The University Of Sheffield.

What you lookin' at?

Capturing visual engagement with urban street edges towards an understanding of how to make them more experientially engaging.

By:

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The University of Sheffield
Faculty of Social Science
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Dedicated to

Jackie Simpson (Müt)

1957-2017

Abstract

What you lookin' at? is a conceptual exploration, building upon existing theory, and subsequent empirical examination of urban street edges. The reason for doing this is to develop a progressive knowledge foundation from which to answer the question - *how might we be able to create more experientially engaging urban street edges?* This is in an attempt to aid in addressing not only real-world problems that are impacting urban street edges but also theoretical issues stemming from how we think about street edges (knowledge issues) and act when seeking to change them (practice issues). In order to address these issues and answer the overarching question an innovative data collection method was employed – real world mobile eye-tracking – along with progressive analytical techniques developed. These provided new empirical and direct insight into urban street edge engagement, establishing a robust evidence-base for the development of new ideas.

The findings from the current investigation start to focus upon the need to facilitate the territorial appropriation and personalisation of experientially significant ground floor edge spaces, or *segments*. This is whilst building upon the new empirical understanding that street edges are engaged as socio-spatial realms; multi-scalar assemblages comprising morphological infrastructure and experientially significant territorialised realms; multifaceted entities in their own right, yet experientially entwined with adjacent streets establishing a complex experiential multi-directionality and that engagement with them is influenced by the territorial establishment of affordances within their ground floors.

The ideas developed during the current investigation make a significant and unique contribution to a growing body of progressive urban edge and interface works, which seek to help deliver more experientially rich and socially beneficial urban environments for people to inhabit and use. Overall, the current investigation innovatively establishes a significantly stronger, evidence-based understanding of how to make street edges more experientially engaging for street inhabitants going about their everyday lives.

Acknowledgements

The work undertaken is dedicated to my mum Jackie Simpson (Müt). I am not sure you would have read the whole of my thesis… but it makes a good coffee-table book and hopefully you would have been proud to have it on display.

First and foremost I would like to thank my wife Kimberley. Without her none of this would have been possible. I am sorry it took me so long to write and that you have had to put up with my boring ramblings a little too often. Long may it continue…

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Thwaites, K., **Simpson, J.** & Simkins, I. M. (In Review) Transitional Edges: towards development of a socio-spatial evaluation toolkit for urban street interfaces. *Urban Design International.*

Declaration by the author

I declare that this thesis is an original report of my research, has been written by myself and has not been submitted for any previous degree or professional qualification. The experimental work is entirely my own work; any collaborative contributions have been indicated clearly and acknowledged. Due references have been provided on all supporting literatures and resources.

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Chapter 1

Introduction

If the edge fails, then the space never becomes lively.

Alexander et al., 1977, p.600

For over 50 years many writers and researchers have detailed the social and experiential significance of *edge* interfaces, which span the division between indoor and outdoor urban realms (Figure 1). Even though this is the case, there has been widespread inability to deliver experientially rich and appealing urban edges for people to inhabit and use during their everyday lives. The result is an abundance of edges in contemporary towns and cities that are uninteresting, monotonous, characterless and disengaging. The current investigation aids in addressing this issue, specifically within an urban street context. It does this by providing new empirical and direct insight into how people experience street edges through the use of a currently underutilised data collection technique – *real-world mobile eye-tracking*. The data gained subsequently evidences new and progressive knowledge foundations influencing how change within street edges is approached in order to make them more socially and experientially responsive. In doing so, this current investigation contributes to the growing body of ideas that seek to address issues that are currently impacting urban streets and edge interfaces, whilst answering the overarching question –

How might we be able to create more experientially engaging urban street edges?

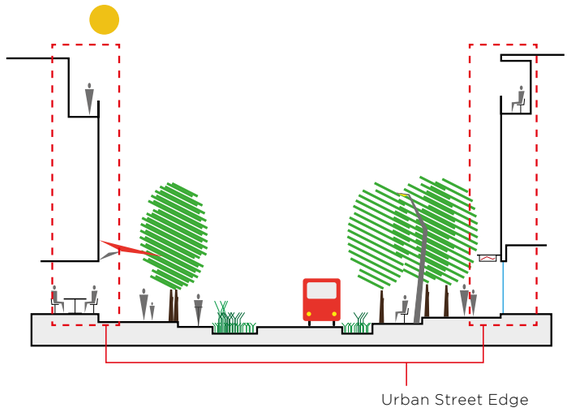


Figure 1 – Urban Street Edges

Part 1: Thesis structure

The investigation is structured as follows, in order to develop and contribute ideas that answer the question posed –

Chapter 1 – Introduction, looks to examine the overarching question presented in greater detail and discuss why such an inquiry is needed. This is followed by a discussion that defines the scope of streets and edges of specific interest.

Chapter 2 – Critique of problems and issues with urban street edges towards aims and objectives, builds upon the initial ideas forwarded within Chapter 1 through a review of existing literature detailing real-world issues that are impacting contemporary street edges. This is in order to establish what aspects of these realms require specific attention, towards a focus upon the contribution that professional decision-making has made to the problems raised. It then moves onto a theoretical discussion, again building upon existing arguments, highlighting how real-world issues stem from how we think about the edge (knowledge issues) and act when seeking to change it (practice issues). The investigation's aims and objectives are then introduced, which are established in direct response to the practice and knowledge issues examined.

Chapter 3 – Conceptual Edge Framework (CEF), starts to establishes a new philosophical and theoretical urban street edge conceptualisation explicitly, focused from the perspective of human experience whilst inhabiting streets. It does this by reviewing contemporary forward-thinking built environment literature in a creative way; incorporating and progressing ideas towards the formation of an evidence-based conceptual foundation. This subsequently informs working hypotheses and research questions (Chapter 5). Methodologically the process is a key part of the investigation's progressive exploration of street edges rather than solely a literature review that lays out the current state of knowledge. An important aspect within the development of the CEF is the way in which the street edge ideas forwarded are *socio-spatial* considerate. The term socio-spatial is used throughout the investigation, distilling how urban settings, such as street edges, are manifested as a complex interconnectedness of human social processes and actions along with spatial and material properties. The term also acts as an epistemological foundation, which becomes useful when examining the nature of urban street edge experience (Chapter 6) and thus the conceptual ideas detailed within the CEF. As a mindset, socio-spatial thinking incorporates the essential need for assessing the relationship between spatial and locational significant qualities (where someone is), in conjunction with people's everyday social desires, needs and activities (what someone is doing), when seeking to capture and comprehend realistic experience of these multifaceted settings.

Chapter 4 – Methods Framework, sets out the investigative approaches used to empirically examine specific ideas developed within the conceptual edge framework (CEF – Chapter 3). Significant within this is a reflection upon issues impacting existing data collection methods. New data collection and visualisation techniques are subsequently introduced in response to these issues, which could provide opportunity to establish a more realistic, detailed and direct insight into how people experientially engage street edges. This builds upon previous investigations exploring the capabilities and potential of *real-world mobile eye-tracking* (Simpson, 2014; Uttley et al., 2018).

Chapter 5 – Research Questions, introduces a number of working hypotheses and subsequent questions. Rather than detailing these factors earlier within the investigation the intention is to initially establish in-detail at a conceptual level what requires specific examination (Chapter 3 – conceptual edge

framework) and then explore how such ideas might be examined through progressive methodological techniques (Chapter 4 – methodological framework). A sound foundation is therefore provided from which hypotheses and research questions can be forwarded that are focused and responsive towards specific theoretical and methodological considerations.

Chapter 6 – Research Investigation, introduces the study that was undertaken to obtain data used to answer the questions posed (Chapter 5). During this, a range of participants walked a number of differing streets that had variable street edges (spatial settings) whilst carrying out different everyday tasks (social processes). Throughout they wore a mobile eye-tracker, which captured their visual engagement with the environment and urban street edges around them.

Chapter 7 – Results, presents the findings from the eye-tracking walks undertaken (Chapter 6). The insights gained are discussed in response to the research questions and working hypotheses (Chapter 5) and thus distinct aspects of the conceptual edge framework (CEF – Chapter 3). This starts the process of refining ideas examined within the framework in line with how urban street edges are realistically experientially engaged by people.

Chapter 8 – Discussion and Application, explores study findings and evidence responding to the working hypotheses (Chapter 7) within the context of the theoretical issues posed (Chapter 2). Importantly, the discussion also examines how the new empirical insights gained can address points raised within the knowledge and practice aims and objectives (Chapter 2). The intention is, therefore, to detail evidence-based ideas that can influence how we think about urban street edges (considerations responding to knowledge issues) and importantly how we should act when seeking to change these realms (considerations responding to practice issues). A discussion is then undertaken exploring how the ideas forwarded can influence the real-world urban street edge issues, also introduced within Chapter 2. Finally, their is a discussion detailing methodological considerations, stemming from the use of mobile eye-tracking, and an examination of the current investigation's limitations.

Chapter 9 – Conclusion, summarises the investigation that took place and looks to ultimately address the overarching question posed - *How might we be able to create more experientially engaging urban street edges?* It also discusses output and impact resulting from the study as well as directions for future research. During this, the unique contribution of the work to existing urban street edge ideas is highlighted.

Bibliography – highlights the references that were used throughout the current investigation.

Glossary – contains a number of key terms used throughout the current investigation

Part 2: *How might we be able to create more experientially engaging urban street edges?* – Why is this important?

Today urban streets are not solely seen as practical corridors for the efficient movement of people and goods around urban areas. They are instead required to fulfil a wide range of social functions (Gutman, 1986; Moudon, 1987; Bobic, 2004; Jones et al., 2007a; 2007b; Gehl, 2010; Glaser et al., 2012; Mehta, 2013; Harvey & Aultman-Hall, 2016). They are seen as significant contributors towards addressing urban sustainability agendas within design guidance (DETR, 1998; UTF, 1999; Llewewlyn-Davies, 2000; CABE, 2007; DfT, 2008; PPS, 2008; NACTO, 2013; GDCI, 2017), providing a space within which a liveable, safe and healthy city can develop (Gehl, 2010). Even though this is the case, the built edge interfaces that regularly define streets have become challenging components of contemporary urban environments to get right socially and experientially (Bobic, 2004; Glaser et al., 2012; Thwaites et al., 2013). This is important, especially when reflecting upon the way they can significantly contribute towards enriching people's everyday lives –

> *On East Houston Street in Lower Manhattan, the small-lot urban fabric between Orchard and Ludlow was replaced in 2006 by a whole foods grocery store that presents a nearly unbroken swathe of smoked glass for much of the entire city block. Volunteers who joined our psychological tours of the neighbourhood reported feeling markedly less happy on the pavement outside this facade than almost anywhere else on their tour. They felt much better once they got to a grittier but lively stretch of shops and restaurants just a block east on Houston.*
>
> *This points to an emerging disaster in street psychology. As suburban retailers begin to colonise central cities, block after block of bric-a-brac and mom-and-pop-scale buildings and shops are being replaced by blank, cold spaces that effectively bleach street edges of conviviality. It is an unnecessary act of theft, and its consequences go beyond aesthetics, or even the massive reduction in the variety of goods and services that results when one giant retailer takes over a block. The big boxing of the city harms the physical health of people living nearby.*
>
> Montgomery, 2013, p.166-167

It has been known for some time that edge settings play a significant role in defining the social as well as experiential qualities of contemporary urban environments (most recently – Bobic, 2004; Gehl et al., 2006; Gehl, 2010; Porta & Romice, 2010; Speck, 2012; Thwaites et al., 2013; Metha, 2013; Heffernan et al., 2014; Mantho, 2014; Dovey & Wood, 2015; Ellard, 2015; Kickert, 2016; Goldhagen, 2017). They often characterise whether public spaces, such as streets, are inviting; encouraging people to inhabit these spaces and experience what they have to offer. In other words, when engaging they make streets convivial, experientially exciting and enjoyable places in its own right (Jones et al., 2007b; Jones & Boujenko, 2009; Speck, 2012; Ellard, 2015). Montgomery (2013), in the above quote, highlights this in relation to the qualities of Houston. However, edges also have the potential to be disengaging and uninteresting; restricting opportunities for people to occupy, experience and enjoy them, witnessed

by Montgomery on East Houston Street. Within these situations, street edges often focus experience away from the locale, manifesting the open space more as a characterless *link* connecting locations within the built environment together with limited locational qualities or *hereness* (Cullen, 1971; Jones & Boujenko, 2009; Thwaites et al., 2013).

