-book]. Cambridge: Cambridge University Press, pp.23-33.
- Orlikowski, W. J. and Scott, S. V. 2008. Sociomateriality: Challenging the Separation of Technology, Work and Organization. *The Academy of Management Annals*. **2**(1), pp. 433- 474.
- Orton, J. D. and Weick, K. E. 1990. Loosely Coupled Systems: A Reconceptualization. *The Academy of Management. The Academy of Management Review*. **15**(2), pp. 203-223.
- Pavlou, P. A. and El Sawy, O. A. 2010. The "Third Hand": IT-Enabled Competitive Advantage in Turbulence Through Improvisational Capabilities. *Information Systems Research*. **21**(3), pp. 443-471.
- Peim, N. 2009. Activity theory and ontology. *Educational Review*. **61**(2), p167-180.
- Petrides, L. A., McClelland, S. I. and Nodine, T. R. 2004. Costs and benefits of the workaround: inventive solution or costly alternative. *The International Journal of Educational Management*. **18**(2), pp. 100-108.
- Prenekert, F. 2010. Tracing the Roots of Activity Systems Theory: An Analysis of the Concept of Mediation. *Theory & Psychology*. **20**(5), pp. 641-665.
- Pressing, J. 1984. Cognitive Processes in Improvisation. In: Crozier, W. R. and Chapman, A. J. (eds). *Advances in Psychology. Cognitive Processes in the Perception of Art*. New York, NY: Elsevier Science Publishers Co., pp. 345-363.
- Ravitch, S. M. and Riggan, M. (2012) *Reason and Rigour: How conceptual Frameworks Guide Research*. Thousand Oaks, California; London; New Delhi; Singapore: Sage Publications.
- Rinehart, K. E. 2021. Abductive Analysis in Qualitative Inquiry. *Qualitative Inquiry*. **27**(2), pp. 303-311.

- Robey, D., Ross, J. W. and Boudreau, M. 2002. Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change. *Journal of Management Information Systems*. **19**(1), pp. 17-46.
- Röder, N., Wiesche, M., Schermann, M. and Krcmar, H. 2014. Why Managers Tolerate Workarounds – The Role of Information Systems. In: *Twentieth Americas Conference on Information Systems, Savannah*. pp. 1-13.
- Röder, N., Wiesche, M., Schermann, M. and Krcmar, H. 2016. Toward an Ontology of Workarounds: A Literature Review on Existing Concepts. In: *49th Hawaii International Conference on System Sciences (HICSS), 5th-8th January 2016, Kuaai, HI, USA*. Institute of Electrical and Electronics Engineers, pp. 5177-5186.
- Safadi, H. and Faraj, S. 2010. The Role of workarounds during an Open-Source Electronic Medical Record System Implementation. In: *Thirty First International Conference on Information Systems (ICIS) Proceedings, 2010, St, Louis*. Paper 47. pp. 1-10.
- Saunders, M., Lewis, P., Thornhill, A., Bristow, A. 2015. Understanding research philosophy and approaches to theory and development. In: Saunders, M., Lewis, P., Thornhill, A. ed(s). *Research methods for business students*. Seventh edition. Edinburgh Gate, Harlow, Essex, England, UK: Pearson Education Limited, pp. 122-161.
- Schatzki, T. R. 2001. Introduction. Practice theory. In: Schatzki, T. R., Knorr-Cetina, K., Savigny, E. V. eds. *The practice turn in contemporary theory*. Great Britain: Routledge, pp. 1-14.
- Schatzki, T. R., Knorr-Cetina, K., Savigny, E. V. eds. 2001. *The practice turn in contemporary theory*. Great Britain: Routledge.
- Spasser, M. A. 2002. Realist Activity Theory for Digital Library Evaluation: Conceptual Framework and Case Study. *Computer Supported Cooperative Work (CSCW)*. **11**(1), pp. 81- 110.
- Tavory, I. and Timmermans, S. 2014. *Abductive analysis: Theorizing Qualitative Research*. Chicago and London: University of Chicago Press.
- Timmermans, S. and Tavory, I. 2012. Theory Construction in Qualitative Research: From Grounded Theory to Abductive Analysis. *Sociological theory*. **30**(3), pp. 167-186.