Hinted at in the Montgomery (2013) quote is the way that variations in the characteristics of urban street edges can have a positive or detrimental effect upon the psychological and physical well-being of urban inhabitants. Ellard (2009; 2015) has echoed similar points, highlighting from a psychogeographical context how urban environments, and with some focus upon street edges, can manifest feelings of affection, lust, boredom, anxiety and awe. Romice et al. (2016) reviewed in detail such benefits at a pedestrian scale. They discussed the influence of urban settings, of which the street edge is a core component, upon material well-being; emotional and personal development; interpersonal relationships and physical well-being, all of which engaging edges have the potential to contribute towards positively. This is similar to Goldhagen (2017) who details how the physical built environment *shapes our lives* through impacting, often negatively, every aspect of contemporary urban living. For Gehl (1987; 2010) such ideas are manifested within the need for a *good city at eye level*, where urban edges provide opportunity for human protection, comfort and delight. Similar ideas can be seen within the work of Glaser et al. (2012) whilst focusing on the benefits of human-orientated ground floors. From a more socially focused outlook Thwaites et al. (2013) and Mehta (2013) have discussed the potential of good urban streets and edges for promoting human interaction. The restorative potential of these realms has also been explored by Lindal & Hartig (2013) and Thwaites et al. (2013), and their influence upon the walkability and liveability of urban settings has been discussed (Ewing & Clemente, 2013). However, even though these understandings have started to be progressed there is still an overwhelming lack of empirical evidence detailing how these complex places are experientially engaged from the direct perspective of street inhabitants (Heffernan et al., 2014; Kickert, 2016; Harvey & Aultman-Hall, 2016) –

> *There is ample opportunity for a more empirical, efficient, and widespread measurement of physical characteristics and human experiences within urban streetscapes.*
>
> Harvey & Aultman-Hall, 2016, p.155

Developing such an understanding is essential for ensuring the future prosperity and sustainability of urban environments. More so than ever, decision-makers are being required to make sure that urban contexts and thus streets and edges are future proofed. A level of resilience needs to be engrained within them to ensure their prosperity within times of potential social or economic change (Porta & Romice, 2010; Tarbatt, 2012; Feliciotti et al., 2016). Recent influences have already negatively impacted urban streets edges, to be explored in more detail later within Chapter 2 (Jones et al., 2007a; Griffiths et al., 2008; Carmona, 2015). With the potential for more uncertainty, these spaces are going to need to be ready for greater levels of change, to ensure that they stay relevant for the requirements of society and remain engaging places in the future (Thwaites et al., 2007; Porta & Romice, 2010; Romice & Porta, 2015). These notions are given heightened significance with streets quickly becoming the most

abundant area of public open space within many urban areas (Jones & Boujenko, 2009; UN-Habitat, 2013). Combined with the increasing rate of urbanisation and the fact that urban environments are becoming denser (UN-Habitat, 2013), there needs to be a stronger understanding about how today's urban street edges affect people and impact their lives. Within this, there is then opportunity to highlight how street edges can become more experientially engaging components of contemporary and future urban environments, which is the intention that underpins the current investigation.

Recently, the opportunity to make streets and their edges more engaging places for people has started to be made possible through the development of a number of progressive built environment texts. These will be detailed and used within the development of the conceptual edge framework (CEF – Chapter 3). So far, however, the ideas forwarded have often struggled to embed themselves within mainstream decision-making and practice, which is an issue apparent across wider urban planning and design (Cuthbert, 2007; 2010; Punter 2011; Marshall, 2012; Thwaites et al., 2013; Foroughmand Araabi; 2017). A lack of empirical and experientially focused foundations (explored within Chapter 2), which can be used to add evidence towards arguments for a progressive re-consideration of street edges, is a potential reason for this. This is something that this current investigation intends to contribute towards.

Part 3: What are the urban streets and edges of interest?

Streets are an ancient and ubiquitous component of urban environments, the linear spatial dimensions and nature of which can be seen within even the earliest built environments (Kostof, 1991; Moughtin, 1992; UN-Habitat, 2013). Today however these complex settings, and the built edges that define them, have undergone transition and change making them almost unrecognisable when viewed in relation to streets of previous ancient settlements.

Contemporary city centre urban streets and high streets, especially in a Western and notably UK context, have their roots within the rapid industrialisation of the nineteenth century (Kostof, 1991; Mehta, 2013). Streets of commerce and social interaction had existed before. But, during this period spaces were needed en mass to accommodate the expansive growth in retail that sought to deliver the new industrial age to consumers as well as accommodate an expanding population (Dawson, 1988). As a consequence, streets and thus street edges began to evolve around existing centres creating a hierarchical urban infrastructure of innate complexity, reminisces of which can still be seen today (Jacobs, 1993; Bosselmann, 1998). Significantly, development and change since this rapid urban expansion has not ceased (UN-Habitat, 2013; Carmona, 2015). Urban streets and street edges are still continually shifting and being re-developed in-line with societal needs and trends. This has brought us to today where these public open spaces are facing challenging issues going forwards as well as new and exciting opportunities (Griffiths et al., 2008; UN-Habitat, 2013).

The current investigation intends to focus upon street edges within a UK urban context, using Sheffield as an investigation site. The chosen methodology, real-world mobile eye-tracking to be introduced

within Chapter 3, as well as timeframe and scope of the investigation meant that a practical and pragmatic decision needed to be made to use this singular location. It should be noted, however, that even though concentrating upon the study of a range of street edges within Sheffield the intention is not to pass comment upon street edges specifically in relation to this context. But, construct an in-depth understanding of street edges that are beginning to typically characterise UK urban areas (Figures 2 highlighting examples). Importantly, in relation to this, Punter (2010); Thwaites et al. (2013) and Madanipour et al. (2018) have discussed how the built environment of central Sheffield has often mirrored the successes and failures of many other UK urban environments, making it a useful study location.

Figure 2 – Urban street edge examples, Sheffield, UK

To help highlight exactly what streets and street edges are of particular interest the following quotes

from previous investigations, along with street photos denoting particular street typologies (Figures 2), aid in highlighting the scope of the streets and thus the edges to be examined. Fundamentally, the streets to be explored within the current investigation –

> *Encompass the range of mixed commercial streets that bisect traditional cities and that encompass retail streets of strategic significance, but also the continuous mixed corridors that typically extend from these cores and which are primarily of local significance.*
>
> Carmona, 2015, p.3

Beyond this, they are regarded as –

> *A complex and dynamic socio-spatial entity that is increasingly facing particular challenges to its vitality and viability in the light of ongoing economic and cultural change within society.*
>
> Griffiths et al., 2008, p.1155

This current investigation is therefore seeking to explore specifically mixed-use streets that characterise city centre urban contexts and are significant to their everyday functioning and vitality. They are also, however, streets that are feeling the force of social transitions and developments influencing their character and potential as usable and engaging spaces for street inhabitants. A wander around current urban streets, notably within the UK, begins to start reinforcing this last point with streets and their edges often facing challenges at the hands of recent societal shifts. This is a phenomenon somewhat at odds with the sustainability agendas as well as progressive edge concepts mentioned earlier, which will be explored in greater detail within Chapter 3. Overall, human engagement with existing urban street edges can often be a disjointed and disengaging experience influenced by a range of factors to be discussed within Chapter 2.

In relation to the terms adopted, urban street, urban street edge and street edge have already been used during the discussion so far and will continue to be used for a coherent discussion, occasionally being shortened to street and edge. It should be noted, however, that the use of the term edge relates specifically to street edges, not wider urban edges, the specifics of which will be introduced later.

Initial foundations - moving forwards

Now that the structure and initial rationale for this current investigation have been established the intention is to examine, through the use of existing debate, what specific influences are impacting the ability of street edges to be engaging components of contemporary urban environments.

Chapter 2

Critique of problems and issues with urban street edges towards aims and objectives

The current chapter starts by using existing discourse to outline and assess real-world issues that are impacting the experiential qualities of urban street edges (Part 1). The motivations for this are to understand in detail what aspects of street edges require specific attention whilst examining the potential reason for such problems. During this, the conversation will begin to introduce the negative influence of professional practice and expert design decision-making in relation to street edges. This establishes the foundation for the analysis within Part 2, which directs the conversation towards the development of aims and objectives that the subsequent investigation will look to address. These focus upon knowledge issues associated with how we think about street edges, with subsequent knowledge objectives and a specific knowledge aim; as well as practice issues attributed to actions when seeking to change these realms, with subsequent practice objectives and specific practice aim. Through addressing these aims and objectives there will be opportunity to comment on how it might be possible to influence street edges in the future, for the experiential benefit of street inhabitants, and tackle the real-world issues introduced within Part 1.

Part 1: Real-world issues with urban street edges

An ever-increasing population size, combined with an economic system that often regards regeneration and growth as a measure of its prosperity, has meant the scale, rate and turnaround of new development within urban areas has increased dramatically over recent years (Bobic, 2004; Griffiths et al., 2008; Carmona, 2015; Goldhagen, 2017). This has allowed towns and cities around the world to develop and expand in-line with societal shifts, often providing people with safer, more liveable urban environments (Jenks et al., 1996; Punter, 2011). Drawbacks associated with these recent urban changes are however noticeable, especially in relation to urban street edges. The following discussion will use salient points within existing debate, which are focused from the perspective of the street and edge user, to introduced real-world factors that are negatively impacting the potential of street edges to be experientially engaging.

Homogenisation and scale

> *Basically, the slight differences between brands of washing machines in store windows have something in common with the differences between new developments in the landscape. New developments are functional, slightly different in form from the others, but without structural strength and identity.*
>
> Bobic, 2004, p. 26

Many have argued that modern urban environments, along with their associated urban street edges, are starting to look and feel the same regardless of location due to shared aesthetics, the adoption of a common design language and through similarities in functions provided – they are becoming *homogenised* (Bobic, 2004; Punter, 2011; Speck, 2012; Ellard, 2015). Discourse reflecting upon this topic highlights how homogenisation is taking place across two scales that have the potential to impact people's experiential engagement with street edges. Firstly, it is happening at an overall building / development level that is often disconnected in terms of scale from people inhabiting the street (Holston, 1989; Bobic, 2004; Habraken, 2005; Porta & Romice, 2010; Punter, 2011; Speck, 2012). Secondly, it is taking place through the *cloning* of facilities that populate ground floor edge spaces (Wrigley et al., 2002; Simms et al., 2005; Jones et al., 2007a; Griffiths et al., 2008; Ellard, 2015). As a consequence, these commonalities are sterilising opportunity for variable social and experiential richness within streets, as well as limiting the ability of street edges to contribute towards the wider cultural identity and conviviality of engaging built environments (Jacobs, 1961; Lofland, 1998; Kohn, 2004; Gehl, 2010; Ellard, 2015; Goldhargen, 2017).

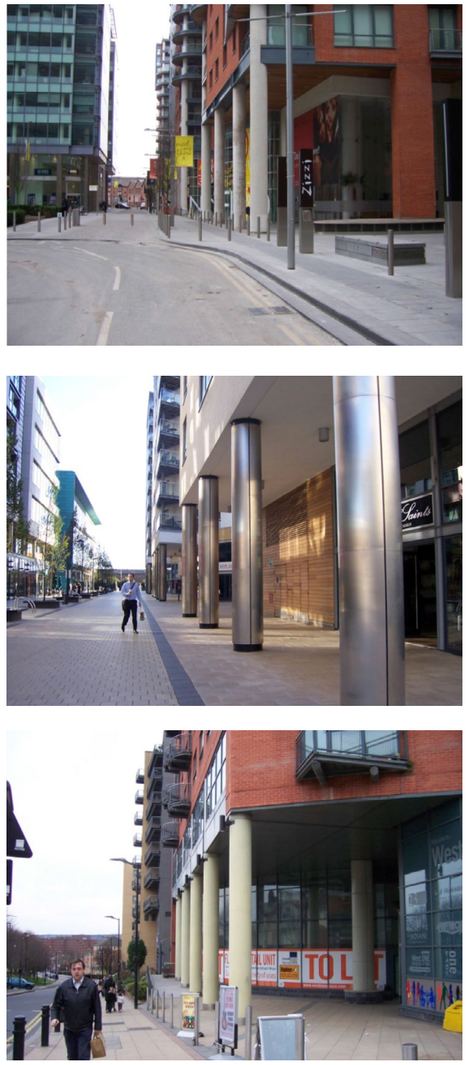


Figure 3 – Homogenised street edges

At the larger scale, buildings and wider developments are beginning to look the same. Bobic (2004), whose quote started this section, has highlighted how modern developments are noticeably similar and lack variable richness within their street edges. Punter (2011) has detailed the impact of stock modern development typologies following the Urban Renaissance on UK streetscapes and edge interfaces. Thwaites et al. (2013) builds upon the work of Punter (2011) furthering the discussion from an edge perspective whilst describing the social impact of edge homogenisation. The work of Porta & Romice (2010), regularly referencing Habraken (2005) and whilst not explicitly mentioning homogenisation, explores a similar argument that aligns with these other thinkers. Holston (1989) detailed an extreme example of homogenisation through a critique of Brazilia, which Gehl (2010) similarly explores during his criticism of modernist design principles. Many have also linked the issue of building and development homogenisation with the way globalisation has impacted the morphology of urban environments (Habraken, 2005; Kickert, 2016; Goldhargen, 2017). The discussion will build upon this point later.

A visual example of large-scale homogenisation across three different UK contexts can be seen within Figure 3. Each photographed edge, and their constituent buildings, display stark similarities in the design styles adopted whilst also being disconnected in scale in relation to street inhabitants. Such buildings resemble a generic and disjointed object dropped into the built environment rather than a contributing component evolving from its existing fabric (Holston, 1989; Gehl, 2010; Porta & Romice, 2010). Noticeable is how an engaging and rich, human-orientated edge and streetscape providing opportunity for comfort, protection and delight is not a primary consideration (Gehl, 2010; Thwaites et al., 2013). Instead the buildings are experientially disengaging street users through their uniform monotony and disconnected scale rather than creating an interesting and enjoyable *place* to inhabit (Montgomery, 2008; Ellard, 2015).

Moving down from the building to a ground floor scale, the term *clone town* has been used to highlight how some UK city centre edges are becoming noticeably similar (Simms et al., 2005). This limited variety has often been caused through chain store dominance (Simms et al., 2005). Wrigley et al. (2002) explored this topic and its significant negative impact upon the small-scale informal economy during a detailed investigation of the Seacroft Development in Leeds. Simms et al. (2005), who coined the term clone town, undertook an extensive survey of UK city streets to highlight their noticeable lack of diversity and widespread homogenisation. Jones et al. (2007a) raised a similar argument whilst advocating the need to create mixed-use streets. More recently Speck (2012); Montgomery (2013); Ellard (2015) and Goldhagen (2017) have also discussed the impact of such function-based homogenisation, albeit from a more US centric perspective.

Significantly, ground floor edge homogenisation does not only provide people with the same facilities, regularly retail. It also makes edges look the same at a human eye-level through uniform, often predicable branding and advertising as well as commonalities in overall frontage design (Simms et al., 2015; Jones et al., 2007a; Speck, 2012). Ellard forwards this as *genericization*, where *– economics, image and a reluctance to include design features that may run counter to the function of a building* (2015, p.120) play dominant roles. Importantly, he goes on to describe how this negatively impacts people's engagement with these realms through fostering a level of boredom and experiential disengagement. Goldhagen (2017) explores this issue from a cognitive psychology perspective and how it impacts the liveability of contemporary urban environments. Similarly, Degan & Rose (2012) detail homogenisation's detrimental experiential impact, from a sensory viewpoint, describing –

> *It's "a town centre, the same as any other town centre", as one of our respondents averred. Memories of other visits to such places seem to be working, not only to mediate sensory encounters by making comparisons between them, but also to develop a typology of places which has the effect of making them less interesting, less engaging, and with less sensory impact.*
>
> Degan & Rose, 2012, p. 3282

Reflecting upon the issues described, it is noticeable how the problems spanning both scales resonates with what Relph (1976) forwards as *placelessness*. This term characterises settings that lack a *sense of place* due to limited grounding within their surrounding environment. This can be socially manifested, in terms of the setting's relationship to the people that occupy and engage with it, or in response to the inherent complexities of its physical context either in terms of scale or aesthetics (Cresswell, 2015). Relph subsequently discussed how placelessness negatively impacts people's perception of settings, a point resonating with Degan & Rose (2012) and Goldhagen (2017) as well as Montgomery (2013) and Ellard (2015) who both reflect upon this explicitly in relation to building edges. Muminovic & Radovic (2011) argue a similar point, significantly whilst starting to detail professional practice's influence upon homogenisation, which the following discussion will build upon –

> *Furthermore, an increasing lacking connection with locality, together with general tendency towards homogenization in design expression, have been associated with proliferation of non-places.*
>
> Muminovic & Radovic, 2011, p. 1

This focus upon design practice is similar to ideas forwarded by Richard Rodgers and the Urban Task Force (UTF, 1999). They argued that development professions as well as those regulating them, notably the planning system, have created problems through becoming tolerant of lazy and over-used designs and generic layouts that lack sensitivity to their context. This is a point also argued by Punter (2011) and others such as Bobic (2004) and Thwaites et al. (2013). Gehl (2010) sees this social and experiential insensitivity demonstrated within the failures of quick-delivery modern developments to provide human-scaled design solutions. For him, urban environments, of which the street and particularly street edge is a key component, should be responsive to human dimensions, which is similar to the arguments of Bobic (2004), Glaser et al. (2012) and Speck (2012). This is not only in terms of scale, measured off and proportional to the human body, but also in response to people's dynamics of movement and sensory system,

thus aligning with the *proxemics* of Hall (1966). Again, Gehl (2010) and Speck (2012) forward that the professionalised system in charge of environment change is a major reason for this lack of human focus and homogenisation –

> *This fact seems to be lost on architects, especially the big names, whose unspoken goal is to claim as much territory as possible for their trademark signature, even if it means a numbingly repetitive streetscape.*
>
> Speck, 2012, p.246

Ellard (2015) and Goldhargen (2017) similarly explore how these issues, and specifically the *genericization* of urban street edges, are a professional problem whilst focusing upon the influence of current architectural training, established upon post-modern and technological mind-sets. Habraken (2005) and Porta & Romice (2010) forward a similar point through exploring cultural issues stemming from architectural education and its theoretical foundations.

Overall, existing discourse highlights that a number of urban contexts and street edges are becoming homogenised. This is at the same time becoming disconnected in scale from the humans that inhabit them. Market drivers and economics are inevitably influencing (Glaeser, 2011; Goldhagen 2017). However, many have also detailed how professional design decision-making has contributed towards these issues. Within such decision-making there is often preference towards off-the-shelf, generic building and development designs that offer spaces for edge-cloning businesses rather than provision of spaces that can promote rich and varied edges. As a result, some urban street edges are starting to look and feel the same, regardless of context. They are lacking localised specific qualities that can positively engage the population using them; they are becoming *placeless* (Relph, 1976). Here, the built environment, which has the potential to promote beneficial experiential and psychological effects within everyday life (Montgomery, 2013; Ellard, 2015; Romice et al., 2016; Goldhagen, 2017), is instead sterilising everyday opportunities for engaging urban street edges.

Abruptness of division between indoor and outdoor realms

In 2006, Gehl et al. defined a built edge typology whilst exploring the significance of permeability and transparency upon edge engagement. This used work stemming from their earlier studies (Gehl, 1987), and the investigations of earlier pioneers such as Lynch (1960); Cullen (1971); Alexander et al. (1977) and Whyte, (1980). The study attempted to address the noticeable trend towards urban edges that fail to promote experiential richness and sensory potential across their division of indoor and outdoor realms; a trend that is still noticeable today and discussed by many (Bobic, 2004; Glaser et al., 2012; Speck, 2012; Heffernan et al., 2013; Thwaites et al., 2013; Montgomery, 2013; Ellard, 2015; Kickert, 2016). Within these situations the opportunity from street inhabitants to engage with internal functions is suppressed by the material harshness of the street edge. There is an abruptness of realm division through an overall lack of permeability

and transparency (Gehl et al., 2006).

Closed off and passive edges divide realms sharply, reducing opportunity for sensory engagements to transition across them. In doing so, they direct experience forwards (within the street) and ultimately away from the edge (Jones et al., 2007b; Thwaites et al., 2013). In terms of the work of Cullen (1971) they promote a directional *there*, focusing away from the *here* (location of habitation / engagement) even though there might not be any specific *there* to focus towards. They are thus often experientially disengaging components of the built environment, delineating the street as a *link* rather than a *place* in its own right (Jones et al., 2007b; Jones & Boujenko, 2009). Ellard describes the implications of this upon people's behaviour –

> *They simply bear down and try to get through the unpleasant monotony of the street until they emerge on the other side, hopefully to find something more interesting.*
>
> Ellard, 2015, p. 109

With streets now seeking to fulfil a number of purposes, beyond just acting as functional corridors for transportation, it is clear that edges have a chance to contribute to the multiplicity of potential street functions (Jones et al., 2007a; 2007b; Griffiths et al., 2008; Carmona, 2015). Inactive edges, which enforce their realm division harshly, could be seen to limit such opportunities (Thwaites et al., 2013). Figure 4 highlights some examples of this. None of these edges promote opportunities for people to linger for any sustained length of time or engage with qualities that might be manifested inside them.

In 2010 and up to today, the work of Gehl and his colleagues continues to use almost exactly the same typology as previously detailed. This highlights a continued interest as well as potential struggle to implement street edges that provide opportunity for engagement across them. More recently, Dovey & Wood (2015) produced a similar edge typology focusing upon the impact of how an edge's public/private gradient is manifested, whilst highlighting how –

> *The urban interface between public and private space has long been an issue of great concern in urban design, planning and architectural theory – the myriad of ways in which the transition from public space is framed, formed, negotiated and governed.*
>
> Dovey & Wood, 2018, p.143

Their work aligns with Bobic (2004), who also produced an extensive typology of edges in order to address issues with their relationship across public and private, as well as Habraken (1998) and his multi-scalar typology of territorial interfaces. Thwaites et al. (2013) within their work on transitional edges and Glaser et al. (2012) whilst investigating street plinths have continued to explore the significance of open and engaging edges, highlighting on-going attention surround this topic.

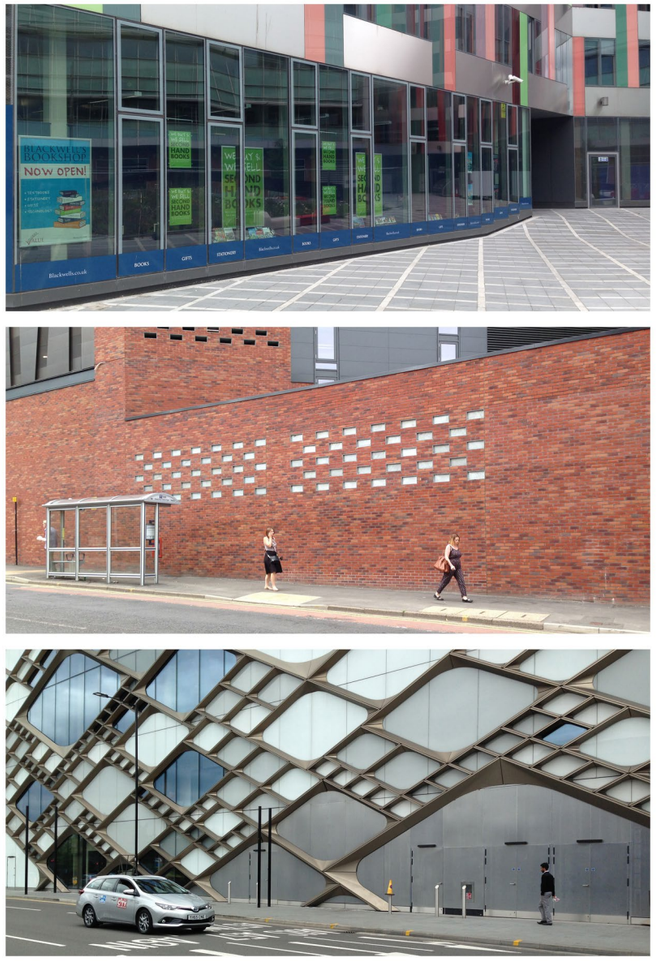


Figure 4 – Abrupt division of indoor and outdoor

In a US context, Speck (2012) has argued that building codes do not take into consideration the significant benefit of porous edges, prioritising floor area ratio over a measure of permeability or transparency. As a result, many US cities have abrupt edges. Heffernan et al. (2013) have explored in detail the relationship between open and active frontages upon public perceptions whilst arguing that they play a key role in how people engage public space, which is similar to the work of Kickert (2016). He has studied and mapped the deactivation of edges within Detroit and The Hague, thus similar modern western contexts to the locale of focus within this current investigation. Significantly, it highlighted the trend towards frontages that are blocked off from the public spaces and notably streets adjacent to them. Whist accepting that this issue is heavily driven by economic and social factors, aligning with Ellard (2015) and Goldhagen (2017), Kickert also argues, however, that design decision-making has played a significant role in the promotion of abrupt urban edges –

> *The role of urban planners, designers and architects has often reflected the aforementioned deactivating trends at best, and reinforced them as worst. Professionals have especially exacerbated the decline of interactive frontages in the downtown periphery by digging under, paving over and building into the struggling fringe in an effort to bolster central business interests – widening the gap between a walkable core and an interactive fringe.*
>
> Kickert, 2016, p. 73

Building upon Kickert, evidence suggests that the existing disciplinary infrastructure that often delineates expertise in response to spatial considerations – indoor and outdoor, for example – has failed to accept for an inherent relationship between realms that is often experientially and socially manifested. This point has been argued by Habraken (1998; 2005); Cullen (2007); Dovey (2010); Thwaites et al., (2013); Mantho, (2014) and the conversation later builds upon this point within Part 2 of the current chapter.