- Tolman, C.W. 1999. Society versus Context in Individual development: Does Theory Make a Difference? In: Engeström, Y., Miettinen, R. and Punamäki-Gitai, R-L. ed(s). *Perspectives on Activity Theory*. Second edition. Cambridge, UK: Cambridge University Press, pp.1-16.
- Tracy, S. J. 2012. *Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact*. Chichester: Wiley-Blackwell.
- Turner, P. and Turner, S. 2001. A Web of Contradictions. *Interacting with Computers*. **14**(1), pp. 1-14.
- Vallgård, A. and Fernaeus, Y. 2015. Interaction Design as a Bricolage Practice. In: *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction*: ACM, New York, USA, pp. 173-180.
- van de Ven, A. H. and Poole, M. S. 1995. Explaining Development and Change in Organizations. *The Academy of Management Review*. **20**(3), pp. 510-540.
- Wallace, M. and Wray, A. 2011. *Critical Reading and Writing for Postgraduates*. 2nd Edition. Thousand Oaks, California: SAGE Publications.
- Weick, K. E. 1993. The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster. *Administrative Science Quarterly*. **38**(4), pp. 628-652.
- Weick, K. E. 1996. Prepare Your Organization to Fight Fires. *Harvard Business Review*. **74**(3), pp. 143-148.
- Weick, K. E. 1998. Introductory Essay: Improvisation as a Mindset for Organizational Analysis. *Organization Science*. **9**(5), pp. 543-555.
- West, M. A. 2012. *Effective Teamwork: Practical Lessons from Organizational Research*. 3rd Edition. Chichester: Hoboken: John Wiley and Sons, Incorporated.
- Whetten, D. A. 1989. What Constitutes a Theoretical Contribution? *Academy of Management Review*. **14**(4), pp. 490-495.
- Williams, J., Davis, P. and Black, L. 2007. Sociocultural and Cultural–Historical Activity Theory perspectives on subjectivities and learning in schools and other educational contexts. *International Journal of Educational Research*. **46**(1), pp. 1-7.

- Wilson, T. D. 1999. Models in information behaviour research. *Journal of Documentation*. **55**(3), pp. 249-270.
- Wilson, T. D. 2006a. On user studies and information needs. *Journal of Documentation*. **62**(6), pp. 658-670.
- Wilson, T. D. 2006b. A re-examination of information seeking behaviour in the context of activity theory. *Information research*. **11**(4), paper 260. (Online) [Accessed 23rd March, 2022] Available from <http://informationr.net/ir/11-4/paper260.html>
- Wong, C. 2014. *When do you know you have found the "right" gaps?* Leeds University Business School, University of Leeds, Leeds, UK.
- Wynn, E. 1996. Groupware in a Regional Health Insurer: Local Innovations and Formative Context in Transition. In: Ciborra, C. U. ed. *Groupware & Teamwork: Invisible Aid or Technical Hindrance?* Great Britain: Biddles Ltd., pp. 211-236.
- Zinchenko, V. P. 1995. Cultural-historical psychology and the psychological theory of activity: Retrospect and prospect. *Sociocultural Studies of Mind*. pp. 37-55.

Appendices

Appendix A. Semi-structured interview protocol

Semi-structured interview guide –General IT/IS provision at university

Opening statement

Universities provide all kinds of IT services to their users i.e. students and staff. But these systems, inherently complex, might present difficulties (i.e. routine disruption or perhaps even unexpected issues) from time to time. Rather than cataloguing these, my research seeks to understand how IT professionals such as yourself and your colleagues, are able to overcome any challenges associated with IT provision.

Person profile

So I'd like to start with you...

1. What is your current role and what does it involve?
2. How long have you been in the role?
3. Have you previously held any similar role(s) at the university or elsewhere?

General IS-related problems/difficulties

4. Do you/have you ever experience(d) any problem(s) relating to IT? any kind)
 - a. Do these issues tend to relate to specific systems/services?
 - b. Are some more common or problematic than others?
 - c. Who (user groups) do these issues affect; how so?
5. How do you deal with these problems in general?

(Prescribed procedure – any resource(s) used – ever any divergence from this i.e.–their own skills?)
6. What if something gets in the way of the remedial effort?

(think CHAT goals and motives)
7. Are efforts made to learn from such efforts? Any documentation kept?

Specific IS-related incidents –and action(s) taken

So thanks for that. We've spoken a bit about the nature and frequency of IS-related problems in general. If possible I'd like to go onto more specific, perhaps unusual or even memorable incidents.

8. Can you recall any specific IS-related problem(s) that were particularly troublesome, unfamiliar or otherwise significant? Why was it/were they so?

9. Who did it affect? (and how?)
10. How was this issue resolved?
(By whom? Did you work together? Any difficulties? e.g. conflicting opinions Alternative approaches?)
11. Thinking back, have you ever had to think on your feet, improvise a solution or workaround?
12. Again, was anything learned from this episode?

Closing questions

13. Are there any other vivid incidents that stand out to you? Perhaps issues you have not been able to overcome straight away?
14. Have you ever had to simply tolerate ill behaving IS, even for a short period?
(Ever anything *partially* resolved?)
15. Do you ever receive blame (rightly or wrongly); how do you respond to this?

Thank you very much for your time.