Whilst arguing that the commonplace presence of harsh urban street edges is experientially restricting, this current investigation accepts that they do in some circumstances need to exist, as argued by Heffernan et al. (2013). This is notably in situations where structural considerations are required or, where territorial necessities such as within residential and industrial situations require a well-defined division of public and private (Newman, 1972; Bobic, 2004; Dovey & Wood, 2015). The main argument however is that many UK and wider Western street edges are beginning to become materially harsh with an abrupt division of realms when they should potentially be promoting opportunity for engagement across them; an idea advocated by many (Bobic, 2004; Gehl et al., 2006; Gehl, 2010; Glaser et al., 2012; Speck, 2012; Thwaites et al., 2013; Heffernan et al., 2013; Ellard, 2015; Kickert, 2016). The continuing interest in developing new edge typologies and interface measures highlights the way urban planning and design theory continues to grapple with addressing issues that impact these complex transitional realms (Glaser et al., 2012; Thwaites et al., 2013; Dovey & Wood, 2015). However, the current investigation accepts that it is impossible, and potentially detrimental, for urban environments and street edges everywhere to sustain continuous openness across indoor and outdoor and it is, therefore, more about achieving balance driven by location (Montgomery, 2013; Ellard, 2015) –

> *A recommendation for future research is therefore to identify under which conditions the various grades of active frontage are appropriate.*
>
> Heffernan et al., 2013, p.101

The issue forward within the current section, backed by others arguing a similar point, is that existing street edges fail to get this balance right. As a result, there are numerous instances where urban street edges have become harsh, sterile and disengaging. This limits experiential opportunity to project across realm divisions and thus enrich people's engagement with urban street edges and their internal functions.

Decline

Urban street edges, within UK and Western contexts, regularly house the retail functions of a city centre (Simms et al., 2005). They have thus been hit hardest by the recent mass closure of stores and wider amenities (Griffiths et al., 2008; Wrigley & Lambiri, 2015). In the wider media this has been described as the *decline of the high street*, with outlets such as the BBC (Fraser, 2016); Guardian (Ruddick, 2016; Siegle, 2017); Independent (Chapman, 2017); Financial Times (McClean, 2016) and Daily Mail (Poulter, 2017) discussing the issue. Significantly, this highlights a level of discourse not solely restricted to academic debate. In terms of street edge engagement, the wide scale closure of facilities has meant that people have limited reason to go and use certain streets and an overall lack of options, established within street edges, with which to engage when they are there (Kicket, 2016).

Figure 5 – The impact of decline in Sheffield (Pitts, 2014)

Street edge decline is frequently attributed to the rise of Internet-shopping, financial difficulties following the credit-crunch and increased use of out-of-town facilities (ibid; APPSSG, 2006; Jones et al., 2007a; Portas, 2011; Carmona, 2015). Factors beyond economic and retail considerations have however also been explored in relation to edge decline, which often focus upon how edges are spatially and materially configured to accommodate amenities and services (Tarbatt, 2012; Feliciotti et al., 2016). Scale is again significant in relation to this. This is highlighted through the continued perception that bigger is better and that it will attract large-scale, often chain-based facilities thus providing stability and continuity over time (Wrigley et al., 2002; Karrholm, 2012; Speck, 2012). Although, the issues that have already been documented – Internet shopping, out-of-town, credit-crunch – have also impacted these larger companies (Wrigley & Lambiri, 2015). For example, in the UK in 2018 Lloyds Bank, Jamie's Italian, Toys R Us, Maplin, BHS, Mothercare, Homebase have all had to close numerous branches. When facilities like these fail or move during times of economic transition large gaps are subsequently left in urban

street edges that many functions struggle to occupy and use, see Figure 5 (Wrigley et al., 2002; Glaser et al., 2012). Short term and temporary pop-up interventions and independent often small-scale business, which have been shown to be beneficial in maintaining an areas economic stability and social vitality, struggle to fill such large-scale spaces (Berwyn, 2012; de Boer, 2012; Kickert, 2016). As a result, people using urban streets are provided with limited facilities and a lack of opportunities with which to experientially engage.

Linked to the recurrent issue of scale is how edge design solutions regularly lack scope for quick and easy adaptation and personalisation. Here, the physical and material *form* of street edges often dominates what is territorially established inside them (Habraken, 1998; Ellard, 2015). This inherently creates an edge that lacks resilience in response to economic and social shifts (Feliciotti et al., 2016; Kickert, 2016). It also limits the potential speedy turnaround of edge functions when required (Glaser et al., 2012). Such a limitation can be regarded as a lack of *looseness* (Franck & Stevens, 2007; Dovey, 2010). Here, edges, instead of being open to a level of regular adjustment and change in response to certain requirements at a given point in time, are being manifested as fixed, often-hard and static entities with limited opportunity for adaptability (Feliciotti et al., 2016). Within these situations ambiguity is being designed out of street edges, which for Franck & Stevens (2007) as well as Thwaites et al. (2013) limits the potential for wider interpretation, appropriation and use that is reactive in line with peoples' day-to-day requirements.

Reflecting upon the points raised, there is significant discussion and evidence in existing literature to support the argument that street edges, which are receptive to small-scale, mixed-use and time-conscious development, could offer potential to establish public realms that are more able to deal with the transitions of a forever-developing society (Jones et al., 2007a; Porta & Romice, 2010; Tarbatt, 2012; Feliciotti et al., 2016). This is whilst also providing people with engaging urban streets and edges even when times are hard (Glaser et al., 2012; Kickert, 2016). However, to date these ideas have failed to take hold within mass decision-making (Porta & Romice, 2010; Thwaites et al., 2013). Such thinking, therefore, sees edge decline as something that can be attributed to more that just economic instability and societal trends. As previously introduced, professional design decision-making has contributed to such issues. This is notably through the way urban edges have been materially and morphologically configured to accommodate people and the various facilities they require everyday – shops and restaurants, offices, housing, etc. (Tarbatt, 2012; Feliciotti et al., 2016). The trend towards the design and implementation of large-scale, often block-based development has meant that street edge decision-making has relied on a single model (Punter, 2011). This potentially worked well in the past but seems to be failing currently and provides limited adaptability for the needs of urban inhabitants (Feliciotti et al., 2016). Likewise, the form of the built infrastructure created has limited the scope for quick and easy territorial appropriation and personalisation (Habraken, 1998; Thwaites et al., 2013). This is ultimately creating urban street edges that are susceptible to decline and as a consequence creating urban street edges that fail to provide an enriching environment for street inhabitants to engage with.

Real-world issues with urban street edges - moving forwards

The current investigation has argued, building upon existing discussion and evidence, that factors spanning homogionisation and scale, an abrupt division of realms, and decline have all contributed to the presence of dis-engaging urban street edges in many UK city centres. Whilst diverse influences have potentially caused these issues, the exploration has started to focus on the way trained professionals have compounded street edge problems through existing design solutions.

Moving forwards, rather than solely attributing the issues raised to the input of expert decision-makers, the discussion that follows will now start to argue that an overall lack of knowledge and empirical understanding has potentially been influential. We currently have limited insight into how these complex settings are experientially engaged by people, as Goldhagen explains –

> *Sometimes market pressures, transmitted through ignorant clients, are to blame. Just as often though, designers simply lack sufficient knowledge about human environmental experience.*
>
> Goldhagen, 2017, p. 32-33

To substantiate this point, it is first essential to undertake an in-depth reflection upon how urban street edges are approached within current design practice, along with associated issues. This will help construct a strengthened understanding of how existing strategies and ideas could be failing to deliver effective street edge frameworks and design intervention. The discussion will then move on to how such failures in practice are compounded by knowledge issues, as introduced above. From this foundation, aims and objectives that seek to address the points raised are subsequently detailed. These will provide the remaining investigation with a focus that can ultimately be used when seeking to respond to the real-world problems forwarded and the over-arching question – *How might we be able to create more experientially engaging urban street edges?*

Part 2: Theoretical issues with urban street edges

Issues when seeking to change street edges (practice)

Street edges are settings like little else within urban environments. Physically inside and outside spaces continually interface along their lengths. Within them, varying internal spaces nest together, with their material division requiring attention in order for street edge to remain standing – street edges have complex *form* (Habraken, 1998). Socially, processes of territorialisation and ownership come into play across, along and within street edges (Thwaites et al., 2013). Here, occupied and owned realms sitting adjacent to each other and next to a regularly changing public open space – they are dynamic *places* requiring a level of *understanding* between various differing agents (Habraken, 1998; Mehta, 2013; Thwaites et al., 2013). These often entwined social and spatial factors make for a setting, which when reviewed in relation to the

existing practice and the infrastructure of design and planning professionals who influence them, could start to highlight a source of some the real-world issues introduced (Thwaites et al., 2013; Mantho, 2014).

Who deals with urban street edges?

Designing the physical structure of street edges is traditionally perceived to fall within the remit of architects, along with the aid and guidance of wider built environment professions (Bobic, 2004; Gehl, 2010; Mantho, 2014). They are seen as the experts within the creation of buildings that are structurally sound and functional, which ultimately establishes the built morphology of street edges (Habraken, 1998; 2005). Even though this is the case, when the buildings they envisage make contact with the ground an awkward realm is inherently created. Here, outdoor landscape (street) and indoor built spaces (building) adjoin and sometimes experientially merge (Bobic, 2004; Frank & Stevens, 2007; Thwaites et al., 2013, Gehl, 2010; Mantho, 2014). Such an interconnection of realms means that practice issues relating to street edges might be more complex than pointing a finger at a single discipline, architecture for example. It could be a problem stemming, to a greater extent, from current disciplinary divisions and their relationship to how street edges are experienced and used by people. Such a perspective resonates with ideas forwarded by Thwaites et al. (2013); Porta & Romice (2010) and Mantho (2014) from street and edge perspectives as well as Cuthbert (2007) during his wider critique of urban design. Jones et al. (2007a), whilst exploring mixed-use urban streets, also discusses this point, relating it to professional fragmentation. Considering such ideas in response to notions of *place* (term to be explored in Chapter 3, Part 1), Dovey highlights –

> *Disciplines are institutional schemas that divide knowledges and practices into discrete categories, places of disciplined thought that can become homes of lazy thinking and territorial control. The sense of place is far too slippery to be contained in these ways.*
>
> Dovey, 2010, p. 9

Resonating with Dovey's thinking is the notion that the structure of established disciplinary boundaries means that urban street edges have received little or no specific attention (Bobic, 2004; Thwaites et al., 2013; Mantho, 2014). This is because current decision-making groups (architecture, landscape architecture, planning, urban design) regularly characterise and demarcate expertise based on overly simplistic physical and spatial realm divisions rather than potentially more fluid and challenging-to-pin-down social and experiential considerations (Dovey, 2010; Thwaites et al., 2013). Street edges, which are inherently positioned at the interface between adjacent realms, could therefore sit between expertise in such a way that no professional knowhow is currently able to fully address their nuance needs and the issues they face (Bobic, 2004; Thwaites et al., 2013; Mantho, 2014).

If it is possible to construct a more comprehensive and empirical understanding of how street

edges are socially engaged and experienced, from the perspective of street inhabitants, there would be opportunity to add weight to a reconsideration of how street edges are professionally approached. This could mean that they are not predominantly seen as physical realms of architectural interest but are potentially something that holds particular significance, at the point of human experience, in their own right. They would therefore become a unit of specific attention rather than sitting awkwardly between built fabric (architecture) and adjacent open space (landscape) (Thwaites et al., 2013; Mantho, 2014). Existing discussion has started the process of exploring this theoretically. But, such thinking has lacked a level of empirical and importantly experientially established evidence from which to inform professional decision-making and disciplinary refinement. Through contributing to such understanding will be provided the opportunity to develop ideas that could start to address aspects of the real-world urban street edge issues previously raised.

Top down / bottom up decision-making

Beyond the potential for a reconsideration of who professionally deals with urban street edges is the opportunity to explore how the relationship between top-down and bottom-up design decision-making impacts these realms. This builds upon ideas already explored by Habraken (1998), Franck & Stevens (2007) and Thwaites et al. (2013). Top-down processes generally involve large-scale interventions driven by policy frameworks, overarching managerial goals and agendas, along with infrastructure administration at a professionalised level. This is in comparison to bottom-up processes typically defined and influence by small-scale, on-the-ground practices and actions instigated in a localised, less-professionalised manner (Sabatier, 1986). Discussion has highlighted how both are often required in order to establish rich and engaging urban environments (Katz, 1993; Habraken, 1998; PPS 2008; Dovey, 2010; Urban Initiatives, 2011). There is evidence to suggest, however, that this balance has shifted in a direction that means that professional, top-down decision-making has started to dominate how street edges are manifested. This limits their potential for informal and variable richness established through bottom-up actions (Habraken, 2005; Franck & Stevens, 2007; Dovey, 2010; Thwaites et al., 2013).

Some have attributed this shift towards top-down influence as a result of alterations in professional thinking along with role definition stemming from the rise of *Enlightenment* thinking during the Renaissance (Habraken, 2005; Porta & Romice, 2010). During this period the ordinary and everyday environment, not just influential statement buildings and engineering works, became of professional concern and since built environment professionals have had almost unrivalled power over the physical and material qualities of public spaces in towns and cities (Habraken, 2005; Porta & Romice, 2010).

More recently, there has also been the ever-increasing need for streets and their edges to be urban realms that contribute towards addressing pressing sustainability agendas. This is notably in response to growing urban densities and considerations such as walkability, liveability and

climate change requiring continual attention (Gehl, 2010; UN-Habitat, 2013; Ewing & Clemente, 2013; Carmona, 2015). Such factors inherently mean that top-down, often-strategic professionalised input is required when street and edge change is approached. This is highlighted through the extensiveness of contemporary street design guidance produced by the bodies such as the National Association of City Transportation Officials (NACTO, 2013) and the Global Designing Cities Initiative (GDCI, 2017). Such a shift has allowed streets and edges to be better equipped for numerous current and future stresses. However, it has also meant that professional influence, through top-down decision-making, regularly dominates how these realms are manifested. As a consequence, street edge qualities and characteristics are often dictated more by designed infrastructure and physical *form* rather than bottom-up, socially initiated and territorially manifested non-professional actions (Habraken, 1998; Dovey, 2010; Porta & Romice, 2010; Thwaites et al., 2013).

A nuanced insight into the *form* dominance of street edges and decision-making influence can be undertaken through a consideration of Habraken's levels of *built environment control,* spanning *form*, *place* and *understanding* (Habraken, 1998). Professionally established *form* provides the material, organisational and stable infrastructure into which human habitation and occupation is possible. Within this structural assembly is the potential for a social dimension to subsequently evolve through human territorialising processes. During such actions human impulses to identify and define ownership through adjustments to the materiality of the environment shape the control of *place*. The relationship between people, and the places they create, subsequently establishes a level of *understanding*. This is established through mutual structures and communal meanings, for example cultural, social, ideological, aesthetic and geographical dimensions. *Understanding* is thus essentially social in conception with *place* motivated by individual territorial considerations (Habraken, 1998). The importance of this, in relation to urban street edges, is that the manifestation of *place* offers opportunity for the creation of a rich and varied edge shaped through the variable population that appropriates it (Thwaites et al., 2013). This is along with the presence of *understanding* establishing a relationship between these social agents and what they spatially and materially create.

Reflecting upon Habraken's controls in terms of top-down / bottom-up decision-making, and the discussion forwarded by others (Cuthbert, 2007; Dovey, 2010; Porta & Romice, 2010; Thwaites et al., 2013), there is evidence to suggest that the relationship between and balance across these influencing factors has shifted. This is notably in a direction that means street edges are becoming *form*-heavy through a dominance of top-down decision-making. As a consequence, the likelihood of place and understanding to take hold, established often through bottom-up actions, is being stifled (Habraken, 1998; Thwaites et al., 2013). The significance of this lies in how it impacts the potential for variable territorialising opportunities that could make urban street edges more experientially engaging.

Whilst the factors detailed are noticeable across many urban contexts, and backed by existing

debate, there are instances where a more balanced top-down / bottom-up relationship has been promoted within urban realms. This is notably through the rise of urbanist thinking and an emphasis towards place-making (Katz, 1993; UTF, 1999; PPS 2008; Urban Initiatives, 2011). With this, professional decision-making endeavours to establish greater flexibility within the environment, so individuals and groups inhabiting professionally designed settings have a chance to adapt and manipulate the environment as they see fit through territorialising actions. Within the context of UK urban streets and edge, however, it is evident that there has been limited promotion of such socially driven processes (Thwaites et al., 2013). Often the way these spaces have been materially configured limits the scope for bottom-up individual and group appropriation. The result has been he manifestation of *form*-heavy and often sterile urban street edges that offer limited opportunity for a richness and variability to be established through territorial adaption and personalisation.

Focus upon the architectural object

> *Not all but many architects are focused more on designing buildings rather than creating good streets.*
>
> Glaser et al., 2012, p.15

On-going debate has highlighted how design professionals, mostly architects, regularly consider the built elements that comprise urban street edges not so much as entities contributing towards a collective whole but as a number of separate and distinct built forms (Glaser et al., 2012; Speck, 2012). Inherently, this stems from their design input often being site based. However, at an extreme level such a mind-set is enforced whilst abstracting their interventions in the a*vant-garde pursuit of object-based expression* (Harris & Burke, 1997; Bobic, 2004; Habraken, 2005; Porta & Romice, 2010; Goldhagen, 2017). Through such actions, physical form and often the shape of intervention often overrides consideration of any potential contribution to existing urban fabric, such as a street edge, or everyday social value benefitting urban inhabitants going about their daily lives (Bobic, 2004; Porta & Romice, 2010). Within these situations designers regularly only reference themselves and what is fashionable at a given point in time, with their in-house aesthetic frequently neglecting context, tradition and importantly scale (Gehl, 2010; Porta & Romice, 2010; Speck, 2012 Goldhagen, 2017). Street edges and wider built environments, along with how these places are experienced, are therefore not the primary focus of attention but the individual building and its visual aesthetic are the measure of its significance and success –

> *The nitty-gritty of the design process inclines professionals to privilege a project's overall composition and pictorial aspects, which is a tiny slice of how it will function in people's lives.*
>
> Goldhagen, 2017, p.36

Corner (1991) has discussed such an issue within a landscape architectural context, exploring

the profession's pursuit of avant-garde thinking along with the promotion of an internationally focused output. Similarly, the influence of artistic expression as a driver within landscape design has been explored by Crewe & Forsyth (2003). Within an urban design context, Porta & Romice (2010) and Cuthbert (2007; 2010) have described how decision-making processes have regularly been approached in this way, aligning with how an architect would approach a single intervention in an abstracted manner. Examples of this can be seen through the way individual buildings dictate the structure and layout of a city as a whole, rather than how they can contribute as a component in response to its wider urban structure, for example within Brasilia at the hands of Costa and Niemeyer, or Chandigarh with Le Corbusier (Holston, 1989; Cuthbert, 2007; Porta & Romice, 2010; Goldhagen, 2017). In relation to this is the continuing issue of scale, which is something that has already been introduced as a street edge problem. Here, the proportions of people are no longer considered as the unit of measure from which design solutions are based (Gehl, 2010; Glaser et al., 2012; Speck, 2012). Instead, design intervention is itself the measure of scale with bigger often being considered to be better, especially in a practice lead design world that is continually in competing to get on the front covers of architectural journals and glossy magazines (Porta & Romice, 2010; Speck, 2012; Goldhagen 2017).

Regularly, within professional practice, buildings that make-up street edges and the build environment as a whole are thus often not intended to be regarded or read as components in an interconnected morphological fabric (Jones et al., 2007a), as represented within figure ground diagrams (Jacobs, 1993); seen as contributing and grounded landmarks within an environment of fluctuating intensity (Lynch, 1960); or aspects of the environment that add to its enveloping real-world complexity for pedestrians (Cullen, 1971; Bosslemann, 1998). But, they are to be observed and gazed upon as entities in their own right, preferably from a detached perspective established through an e*nlightened* modernist mind-set, rather than viewed within the context of *everyday life* (de Certeau, 1984; Lefebvre, 1991; Habraken, 1998; 2005). The impact of this is often most prominent when these buildings connect with the ground and people engage with them whilst inhabiting the street, as argued most prominently by Gehl (2010); Glaser et al. (2012); Montgomery (2013); Thwaites et al. (2013); Ellard (2015) and Goldhagen (2017). Issues with building ground floors are often not resolved fully as the focus has instead been on the overall building as an individual object and how it is engaged from a distance when the building can be viewed in its entirety. This has had a significant impact upon streetscapes and how experientially engaging street edges are overall (Gehl, 2010; Glaser et al., 2012; Goldhagen, 2017).

Practice issues summary, objectives and aim

During the discussion the issues associated with the practice of implementing street edge change have been expressed in an often-severe manner. It should be noted that not every professional intervention within these realms is undertaken in such a way that it begins to negatively impact street inhabitants and their everyday experiences. Responsive urbanist thinking, as introduced earlier, combined with the general decline of the modernist mind-set has meant that deci-

sion-making is often more socially and experientially engaged than at the extremes highlighted within this current investigation. However, the foundations of the issues expressed within the current section still influence the mind-set of many design professionals today, with many writers and researchers arguing a similar point as detailed throughout.

Each of the practice issues raised will now be used within the formation of research objectives that underpin an overarching practice research aim. These objectives and aim are also reflective of the principle experientially focused research question stated in the introduction.

Firstly, debate highlights how urban street edges sit awkwardly within the current built environment disciplinary infrastructure. The objective is, therefore, to forward a better understanding of how no current professional expertise is potentially able to fully detail with their complex needs in response to how they are experientially engaged by street inhabitants (practice objective 1).

There is a foundation of literature that explores an imbalance between top-down and bottom-up built environment decision-making. Urban contexts, of which street edges are key components, have been constructed in a way that limits opportunities for territorial appropriation and personalisation. They have become top-down, *form*-heavy entities. The aim is to therefore comment upon the experiential impact of this, assessing how people's experiences of urban street edges are influenced by factors (material / spatial) that have been manipulated by top-down or bottom-up decision-making (practice objective 2).

Lastly, there has been discussion exploring how the architectural object has sometimes become the dominant focus within design decision-making. This has manifested a potential disconnect between professional edge intervention and how urban street edges are engaged by people. The final objective therefore seeks to forward an experiential understanding of how the architectural object is potentially not the primary factor by which the urban street edge should be considered (practice objective 3).

Based upon the existing evidence and objectives devised there is opportunity to forward of a practice research aim that looks towards addressing the salient issues –

The aim is to highlight what implications a strengthened understanding of how people experientially engage with the urban street edge might suggest for a reconceptualisation of professional design decision-making approaches towards these realms.

Issues with thinking about urban street edges (knowledge)

Earlier it was highlighted how practice issues, when approaching urban street edge change, could be derived from matters relating to existing understandings we have about how urban realms

are experienced. The following will now look to respond to this whilst exploring knowledge issues in greater detail. This will highlight how there is relatively limited attention paid to urban street edges specifically and notably from a direct experiential perspective. Building on this exploration specific objectives and a knowledge aim will then be devised.

Partial street edge focus

> *For many planners, it is this image that first unlocked the idea of urbanism. Most of us have conjured it up repeatedly to explain the magic of cities to relatives, dates, dentists or party guests. But all too often it ends there. We rarely subject this image to much scrutiny, perhaps because it's so useful, and because achieving anything resembling it has consumed the careers of a generation of planners.*
>
> Grant, 2014, Web

Within the above quote Grant, whilst focusing upon the importance of building edge ground floors, highlights an issue within our current street edge thinking – we have not focused our attention upon them enough to understand them in detail.

With streets being the most ubiquitous and abundant area of public open space within many contemporary cities it is inevitable that a considerable amount of knowledge has been acquired about them (Mehta, 2013). Within the early work of Lynch (1960), Jacobs (1961) and Cullen (1971) through to Alexander (1979), Whyte (1980), Appleyard (1981), Gehl (1987), Jacobs (1993) and Bosselmann (1998), to name but a few influential writers, we have acquired a detailed understanding of the multifaceted nature of urban streets and public open spaces. Over the past ten years there has been a renewed interest in streets through the work of people such as Gehl (2010), Ewing & Clemente (2013), Mehta (2013) and Mantho (2014). However, even though these seminal and more recent writers and researchers all to a greater or lesser extent express the importance of street edges, their discussions are often broad in scale. They focus on streets and public spaces overall with the work being so extensive that wider urban issues and ideas overwhelm the interest specifically in relation to street edges (Heffernan et al., 2014). This has meant that whilst we have begun to understand street edges broadly there is still a limited amount of mainstream knowledge that specifically focuses upon edge interfaces within a specific city centre street context. This is especially in a way that is up-to-date in-line with contemporary social and economic shifts and issues (Bobic, 2004; Jones et al., 2007a; Glaser et al., 2012; Baker & Lopez, 2014).