Appendix B. Participant information sheet

**Leeds University Business
School**

FACULTY OF BUSINESS



UNIVERSITY OF LEEDS

Participant Information Sheet

1. Title of research project:

'Means toward congruence in IS support: An Activity Theoretical Approach'

2. Invitation to participate

You have been identified as a suitable research participant. This sheet overviews the purpose of the research and the participant role. Please consider the points that follow. If any aspect remains unclear, please contact member(s) of the research team directly (details below). Participation is voluntary.

3. Explanation and purpose of the project:

 University offers a wide variety of IT/IS services. These require maintenance, however, and occasionally users may experience difficulties. The research focuses on how support personnel work to ensure that these essential services remain available to users.

4. Why have I been chosen?

Prospective participants are those working within an IS-support capacity; these people are naturally likely to have experience in overcoming IS-related difficulties.

5. Do I have to take part?

Not necessarily: it is your choice. Those choosing to participate may freely cease involvement at any point in the process, and will not be penalised for doing so.

6. What do I have to do; what will happen if I choose to participate?

You will be interviewed for approximately 30-45 minutes; this will happen at a time and location convenient to you. Questions will concern IS-related difficulties in general, and the procedure(s) for addressing them; it will then continue to specific instances and how they were resolved. All you have to do is respond to the questions as fully and honestly as possible; no responses will be considered incorrect.

7. Will I be recorded, and how will the recorded media be used?

If you give permission, interviews will be audio recorded, allowing subsequent analysis. This is not mandatory. The data will be temporarily stored on a password-protected voice-recording device. It will then be promptly transferred to secure servers belonging to the University of

Leeds, and the original copy wiped. Only the immediate research team will be authorised to access it.

8. What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

The research takes the first-hand accounts of individuals as its primary data source. The information sought during interviewing will focus on instances of IS-related difficulty and how (or if) it was addressed. Shortly following the interview, any audio recording will be transcribed word-for-word; this will then be analysed by the researcher using specialist software.

9. Are there any benefits of taking part?

By participating you would be contributing towards a more comprehensive understanding of how IS-related problem(s) and associated challenges are addressed, such that the work of user groups can continue.

10. Are there any disadvantages of taking part?

The only perceivable disadvantage is the time expended in participating in the interview.

11. Will my participation in the project be confidential; what will happen to the results of the research project?

Any information you provide during the interview will remain anonymous. It will not be possible to identify you as an individual, nor that specific information was provided by you, in any subsequent publications.

12. What will happen to the results of the research project?

The results will comprise part of the researcher's PhD dissertation, which is due in 2017 or 2018. In the interim and afterwards, anonymised results may be used in university presentations, conference proceedings and/or academic publications.

13. Who is organizing/funding the research?

The Economic and Social Research Council (ESRC) has issued a scholarship to the researcher and is funding the project.

14. Contact details

Primary Researcher	First Supervisor	Second Supervisor
Kristian Goddard	Prof. David Allen	Dr Stan Karanasios
bnklg@leeds.ac.uk	Da2@lubs.leeds.ac.uk	sk@lubs.leeds.ac.uk
+44(0)7449285367	+44(0)1133437015	+44(0)1133438687

Appendix C. Participant information sheet (financial incentive)

Leeds University Business School

FACULTY OF BUSINESS



UNIVERSITY OF LEEDS

Participant Information Sheet

1. Title of research project:

'Means toward congruence in IS support: An Activity Theoretical Approach'

2. Invitation to participate

You have been identified as a suitable research participant. This sheet overviews the purpose of the research and the participant role. Please consider the points that follow. If any aspect remains unclear, please contact member(s) of the research team directly (details below). Participation is voluntary.

3. Explanation and purpose of the project:

 University offers a wide variety of IT/IS services. These require maintenance, however, and occasionally users may experience difficulties. The research focuses on how support personnel work to ensure that these essential services remain available to users.

4. Why have I been chosen?

Prospective participants are those working within an IS-support capacity; these people are naturally likely to have experience in overcoming IS-related difficulties.

5. Do I have to take part?

Not necessarily: it is your choice. Those choosing to participate may freely cease involvement at any point in the process, and will not be **penalised** for doing so.

6. What do I have to do; what will happen if I choose to participate?

You will be interviewed for approximately 30-45 minutes; this will happen at a time and location convenient to you. Questions will concern IS-related difficulties in general, and the procedure(s) for addressing them; it will then continue to specific instances and how they were resolved. All you have to do is respond to the questions as fully and honestly as possible; no responses will be considered incorrect.

7. Will I be recorded, and how will the recorded media be used?

If you give permission, interviews will be audio recorded, allowing subsequent analysis. This is not mandatory. The data will be temporarily stored on a password-protected voice-recording device. It will then be promptly transferred to secure servers belonging to the University of

Leeds, and the original copy wiped. Only the immediate research team will be authorised to access it.