In terms of recent work, it could be argued that Gehl (2010) and Gehl et al. (2006) are street edge specific; however, a focused reading of this work highlights an interest upon edges within wider urban contexts. This is the same for Kickert (2016), who whilst exploring active frontages is not street specific. He focuses heavily upon the locational implications of decline overall within the building edges of Detroit and The Hague rather than just street edges. This is similar to

Heffernan et al. (2014), who focus upon active frontages in relation of public perceptions, thus aligning with this current investigation. However, these edges are positioned within the context of broader public space not explicitly streets. Thwaites et al. (2013) focus on the *transitional edge* as an urban concept from a wider social and restorative perspective without specifically detailing their ideas within a street context. Bobic (2004) has produced an extensive study of edge realms, notably in response to streets whilst positioning the street as *a place between the edges*. However, his ideas are often residential focused, especially when he looks to develop a number of edge interface typologies. Such settings are subtly different from the focus of this current investigation, which is exploring mixed-use city centre streets. Dovey & Wood (2015), who studied public/private urban interfaces, regardless to some extent of urban locale, suffer from a similar issue in response to the focus of the current investigation. Porta & Romice (2010) do highlight the significance of urban street edges. But, due to their emphasis upon the plot (individual building scale) there is limited expansion upon the discussion. This can also be seen within Feliciotti et al. (2016), who do move to a more scalar consideration. But again, edges fit within a wider urban investigation exploring resilience. Jones et al. (2007b) forward the importance of built frontages but emphasise greater attention upon functional land uses in relation to pedestrian and vehicular thoroughfares. Within urban planning and design guidance the street edge interface continues to be seen as significant, for example within the Urban Renaissance (UTF, 1999); Urban Design Compendium (Llewellyn Davis, 2000) and PPS (2008). More recently within two extensive street edge studies – GDCI's (2017) Global Street Design Guide and NACTO's (2013) Urban Street Design Guide – the importance of street edges continues to be forwarded. Their significance, however, is rarely fully explored and urban streets as spatial entities for movement and transportation receives greater attention within these works. The expansiveness of these documents and their overarching urban agenda also often dwarfs the discussion associated specifically with street edges. Potentially the most street edge focused work is Glaser et al. (2012), who have looked at edges specifically within a street context, focusing upon the importance of their ground floors or *plinths*.

Through a review of existing built environment literature it is noticeable that there is interest in streets and urban built edges / interfaces, with many developing progressive ideas and concepts in relation to these realms. These texts are, however, not often focused upon urban street edges specifically whilst regularly concentrating upon issues that do not fully relate to the nuanced needs of contemporary urban street edges. Beyond this, regardless of whether it is believed that the writings introduced are street edge specific or not, it is clearly noticeable that street edges have not received enough attention in regards to the potential significance they hold in terms of urban engagement and current societal needs (Bobic, 2004; Jones et al., 2007a; Glaser et al., 2012; Baker & Lopez, 2014). It is the argument of the current investigation, whilst reflecting upon existing literature, that there has not been enough up-to-date study and ideas specifically focused towards urban street edges.

Limited empirical account of direct street edge experience

Within the introduction, a Goldhagen quote was presented – *designers simply lack sufficient knowledge about human environmental experience* (2017, p.32-33). The following will now seek to explore this notion further within a street edge specific context. Overall, across existing literature, very few attempts have been made to capture what it is like to experientially engage urban street edges. This is especially from a direct, first-hand perspective that empirically manages to encompass the experiential impact of social and spatial considerations when inhabiting streets (Bobic, 2004; Metha, 2013; Harvey & Aultman-Hall, 2016) –

> *More noticeable is the fact that most of the existing works categorically separate the study of the physical aspects of the environment from the use and management of land uses and businesses and places that hold special meanings for people … none of the books categorically addresses the street as a setting for social behaviour, covering in detail the typology of social behaviours, and none provides detailed tools to create sociable streets based upon grounded empirical evidence.*
>
> Mehta, 2013, p,3

The ideas above and within the Mehta quote align with existing discourse that questions the empirical as well as social and spatial encompassing foundations of urban design and planning theory as a whole (Cuthbert, 2007; Marshall, 2012; Dovey & Pafka, 2016; Foroughmand Araabi; 2017). It also positions itself in response to the way that wider urban public spaces have received renewed attention focusing upon how people experience and engage them whilst going about their everyday lives (Degen et al., 2010; Degen & Rose, 2012; Ellard, 2015; Goldhagen, 2017). The issue is that street edges have not currently been explored in detail in-line with renewed attention. Limited attempts have been made to forward direct, experiential considerations in an empirical manner. Returning to Harvey & Aultman-Hall's quote –

> *There is ample opportunity for a more empirical, efficient, and widespread measurement of physical characteristics and human experiences within urban streetscapes.*
>
> Harvey & Aultman-Hall, 2016, p.155

Gehl (1987; 2010) is the predominant researcher over recent years that has constructed theoretical edge ideas upon a level of real-world, experientially focused investigation. This is mostly through the use of observational techniques; looking at how people engage with the urban edges around them, as discussed within Gehl & Svarre (2013). Such a method is similar to the observational foundations of Whyte (1980) and Jacobs (1993), whilst also aligning with the recent social streets work of Mehta (2013). Yet these studies lack a direct and to an extent empirical insight in to street and edge engagement. This will be reviewed in greater detail later when critiquing current data collection methods (Chapter 4). Looking at the progressive edge texts

introduced before, Thwaites et al. (2013), Porta & Romice (2010) and Feliciotti et al. (2016) all present their ideas at a theoretical level but testing of their ideas within a real-world experiential context is limited. Thwaites et al. accept, however, that there is the future need for socio-spatial edge investigations that focus explicitly upon how these realms are lived and experienced by people, with the need for –

> *A more explicit understanding of the human-environment relationship at the heart of approaches to research, teaching and practice underpinned especially by phenomenological perspectives.*
>
> Thwaites et al, 2013, p. 226

Such a phenomenological (experiential) perspective will be discussed within the development of the conceptual edge framework (CEF – Chapter 3). Dovey & Wood (2015) seek to empirically study edges and back-up their edge ideas through mapping interfaces, yet present no account of edge experience. Mantho (2014) maps the physicality and spatial structure of streets, and thus edges, yet does not fully consider such dimensions for a direct experiential perspective. This is similar to Bobic (2004) within his street typology that whilst being socially considerate is focused towards visualising physical and material edge characteristics.

Moving away from an edge specific discussion, it is noticeable that street thinking as a whole often focuses limited attention upon experiential influences. The wide reaching UN-habitat paper on *Streets as Public Spaces and Drivers of Urban Prosperity* (2013) is an example of this. They forward a progressive model that details streets as a holistic relationship of social and spatial dimensions that can contribute to their success as well as failure. However, they contain only a partial account of how public experience of these settings can act as a key driver in defining how streets function as vibrant public spaces. This is similar to Carmona's (2015) *The problems, potential and complexities of mixed street corridors*, which explored the functioning of London's streets. Again, the exploration neglects any in depth consideration of the experiential manifestation of streets. Greater focus is upon streets as locale for social and cultural exchange and less upon the importance of peoples' direct experience of these complex settings.

Overall, existing literature contains very few attempts to capture and empirically articulate how urban streets and street edges are experienced from the direct perspective of the street inhabitant and then use such insights to establish evidence-based knowledge foundations. Building upon arguments made by contemporary writers and researchers, such as Goldhagen (2017); Metha (2013); Harvey & Aultman-Hall (2016) and Thwaites et al. (2013), the current investigation has sought to examine specifically how such experiential considerations are often missing from existing edge and wider street ideas. Significantly, such arguments regularly highlight that if we are to address (real-world) issues that are currently impacting urban contexts we need to establish greater empirical insight into everyday urban experience.

Knowledge issues summary, objectives and aim

The current investigation has argued, through reflecting upon existing literature, that there are two predominant issues with our existing knowledge of urban street edges. As within the practice-focused exploration these insights will now be used within the creation of objectives in order to underpin a knowledge aim.

Firstly, a relatively comprehensive understanding of the significance of urban edge interfaces has been developed, however, this is often not street edge specific. The objective is to therefore focus attention specifically towards urban street edges during the development of an up-to-date street edge model, which takes into account recently developed progressive ideas regarding broader edge realms (knowledge objective 1). This model (Chapter 3) can subsequently be examined and refined within the real-world complexities of urban streets (Chapter 6). The second knowledge issue builds upon the lack of street edge focus, highlighting how there is limited empirical insight into how these realms are experientially engaged by people from a direct first-hand perspective. The objective is thus to capture and empirically articulate a first-hand account of how urban street edges are experienced by people inhabiting the street (knowledge objective 2). In response to these points –

The aim is to build upon progressive and up-to-date foundations in the development of an in-depth and empirical knowledge of how urban street edges are engaged spanning the experiential overlap of socio-spatial considerations.

Theoretical issues with urban street edges - moving forwards

There are a range of theoretical problems associated with urban street edges. These encompass practice issues, when seeking to change street edges, and knowledge issues, when thinking about and understanding these complex settings. It is the belief of the current investigation that such issues have subsequently contributed towards existing real-world problems that are affecting urban street edges – homogenisation and scale, abrupt realm divisions and decline. In order to start addressing these problems the current investigation has used existing discourse to examine in detail practice and knowledge issues, which has subsequently informed aims and objectives that the remaining inquiry builds upon.

The next step is to develop a conceptual edge framework (CEF – Chapter 3). This draws together progressive philosophical and theoretical street edge, built environment as well as broader urban literature towards a focus upon how street edges are engaged by street inhabitants. The model established will subsequently be examined through a real-world, experientially focused investigation (Chapter 6), with the methods to be used detailed within Chapter 4. During this, real-world mobile eye-tracking will be introduced as a data collection technique, building upon

previous exploration of this technique (Simpson, 2014).

Figure 6 highlights a visualisation of the overall thesis workflow, placing into context the subsequent processes of the investigation, notably, in relation the issues discussion that has taken place so far and study aims and objectives.

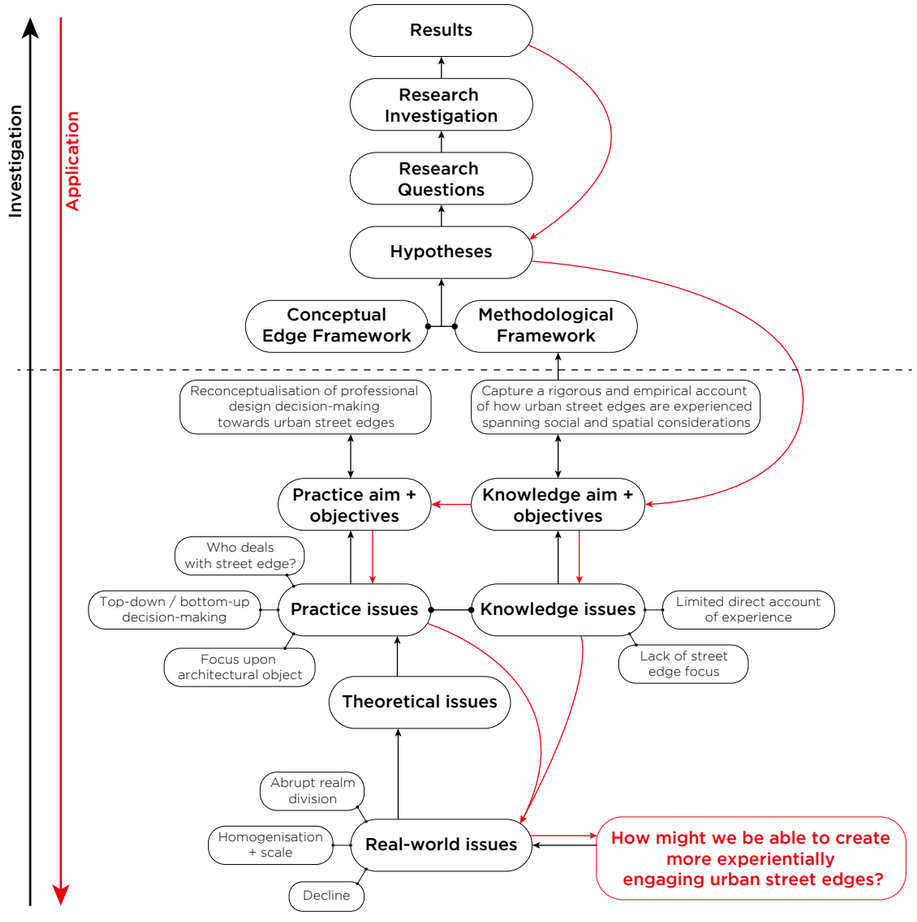


Figure 6 – Investigation workflow

Chapter 3

Conceptual edge framework (CEF)

The current chapter uses existing literature spanning progressive street and street edge, wider urban interface and built environment ideas to develop a *conceptual edge framework* (CEF). Rather than just being a review of existing discourse the development of the CEF seeks to forward ideas in a creative exploration whilst establishing foundations for working hypotheses (Chapter 5). Part 1 philosophically examines how urban street edges can be considered as *lived and experienced socio-spatial assemblages*. This is done through exploring ideas manifested within progressive conceptions of *place*. During this philosophical development the intention is to shift the focus of attention towards an ontological foundation of understanding (nature of being, existence and reality) that is experientially manifested, yet considerate of wider socio-spatial influences. In doing so, it will also set the epistemological underpinnings of the study (how knowledge about the edge can be acquired), providing a stable platform for subsequent fieldwork that seeks to examine the ideas progressed within the CEF (Chapters 4 and 6). Part 2 uses existing discourse to explore street edges as *nested, multi-scalar* entities comprising built *plots*, *plinths* and territorially as well as experientially significant ground floor edge *segments*. It also details how these scales influence the experiential *multi-directionality* of the street edge through their potential to suppress the dominant linear directionality of the wider street. Part 3 looks in detail at the properties of urban street edge segments and how they are *territorially appropriated* and *personalised* in ways that can experientially engage street inhabitants. This is established through the manifestation of *affordances*, particularly *distinctiveness*, *transitional quality*, *sensory complexity* and the *temporality* of all these characteristics. A glossary is provided at the back of the thesis for reference.

Part 1: Philosophical foundations of urban street edges as a distinct *places*

For many years, a broad range of academic fields have sought to comprehend how urban environments, such as urban streets and their edges, come into being, attain significance and become definable *places* (Casey, 1997; Dovey, 2010; Cresswell, 2015). Recently, according to Cresswell (2015), there have been three predominant ways in which to approach place, all of which overlap to some extent. Firstly, places can be understood though a *descriptive* approach. This follows a relatively common-sense conception of the world being a collection of places that can be discussed as entities in their own right and at varying interconnected scales. Secondly, place can be explored as a *phenomenological* construction. This is established through and interested in the essence of human existence and experience of being *in-place*. Lastly, he highlights a *social constructivist* approach. Here, the particularity of place is developed and re-enforced through general underlying social processes. This has equipped poststructuralists with a framework to explore how places exist as *assemblages*.

An initial reflection upon Cresswell's three-part understanding of place highlights how this broad concept can mean many different things. However, an in-depth review, which will be undertaken within the current chapter, has the potential to establish how certain ways of thinking can provide differing frameworks for understanding the intricacies of the world and the multiplicity of place(s). The following will look to introduce and critique place conceptions, building upon Cresswell's foundation, whilst reflecting upon how differing philosophical mind-sets can influence research and design decision-making specifically in relation to urban street edges.

Understanding urban street edges through a descriptive notion of place

For millennia people have described and contrasted areas of the world giving the word place a range of characteristics: location – *what place should we meet at?*; feelings – *Leicester is a horrible place*; ownership and territory – *should we go back to your place?*; social hierarchy – *I put him in his place* (Habraken, 1998; Dovey, 2010; Cresswell, 2015). Place is therefore not only a noun, articulating places as solely physical realms, but its usage expresses a complex interconnectedness of spatial and social dimensions. It articulates a tangible *location* (spatial and material realm), as well as expresses a *locale* (scene where something happens) (Wylie, 2007; Dovey, 2010). In simple terms, this socio-spatial understanding can be considered whilst reflecting upon a place known to many in contemporary Western society; physically comprising of walls, celling, doors, window, bed, chair, cabinet. Within this situation, however, it is not until a consideration of social processes come into play that we would understand such a place to be a bedroom, a place for sleep, play and relaxation amongst other things. Without social activities the bedroom remains merely as a three-dimensional void defined by physical walls containing a range of objects –

> *It is what people do in space that turns that a space into a place.*
> Spivak, 1973, p.44

Places are thus thought about and described often unintentionally as socio-spatial realms where the physical and material make-up of a given setting is entwined with the human processes that take place within it (Canter, 1977; Alexander, 1979; Habraken, 1998; Massey, 2005; Dovey, 2010; Thwaites et al. 2013). Within the context of the bedroom analogy such a socio-spatial relationship is easy to comprehend. However, introducing a setting with such innate complexity as the urban street edge complicates the ability to accurately describe what such a place might physically be like and what people do in and around it. This is inherent within the street multiplicity observed by Jacobs (1961), Moudon (1987) and Mehta (2013). Within the context of the current investigation the conception of place is, therefore, required to move away from a purely descriptive notion, which could be seen to restrict the richness of edge possibilities, towards a philosophical way of thinking about street edges (Cresswell, 2015). Even though this is the case, the descriptive manifestation of place highlights the importance of ideas that are both spatial and socially incorporating. The following seeks to use this socio-spatial understanding whilst introducing more nuanced philosophical notions of place through two strands of thinking – phenomenology and assemblage theory.

Understanding urban street edges through the phenomenology of place

Phenomenology focuses explicitly upon first-hand lived experience (Smith, 2013; Cresswell, 2015). As a movement it came to prominence in the early 20th Century, notably through the work of Husserl (Laverty, 2003). Within his pure-phenomenology he attempted to develop a philosophy for understanding the world as something that cannot be observed from a detached position or regarded as something *out there*, providing an alternative to the developing Cartesian and enlightenment perspectives of the time (Lincoln & Giba, 1985). This social focus provided a humanist platform through which real-world values and perceptions could be understood, which for Husserl was accomplished through exploring the essence of experiential phenomena via the subjective and individual consciousness of people. Significantly for him, phenomenological reduction or bracketing was required, where one brackets out / suppresses personal biases, judgments or belief so that phenomena can be understood without personal values attached (Laverty, 2003; Kafle 2011). Such an understanding provided a human-centric philosophical framework allowing the world to be studied and subsequently described in rich experiential terms that later thinkers have sought to build upon.

Heidegger (1953) expanded Husserlian phenomenological foundations whilst moving away from bracketing individual bias. He accepted that the challenges associated with removing all prior understanding limited an ability to describe true lived phenomena, creating a skewed perspective of the world. In doing so, Heidegger broke from the sole focus on consciousness and the essence of experience, bringing phenomenology into a more hermeneutic (interpretive) sphere (Finlay, 2009; Kafle, 2011). He focused upon the importance of *dasein*, broadly translated as being-there or being-in. Within the genealogy of place conceptions, such thinking contributed greatly to our understanding of phenomenological place notions through shifting away from purely un-contextualised and bracketed impersonal experience (Laverty, 2003; Kafle 2011; Cresswell, 2015). An understanding of the world is thus constructed directly via one's everyday experiential interaction with the environment they inhabit and through the everyday social actions they engage with (Smith & Thomasson, 2005; Smith, 2013). Such a mind-set implied significance upon dwelling and human existence being-at-one with and within the world, which later thinkers have successfully used for place examination, most prominently Relph (1976), Tuan (1977) and Seamon (1980). All of these writers explored the importance of being-in place as well as the disconnectedness of being-out of place, or *placelessness* (Relph, 1976), enabled by the nuances of subjective human experience.

Sitting alongside the Heideggerian foundations of being-in the world is Merleau-Ponty's (1962) contribution to phenomenological place thinking. He specifically emphasised the importance of embodied experience and how the functioning of the physical multi-sensory human body provides a platform for understanding the world and existence within it (Smith, 2013). In doing so, Merleau-Ponty directed his discussion from an existential body-subject perspective (Cresswell, 2015). Within the context of the current investigation, examining urban street edges, this

is important as it focuses greater importance, in contrast to Heideggerian and Husserlian ideas, upon a place's spatial manifestation; with him describing –

> *We have said that space is existential; we might just have said that existence is spatial.*
> Merleau-Ponty, 1962, p.293

For him, and later thinkers using his ideas, spatial factors are a key component of what it is to be human. Space is not a container within which everyday life plays out but it is where human processes and existence becomes possible (Smith, 2013). This moved to a strengthened philosophical understanding of phenomenological places being holistic socio-spatial realms. Places are thus engaged existentially through the multi-sensory human body whilst drawing together human practices with material and spatial properties of the environment (Smith, 2013). Such a mind-set is similar to philosophical notions forwarded by de Certeau (1984) and Lefebvre (1991), which whilst not being explicitly phenomenology based echo such a holistic subject / object ontology.

The development of phenomenological thinking within the work of Husserl, Heidegger and Merleau-Ponty provides place with a productive philosophical position through which an intricate experiential insight into the socio-spatial nature of the world can potentially begin to be understood (Cresswell, 2015). It is a perspective that not only sees human processes within the world, and the experiences entwined with these processes, as important but requires them to build an understanding of what makes places what they are. The focus on the subjective essence of human experience (Husserl), being-in the world (Heidegger) and the understanding of the importance of the multi-sensory human body and its entwined subject-object relationship (Merleau-Ponty) has since provided many, across a wide range of academic fields, with a framework for understanding places, for example, within geography (Relph, 1976; Tuan, 1977; Ingold, 2000), environmental psychology (Canter, 1977; Seamon, 1980) and architectural / built environment studies (Norberg-Schulz, 1971, 1980; Stevens, 2006; Thwaites et al., 2013).

Phenomenological research, design decision-making and counter arguments

In order to further understand the phenomenological ideas explored, it is beneficial to reflect upon such thinking within the context of contemporary urban street edge research and design decision-making. Its benefits and drawbacks in relation to the current investigation can therefore be understood in greater detail.

In a research context phenomenology has the potential to equip researchers with an intrinsically humanist framework of understanding. Through this, the socio-spatial complexities of place(s) can be understood via human experience (Cresswell, 2015). It breaks from the dualities at the centre of Cartesian philosophies (mind/body, subject/object, thought/senses) whilst seeking to express that such an outlook fails to fully articulate real-world phenomena (Wylie, 2007). Human engagement with urban street edges for example. A rich and realistic understanding of

how street edges function, and are experienced, could thus begin from such an epistemological foundation, which Thwaites et al. (2013) and Dovey (2010) highlight.

In response to designing and implementing change within street edges the socially focused nature of phenomenology provides a grounded and real-world perspective on interventions. The urban street edge is a lived component of the built environment and by approaching change phenomenologically, especially in a multi-sensory and holistic subject-object accepting manner, the benefit of interventions can be explored and considered in real-world social terms (Corner, 1991; Aravot, 2002; Armstrong, 2003). Design decision-making can potentially, therefore, be responsive and reflective of everyday human actions and intentions manifested within streets and their edge.

Even though this is potentially the case, a number of theorists have started to question the validity of phenomenological ways of thinking and acting, which the following will explore. During the discussion it should be understood that it is not the intention to build an argument totally dismissing phenomenology as a valid philosophical route of inquiry. The aim is to build an understanding of its limitations so that the resulting philosophical position employed within the current investigation is responsive to recent arguments and debate. This discussion also forms the foundations of the methodological exploration to be undertaken within Chapter 4.

Subjectivity

Rather than avoid the complexity inherent within an individual's subjective subject-object relationship phenomenology seeks to use this as an ontological starting point for exploration. Some have argued that this limits its ability to elicit an understanding spanning a mixed population experiencing the world in variable ways (Wylie, 2007; Dovey, 2010). It could thus ultimately fail to take into consideration variable sociological, historical and political contexts within which individuality and ultimately places are established (Wylie, 2007). As a consequence, phenomenological research may produce knowledge that restricts a true representation of a diverse and variable society. Even though the understandings elicited will be inherently rich, with an ability to tap into the experiential socio-spatial nature of everyday places, such as the urban street edge, the understandings gained could be so laden with multiplicity that distillation of coherent and useable findings becomes challenging. Ultimately, it lacks a foundation for concise and empirically focused output (Ihde, 2008; 2009). When taking this into a design context, phenomenological thinking could fail to address the needs of a diverse population due to its individualist foundations. Designers are required to take knowledge of the world then seek to improve urban spaces of cities for people to inhabit and use. However, if the information they are provided with, from which to make design-decisions, is so entrenched with individual values and perceptions the resulting spaces could alienate more people than they engage.