8. What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

The research takes the first-hand accounts of individuals as its primary data source. The information sought during interviewing will focus on instances of IS-related difficulty and how (or if) it was addressed. Shortly following the interview, any audio recording will be transcribed word-for-word; this will then be analysed by the researcher using specialist software.

9. Are there any benefits of taking part?

By participating you would be contributing towards a more comprehensive understanding of how IS-related problem(s) and associated challenges are addressed, such that the work of user groups can continue. You will also receive a £10 voucher for Amazon or a retailer of your preference, shortly after the interview.

10. Are there any disadvantages of taking part?

The only perceivable disadvantage is the time expended in participating in the interview.

11. Will my participation in the project be confidential; what will happen to the results of the research project?

Any information you provide during the interview will remain anonymous. It will not be possible to identify you as an individual, nor that specific information was provided by you, in any subsequent publications.

12. What will happen to the results of the research project?

The results will comprise part of the researcher's PhD dissertation, which is due in 2017 or 2018. In the interim and afterwards, anonymised results may be used in university presentations, conference proceedings and/or academic publications.

13. Who is organizing/funding the research?

The Economic and Social Research Council (ESRC) has issued a scholarship to the researcher and is funding the project.

14. Contact details

Primary Researcher Kristian Goddard bnklg@leeds.ac.uk +44(0)7449285367	First Supervisor Prof. David Allen Da2@lubs.leeds.ac.uk +44(0)1133437015	Second Supervisor Dr Stan Karanasios sk@lubs.leeds.ac.uk +44(0)1133438687

Appendix D. Consent form

Leeds University Business School

FACULTY OF BUSINESS



UNIVERSITY OF LEEDS

Participant consent form

Date: November 1st 2017

Research Project Title: 'Means toward congruence in IS support: An Activity Theoretical Approach'

Researcher Name: Kristian Goddard, bnklg@leeds.ac.uk, 07449285367

Please tick beside each statement to indicate that you agree:

I have read and understood the accompanying information sheet, the purpose of the research and my role as a participant. I have had the opportunity to ask question(s) where necessary and received satisfactory response(s).	
I understand that my participation is voluntary and that I can cease participation at any point, without providing rationale. Further, I understand that I do not necessarily have to answer every question asked.	
I understand that the interview audio data will be sent to a secure, UK transcription company for transcription, and that the subsequent anonymised transcription will only be accessed by the research team.	
I agree that my data may be anonymised and stored for use in future research.	
I understand that it will not be possible for me to be identified in any subsequent publications.	
I agree to participate in the <u>research</u> , and will make the researcher aware should my contact details change.	

Participant Name (Capitals):	
Participant Signature:	
Researcher Name (Capitals):	KRISTIAN GODDARD
Researcher Signature:	K. Goddard

Appendix E. Consent form (financial incentive)

Leeds University Business School

FACULTY OF BUSINESS



UNIVERSITY OF LEEDS

Participant consent form

Date: _____

Research Project Title: 'Means toward congruence in IS support: An Activity Theoretical Approach'
 Researcher Name: Kristian Goddard, bnklg@leeds.ac.uk, 07449285367

Please tick beside each statement to indicate that you agree:

I have read and understood the accompanying information sheet, the purpose of the research and my role as a participant. I have had the opportunity to ask question(s) where necessary and received satisfactory response(s).	
I understand that my participation is voluntary and that I can cease participation at any point, without providing rationale. Further, I understand that I do not necessarily have to answer every question asked.	
I understand that the data I provide will remain anonymous and only be accessed by the research team. I agree that my data may be anonymised and stored for use in future research.	
I understand that it will not be possible for me to be identified in any subsequent publications.	
I agree to participate in the research, and will make the researcher aware should my contact details change.	
I understand that I will receive a £10 voucher for Amazon or a retailer of my preference, shortly after the interview.	

Participant Name (Capitals):	
Participant Signature:	
Researcher Name (Capitals):	KRISTIAN GODDARD
Researcher Signature:	

Appendix F. Ethical approval for initial university

Research & Innovation Service
Level 11, Worsley Building
University of Leeds
Leeds, LS2 9NL
Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk



UNIVERSITY OF LEEDS

Kristian Goddard
Management Division
Leeds University Business School
University of Leeds
Leeds, LS2 9JT

**AREA Faculty Research Ethics Committee
University of Leeds**

28 February 2017

Dear Kristian

Title of study: Means towards congruency in academic work: An activity theoretical approach
Ethics reference: LTLUBS-112 Amendment Feb 17

I am pleased to inform you that your amendment to the research application listed above has been reviewed by the Chair of the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	Version	Date
LTLUBS-112 Amendment Application 2017.pdf	1	15/02/2017

Please notify the committee if you intend to make any further amendments to the original research as submitted at date of this approval as all changes must receive ethical approval prior to implementation. The amendment form is available at <http://ris.leeds.ac.uk/EthicsAmendment>.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at <http://ris.leeds.ac.uk/EthicsAudits>.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Victoria Butterworth
Research Ethics Administrator, Research & Innovation Service
On behalf of Dr Kahryn Hughes, Chair, [AREA Faculty Research Ethics Committee](#)

CC: Student's supervisor(s)

Appendix G. Ethical approval for £10 incentive

Performance, Governance and Operations
Research & Innovation Service
Charles Thackrah Building
101 Clarendon Road
Leeds LS2 9JT Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk



UNIVERSITY OF LEEDS

Kristian Goddard
Management Division
Leeds University Business School
University of Leeds
Leeds, LS2 9JT

**ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee
University of Leeds**

28 March 2017

Dear Kristian

Title of study: Means towards congruency in academic work: An activity theoretical approach
Ethics reference: LTLUBS-112 Amendment March 17

I am pleased to inform you that the above application for light touch ethical review has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee. I can confirm a favourable ethical opinion on the basis of the application form as of the date of this letter.

The following documentation was considered:

Document	Version	Date
LTLUBS- 112 Amendment Mar 17 - Amendment form_28th_Mar_2017.doc	1	28/03/2017
LTLUBS- 112 Amendment Mar 17 - consent_sheet_10_incentive.docx	1	28/03/2017
LTLUBS- 112 Amendment Mar 17 - Participant Information sheet 10 incentive.docx	1	28/03/2017

The Committee has made the following comments about you application:

- The committee is happy to approve this amendment. It's very modest, and there are no harms involved. You may want to reflect on incentivisation more generally as part of your PhD, but that is methodological rather than an ethical recommendation.

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at <http://ris.leeds.ac.uk/EthicsAmendment>.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at <http://ris.leeds.ac.uk/EthicsAudits>.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Victoria Butterworth

Research Ethics Administrator, Research & Innovation Service

On behalf of Dr Andrew Evans, Chair, [AREA Faculty Research Ethics Committee](#)

CC: Student's supervisor

Appendix H. Ethical approval to collect data from other universities

Performance, Governance and Operations
Research & Innovation Service
Charles Thackrah Building
101 Clarendon Road
Leeds LS2 9JT Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk



UNIVERSITY OF LEEDS

Kristian Goddard
Management Division
Leeds University Business School
University of Leeds
Leeds, LS2 9JT

**ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee
University of Leeds**

02 June 2017

Dear Kristian

Title of study: 'Means toward congruence'
Ethics reference: LTLUBS-112 Amend May 17

I am pleased to inform you that the above application for light touch ethical review has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee. I can confirm a favourable ethical opinion on the basis of the application form as of the date of this letter.

The following documentation was considered:

Document	Version	Date
LTLUBS-112 amendment May 17 amendment_may_22nd_2017	1	22/05/2017
LTLUBS-112 amendment May 17 blank diary	1	22/05/2017
LTLUBS-112 amendment May 17 consent sheet for IT pro interviews	1	22/05/2017
LTLUBS-112 amendment May 17 consent sheet university staff diary interviews	1	22/05/2017
LTLUBS-112 amendment May 17 info sheet IT pro individuals	1	22/05/2017
LTLUBS-112 amendment May 17 info sheet IT pro new organisations000	1	22/05/2017
LTLUBS-112 amendment May 17 info sheet IT pro new universities	1	22/05/2017
LTLUBS-112 amendment May 17 info sheet university staff interview and diaries	1	22/05/2017

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at <http://ris.leeds.ac.uk/EthicsAmendment>.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at <http://ris.leeds.ac.uk/EthicsAudits>.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Victoria Butterworth

Research Ethics Administrator, Research & Innovation Service

On behalf of Dr Andrew Evans, Chair, [AREA Faculty Research Ethics Committee](#)

CC: Student's supervisor

Appendix I. Ethical approval to outsource interview transcription

The Secretariat
Level 11, Worsley Building
University of Leeds
Leeds, LS2 9NL
Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk



UNIVERSITY OF LEEDS

Kristian Goddard
Management Division
Leeds University Business School
University of Leeds
Leeds, LS2 9JT

**AREA Faculty Research Ethics Committee
University of Leeds**

12 September 2017

Dear Kristian

Title of study: Means towards congruency in academic work: An activity theoretical approach
Ethics reference: LTLUBS-112 amendment August 17

I am pleased to inform you that your amendment to the research application listed above has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	Version	Date
LTLUBS-112 amendment August 2017 researcher's response.txt (by email)	1	05/09/17
LTLUBS-112 amendment August 2017 amendment_august_2017.doc	1	15/08/17
LTLUBS-112 amendment August 2017 info_sheet_aug_2017.docx	1	15/08/17
LTLUBS-112 amendment August 2017 consent_aug_2017.docx	1	15/08/17

Please notify the committee if you intend to make any further amendments to the original research as submitted at date of this approval as all changes must receive ethical approval prior to implementation. The amendment form is available at <http://ris.leeds.ac.uk/EthicsAmendment>.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at <http://ris.leeds.ac.uk/EthicsAudits>.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Jennifer Blaikie
Senior Research Ethics Administrator, the Secretariat

On behalf of Dr Kahryn Hughes, Chair, [AREA Faculty Research Ethics Committee](#)

CC: Student's supervisor(s)

Appendix J. Tabulation (Kajamaa and Engeström, 2014)

Table 3 An overview of the disruptions, mending efforts and mending solutions

Type of disruption	N	Mending effort		N	Mending solution	Total number of mending solutions
The patient's severe or worsening condition	59	Technical	17	55	12	41
		Cognitive-emotional	34		25	
		Extended collaborative	4		4	
		No mending efforts	4			
Information flow among the medical practitioners	31	Technical	11	29	9	20
		Cognitive-emotional	13		7	
		Extended collaborative	5		4	
		No mending efforts	2			
Division of labor of the medical practitioners	7	Technical	5	5	3	3
		Cognitive-emotional	0		0	
		Extended collaborative	0		0	
		No mending efforts	2			
Tools used in surgical care	32	Technical	26	30	25	29
		Cognitive-emotional	0		0	
		Extended collaborative	4		4	
		No mending efforts	2			
Complexity of care provision	21	Technical	9	17	6	13
		Cognitive-emotional	3		3	
		Extended collaborative	5		4	
		No mending efforts	4			
TOTAL	150			136		106

Appendix K. Critical incident log (first page)

+	Antecedents			Means towards congruence			Outcome – Congruence or otherwise				
	Incident no.	Interviewee no.	Description (Precursor to incident)	Area(s) of tension (Activity system(s) and component(s))	Initial efforts (Activity system, actor(s) and action(s))	Challenges, where applicable (Activity system(s), component(s)) and nature(s)	Additional efforts, where applicable (Activity system, actor(s) and action(s))	Description	Status of initial tension(s)	Broadened system (activity system, actors, nature and time)	Critical reflection
1	1	1	Addition Within institution, Involves or divides labour to among IT community Addition Within institution, Involves or divides labour to among user community The university commissioned a new TOOL for its users, "Clutter". SO MODIFICATION TO ADOPTION OF TOOL(S) OR RESOURCES) PERM FOR USERS which makes decisions and arranges email based on user behaviour. Some members of the IT community decided to apply with it. In the IT activity system, one staff member (COMPLUNITY) raised a formal complaint, it was "escalated" (NORM), i.e. STRAIGHTFORWARD FOLLOWING OF ESTABLISHED NORM(S) / RULE(S) / PROCEDURE(S) FOLLOW EVERYDAY CONVENTIONAL NORM(S) RULE(S) / PROCEDURE to the head of IT (SUBJECT), reflecting a source of TENSION.	Initially, ACADEMIC USER ACTIVITY SYSTEM SUBJECT head of IT engaged in INFORMATION EXCHANGE EFFORT(S) TO COMPREHEND EXPLAIN ISSUES OR REQUIREMENTS) i.e. BETWEEN SUBJECTS AND TEACHERS. She then "to build up a rapport with the person who was reporting to really understand what their problem was." She also engaged in INFORMATION EXCHANGE EFFORT(S) TO COMPREHEND EXPLAIN ISSUES OR REQUIREMENTS) i.e. AMONG IT and BETWEEN IT AND THIRD PARTIES to develop comprehension of relevant decision-making regarding its initial commissioning.	N/A	IT ACTIVITY SYSTEM By engaging in dialogue with the academic, the head of IT attained an ACCURATE DIAGNOSIS OF ISSUES OR REQUIREMENTS, a more accurate understanding of the academic's activity system. Rather than haphazard flouting the RULES, "business need" because "what or 'preyer' does not qualify for financial reimbursement. To reiterate, mere use of the academic's activity, in CHAT terms, this TECHNICAL TOOL, was not an achievement of its research-related OBJECT.	IT ACTIVITY SYSTEM By engaging in dialogue with the academic, the head of IT attained an ACCURATE DIAGNOSIS OF ISSUES OR REQUIREMENTS, a more accurate understanding of the academic's activity system. Rather than haphazard flouting the RULES, "business need" because "what or 'preyer' does not qualify for financial reimbursement. To reiterate, mere use of the academic's activity, in CHAT terms, this TECHNICAL TOOL, was not an achievement of its research-related OBJECT.	IT took the decision to keep the "Clutter" TOOL in place. This was based on the rationale that it suited the majority of users, and that it was possible to disable it. The complainant was not absolutely satisfied by this decision, from which it could be seen that it was not a "happy for you" off for you."	ACADEMIC USER ACTIVITY SYSTEM UN-ADDRESSED: "Clutter" TOOL remained switched on by default. Uninterrupted achievement of OBJECT shown to be a possibility. BETWEEN ACADEMIC USER & IT ACTIVITY SYSTEM: PRESUMABLY UN-ADDRESSED.	ACADEMIC USER ACTIVITY SYSTEM FUTURE: IT's refusal to disable Clutter uniformly means disgruntled academics have to disable Clutter themselves if desired i.e. MODIFICATION TO ADOPTION FOR USERS' BACKTRACKING CONDENSING OFF FUNCTIONALITY	The initial tension between the IT desk (as SUBJECT) and university member (as COMPLUNITY) was only partially resolved, from the angle that "Clutter" was not a continuous outright. At the same time however, if disgruntled users were permitted to deactivate the tool, the SHARE OF LABOUR USER ASSUMES SHARE OF LABOUR and ultimately disable it themselves, then their respective activities could indeed resume uninterrupted in its absence: an arrangement more aligned with, if not identical to, their wishes. Though they had to action it themselves, CONGRUENCE was an option for university members. This labour was not new however. It had in fact always been the case that users would have to disable Clutter themselves, but now they were more informed about this necessary.
2	1	1	Addition Within institution, Involves or divides labour to among IT community The university "would rather people use certain applications for data storage" (COMPLUNITY) decided to use OneDrive, (TECHNICAL TOOL), rather than a recommended alternative, SO MODIFICATION TO ADOPTION OF TOOL(S) OR RESOURCES) PERM FOR USERS. From the perspective of the IT activity system, decision-makers (SUBJECTS) were not prepared to hand the "black" of IT (SUBJECT).	Initially, ACADEMIC USER ACTIVITY SYSTEM SUBJECT head of IT engaged in INFORMATION EXCHANGE EFFORT(S) TO COMPREHEND EXPLAIN ISSUES OR REQUIREMENTS) i.e. BETWEEN SUBJECTS AND TEACHERS. She then "to build up a rapport with the person who was reporting to really understand what their problem was."	IT ACTIVITY SYSTEM By engaging in dialogue with the academic, the head of IT attained an ACCURATE DIAGNOSIS OF ISSUES OR REQUIREMENTS, a more accurate understanding of the academic's activity system. Rather than haphazard flouting the RULES, "business need" because "what or 'preyer' does not qualify for financial reimbursement. To reiterate, mere use of the academic's activity, in CHAT terms, this TECHNICAL TOOL, was not an achievement of its research-related OBJECT.	IT ACTIVITY SYSTEM By engaging in dialogue with the academic, the head of IT attained an ACCURATE DIAGNOSIS OF ISSUES OR REQUIREMENTS, a more accurate understanding of the academic's activity system. Rather than haphazard flouting the RULES, "business need" because "what or 'preyer' does not qualify for financial reimbursement. To reiterate, mere use of the academic's activity, in CHAT terms, this TECHNICAL TOOL, was not an achievement of its research-related OBJECT.	The initial decision to refuse reimbursement was overruled. In the IT provision activity system, it can reasonably be assumed that this decision would have eased the TENSION between COMPLUNITY member. The academic was able to have his Dropbox funded.	ACADEMIC USER ACTIVITY SYSTEM ADDRESSED: IT practitioners clarified "need" for software, expelling initially suspected tension. Whilst subsequently reimbursed, academic always able to use software towards OBJECT. BETWEEN ACADEMIC USER & IT ACTIVITY SYSTEM: ADDRESSED.	IT ACTIVITY SYSTEM FUTURE: Reimbursement decision ostensibly contradicted RULES and initial rejection decision, but these clarified. No evidence of time-subject tension. Subsequent decision informed both by policy, and by augmented appreciation of the academic's "business need" – interpreted here as an OBJECT that could be met by Dropbox. For the IT practitioner, this reflects that one of "a small number of cases" – IT practitioners reflect on the PERCEIVED PROPOSE- OBJECT of the IT activity system: "what we are here to do in IT, is enable the university to do its business effectively". She further reflects on LESSONS LEARNED FROM PRACTICE:	In the academic's activity system, it was not the case that they achieved the OBJECT by using the TECHNICAL TOOL. "we can't stop him using it". By authorizing its reimbursement therefore, it cannot be claimed that IT practitioners removed any such TENSION that outright prevented continued achievement of this OBJECT.	

Appendix L. Means list (first page)

Means towards <u>congruence</u>	
Definition of means towards congruence: Means towards congruence denote intentional, specific, and in the immediate, goal-driven actions, undertaken by Subjects individually and/or collaboratively with other(s) <u>e.g.</u> community member(s), the pursuit of which ultimately contributes towards instilling/ promoting/ bolstering/ supporting - but neither guaranteeing nor determining- continued/ongoing activity or activities, <u>i.e.</u> achievement of its/ their respective Object(s). That is, congruence. All 7 heterogeneous means are informed by empirical evidence, <u>i.e.</u> provided by IT practitioners asked about challenging episodes and their resolution. All are therefore associated with -and significant to- the same, rather than just representing any, arbitrary action(s): • Information ~~behaviour~~ (IB); • Working <u>together</u>; • Change(s) to/of tool(s)/ instrument(s)/ resource(s); • Conduct relative to rule(s) and/ or norm(s), <u>e.g.</u> adherence / change(s); • <u>Workarounds</u>; • <u>Bricolage</u>; • Improvisation. Intentional and overarching congruence <i>efforts</i> (comprising any number and/or assortment of <i>heterogeneous</i> and <i>interacting</i> means) may manifest due to: Past and/or present event(s), characterised with reference to contradiction(s) and/or challenge(s) to congruence; or neither, and instead simply indicate <u>e.g.</u> anticipatory and/or productive initiatives that do not perceivably overhaul the Object. Pink means I agree with the placement of evidence in May 2021.	
Column 1. Means (Pattern)	Column 2. Empirical evidence from critical incidents, <u>i.e.</u> instances of means. [Incident no.] and brief description of incident; snippet description of particular aspect(s) of/ in an incident; quote(s) <u>where</u> beneficial.
Information behaviour (IB)	User (subject) alerts to IT practitioner(s) (subject(s)) These may or may not indicate a lack of understanding on the part of those alerting, <u>e.g.</u> it could be a complaint and/or request. [1] Clutter. User communicated dissatisfaction with Clutter. [3] Big network thing, DDoS, etc. Users communicate various issue(s) <u>e.g.</u> email and printing. [4] ~~MyPrint~~ failure. Users communicate problem(s) printing. [10] Print server failure. "Pattern" of users contacting. [12] Retired academic. Contacted regarding email problem(s)

Appendix M. Challenges list (first page)

Areas of challenge	
• Tool(s)/ instrument(s)/ resource(s); • Comprehension and/or understanding of the issue(s) and/or situation <u>faced</u>; • Social <u>conflict</u>; • <u>Labour</u>; • Adherence to rule(s) and/or norm(s); • <u>Unrealised</u>, potential risk(s). Pink means I agree with the placement of evidence in May 2021. In each area of challenge, there is also post-referral re-assessment, from exercise Aug/Sept/Oct 2024, identifying challenges to and/or associated with means, and therefore overarching congruence efforts [inserted 9th Oct 2024]. Also, there has/have been one or more adjustment(s) in 2025 [2nd Feb 2025].	
Column 1. Challenge (Pattern)	Column 2. Empirical evidence from critical incidents, <u>i.e.</u> instances of means. [Incident no.] and brief description of incident; snippet description of particular aspect(s) of/ in an incident; quote(s) <u>where</u> beneficial.
Tool(s)/ instrument(s)/ resource(s)	Any activity. Objective state of tool(s), resource(s), documentation prescribed or available. May refer to improvised and/or bricolage product(s). Could be insufficient/ poor because lacking in some respect, overly complicated or badly designed/ heavily upgraded. Also refers to instances where a tool is unavailable for some reason. Ordinary use may be burdensome, tricky, laborious, etc. [3] Big network thing, DDoS, etc. Various issue(s) <u>e.g.</u> email and printing. Reflects tension(s) regarding tool(s)/ resource(s) of user activities; challenged congruence of user activities. Means underway, <u>e.g.</u> IB user alert, but IT network tool(s) failed. Reflects tension(s) regarding tool(s)/ resource(s) of IT activities; challenged congruence effort(s). “Whilst they have sort of things that normally would flag up these problems with the network, it wasn’t showing up, everything was green”. [4] MyPrint failure Problem(s) printing. Reflects tension(s) regarding tool(s)/ resource(s) of user activities; challenge(s) to congruence of user activities. Interviewee recalls instances whereby “MyPrint servers are down” at times where “people need to print” and “work is really critical that day”. [5] Problem printing colour IT practitioner could not print in colour. Reflects tension(s) regarding tool(s)/ resource(s) of IT activity; reflects challenge(s) to congruence of IT activity. Means underway, <u>e.g.</u> interviewee adhered to norm by consulting driver stash, but this presented issue(s). Reflects tension(s) regarding tool(s)/ resource(s) of IT activity; challenged congruence effort(s).