Dwelling

Issues have been raised when reviewing the Heideggerian notion of dwelling / *dasein* in relation to the forever-shifting and mobile world of contemporary society (Dovey 2010; Cresswell, 2015). For Dovey (2010) dwelling infers a stabilisation of understanding, and subsequently a stasis of place, which fails to accept for real-world development over time. The secure nature of dwelling also implies a focus on the reliability of the present when lived experience is reflective and dictated by a continuous flow of past engagement and future intentions (Dovey, 2010). The establishment of Husserl's experiential essences further grounds the philosophy within this static, descriptive notion of how present phenomena appears to be structured. Merleau-ponty (1962) does, however, through his acceptance of the need for human motion, begin to break from the dwelling perspective (Cresswell, 2015). This can also be seen later within the work of Seamon (1980). Although, they never fully distance themselves from the foundations of other phenomenological thinkers and their dwelling based ontologies.

Such a static mind-set inevitably impacts research with dwelling perspectives resulting in output that describes how places appear to the observer often at a single point in time. This might, therefore, restrict the potential of mobile and transitionally time-sensitive investigations (Sheller & Urry, 2006; Wunderlich, 2013), which seek to explore the shifting nature of not only social processes but also their spatial manifestation (Dovey, 2010). Within a design context such a stabalising mind-set suppresses the desire and often-beneficial need for responsive and reactive temporal change. A fast moving, forever-developing world with a continually increasing population size requires a framework for renewal that does not seek to solely reaffirm existing manifestations. But, needs a reflective yet progressive foundation that moves beyond places being a location for secure dwelling within-the-world, towards an alignment with realistic and continually transitioning human everyday needs (Dovey, 2010).

Romanticism and technology

Wylie (2007) has highlighted how phenomenology forwards a reflective and romantic mind-set that at an extreme harks back to rural, pre-modern and often non-western ways of life. This is firstly due to it being formed around static, dwelling perspectives established through Heideggerian notions. Beyond this, nostalgic romanticism is noticeable in the language of philosophers such as Merleau-Ponty, who expresses the need for – *re-establishing a direct and primitive contact with the world* (1962, p.xi). Wylie (2007) focuses upon the word primitive here, which looks backwards whilst potentially shying away from contemporary environmental complexities; a distinct romanticism for the simplicity of the past. As a consequence, discourse has highlighted how this nostalgia and romanticism has instilled phenomenological thinking with a mistrust of technology and an exploration of lived experience through such means (Ihde, 2008; 2009). Heidegger is well known to have distrusted technologies (Dreyfus & Spinosa, 2004), which is noticeable within his phenomenological reflections and also place conceptions. Recently, due to

the world being more technologically advanced than in the eras of Husserl, Heidegger and Merleau-Ponty, academics and philosophers have started to accept that a disregard for technology might be restricting the way we think about the world and also undertake research (Ihde, 2008; 2009; Ash & Simpson, 2016; Dovey et al., 2018). The opportunity that technology has to offer phenomenological research will be explored later whist introducing post-phenomenologically ideas within Chapter 4.

Within a design context this romanticism and technological mistrust is inherently at odds with how modern design processes are regularly structured and undertaken, for better or for worse. Computer aided design (CAD), computerised modeling and rendering are established tools across many built environment design professions (Goldhagen, 2017). Yet a discussion of their impact, from a phenomenological perspective, is challenging. This is due to the way phenomenological foundations contain limited scope of the potential benefit of such design methods or even the opportunity to discuss how they might be impacting the way initiating environmental change is undertaken.

Social over spatial and material

Poststructuralist philosophers Derrida (1974), Deleuze (1990) and notably Foucault (1979) have expressed failings with phenomenology due to its insistence on taking the human and its experiences of the world as the starting point and ultimate ontological measure of all things. For them, emphasis on individual agency, subjectivity and perception suppresses the complexity of the world whilst lessening the value of spatial and material dimensions as well as the influence of wider social structures (Dovey, 2010). Whilst Merleau-Ponty (1962) expressed significance upon spatial factors and their impact on existential being, for poststructuralists his ideas and those of other phenomenological thinkers are not balanced enough (Wylie, 2007). Overall, therefore, whilst phenomenology is socio-spatial in principle, especially within the ideas of Merleau-Ponty, it is often heavy bias towards social factors (individual subjectivity) over spatial considerations.

For an investigation examining urban street edges this socially driven experiential focus has noticeable implications. Street edges have been discussed as an interconnection of social and spatial (Thwaites, et al. 2013; Dovey & Wood, 2015), however, establishing and contributing to the knowledge of these realms via a phenomenological framework could suppress a full understanding of the impact of certain spatial and material factors. By focusing upon understanding and ultimately describing experience of street edges it becomes challenging to fully understand what it is about them physically that makes them what they are.

When design decision-makers seek to initiate environmental change without considering the impact of their intentions on society the results can be devoid of social responsiveness and experiential richness (Montgomery, 2013; Ellard, 2015; Goldhagen, 2017). Phenomenological thinking fundamentally intends to address this. However, if design intentions are so humanist in focus that material quality and spatial characteristics are not fully considered or resolved the resilience, usability and opportunity for personal adaptability and change may not be incorporated or facilitated within design interventions. The manipulation of the environment is both social and spatial, neither existing without the other but in balance (Habraken, 1998). An approach that is too phenomenologically focused could therefore potentially push this balance in a direction that fails to provide a robust environment (street edge) for people to inhabit and use.

Phenomenology overview

Phenomenological thinking has contributed greatly towards equipping people with a philosophical framework for understanding the inherent complexity of place(s) (Cresswell, 2015). As living and experiencing human beings it is only natural that to foster an understanding of the world we need to engage and experience it to comprehend its fluctuating richness. This humanist-driven experiential grounding has provided many with a comprehensive starting point, however, a number of people have started to question the foundations of phenomenological ideas. The next section will further introduce the ideas of one such group who have argued against phenomenology in the pursuit of a more balanced socio-spatial ontology.

Understanding street edges through a social constructivist assemblage of place

Over the last thirty years, and more intensively during the past fifteen, a number of theorists have started to consider place not just in experiential and subjective lived terms but as a broader idea encompassing a multitude of societal factors spanning political, cultural and economic influences (Cresswell, 2015). Philosophers of place, such as Casey (1997) and Malpas (1999; 2006) have pushed such thinking. They have argued that place is not only naturally formed but that it is often created directly through human action and processes, especially in urban contexts. Within geographical debate such thinking is topical as we enter a new epoch: the *Anthropocene* (Steffen et al., 2007; 2015). This accepts that human influence regularly dominates natural environmental processes that previously defined human existence. Within such a mind-set is embedded the understanding that the materiality of the world is inherently socially established, and not just something that is pre-given and experienced by humans, as within some phenomenological thinking (Wylie, 2007; Dovey, 2010). Place therefore takes on a more integrated social-spatial conception, which some poststructuralist thinkers have used to establish a philosophical position based upon *assemblage*s (Deleuze & Guattari, 1987; DeLanda 2006).

Assemblage is a mind-set that has been productive within geographical (McFarlane & Anderson, 2011) and importantly urban built environment contexts, with some degree of focus upon urban edges (Dovey, 2010; Dovey & Wood, 2015; Dovey, 2016; Dovey & Pafka, 2017; Dovey et al., 2018). At a philosophical level assemblage refers to a whole, the properties of which emerge from the interactions between both social and spatial heterogeneous parts (DeLanda, 2006). For Dovey & Wood, within the context of place, assemblage acts as a verb that cuts across the

subject/object divide, ontologically focusing –

> …*attention on processes of connecting: connecting people or firms to each other; producers to consumers; people to buildings; public to private space.*
>
> Dovey & Wood, 2015, p.4

Central within such thinking is the concept of the rhizome and its influence upon socio-spatial connections (networks) and thus the fundamental characteristics of reality (Dovey, 2010; Dovey & Wood, 2015). Storper & Scott, during their recent critique of current debates in urban theory, discuss this –

> *These networks bind together unique human and non-human objects within fluid, hybrid mosaics forming more or less temporarily stabilised systems of interconnections representing the current state of the observable world. Assemblages become stabilised by 'territorialisation' (as opposed to destabilising deterritorialisation) when they are anchored to particular geographical space. Importantly, any state of reality in this theory is taken to be 'flat' in the sense that any perceived hierarchical or scalar ordering (from top to bottom) decomposes back again into the kaleidoscopic, rhizomatic and horizontal relations that are said to constitute it.*
>
> Storper & Scott, 2016, p.12

Assemblage is therefore inherently socio-spatial in nature; it highlights connections existing between places and objects and also between people and places. Significantly, however, assemblage ideas focus upon the connections between things, rather than the things themselves, notably, in relation to how these connections are structured in a rhizomatic way. Dovey & Wood highlight – *assemblage is cluster of interconnections rather than a 'thing'* (2015, p.4). This rhizomatic outlook sees the connections within the world as equal and interconnected as opposed to hierarchical (Dovey, 2010).

Apparent within the network of connections is the way territorialisation, through *segmentarity*, plays a role in stabilising what could be perceived as a transient structure of socio-spatial flows in a continual state of *becoming* (Dovey, 2010). This territoriality is the structuring element that ties people to place through the creation of socio-spatial boundaries, which resonates with the ideas of Habraken (1998) and his levels of built environment *control* as well as Thwaites et al. (2013). Such territorial definition within an assemblage can be as simple as repositioning and occupying a chair within a park or standing up against a bar waiting to be served, which subsequently highlights how places are continually being territorially remodeled (Deleuze, 1990; Dovey, 2010). Place is thus given a more dynamic temporality and fluid philosophy within assemblage. It is also more balanced in socio-spatial understanding than phenomenological notions through its perspective on social influenced materiality and thus place(s) (Cresswell, 2015).

Research, design decision-making and counter arguments to assemblage

> *The major contribution of places as assemblages is at the practical application of theory to analysis and design.*
>
> Muminovic, 2015, p.308

Overall, the use of assemblage in research is a relatively limited, especially within a built environment context with Kim Dovey and colleagues using the approach most prominently (Dovey & Wood, 2015; Wood & Dovey 2015; Dovey & Ristic, 2015; Dovey & Pafka, 2017; Dovey et al., 2018). The above quote, written during a critique of assemblage thinking by Muminovic (2015), does however highlight how people are beginning to explore its potential for both built environment research and design.

Whilst maintaining a humanist focus, notably within the work of Dovey (2010), assemblage beings to address from some of the issues that potentially impact a phenomenological research approach. Its transition from dwelling to becoming; wider social drive over subjective experience and ability to complement a strong human orientation with a material understanding helps move the mind-set beyond phenomenological ideas. This is whilst remaining grounded within real-world understandings. It, therefore, maintains the anti-Cartesian principles established within the conception of phenomenology whilst realigning some of its ideas within the context of modern societal needs within a forever-developing world. For theorists like Dovey (2010), who heavily references phenomenologists, notably Merlau-Ponty (1962), assemblage is regularly regarded as a re-orientation of lived principles, which are still established through the embodied nature of real-world multi-sensory experience. Thus the potential of the human body for understanding the nature of assemblages still holds potential within a research context. A change in mind-set, however, from subjectively describing the essence of experience towards a greater materially driven and wider societal comprehension, based upon the connection between aspects of an assemblage, brings the approach into a more progressive and balanced socio-spatial sphere –

> *It enables us to encounter and understand the sense of place as an everyday experience rather than either an essentialized 'genius loci' or myth.*
>
> Dovey, 2010, p.30

Thinking in such a socially enabling yet materiality-accepting way also provides assemblage ideas with potential usability within a design context. However, such an idea has received little interest especially through Deleuzian philosophical foundations (Muminovic, 2015). With the acceptance that places are made up of an interaction of parts, in the creation of a whole, assemblage ideas shift design focus away from buildings and spaces as individual and separate entities (an issue detailed earlier) towards an interconnected comprehension of territorially manifested socio-spatial realms (Dovey, 2010). It also moves beyond an attempt to base design intervention upon the

multiplicity of subjective experience, which is a problem discussed with phenomenological thinking. Within the context of the urban street edge such a comprehension is potentially beneficial, especially in the way multiple territorialised realms sit adjacent to each other within and across urban street edges (Thwaites et al., 2013). Here, street edges are not singular entities to be acted upon but are an interconnection of parts that when adjusted can influence the manifestation of the wider assemblage (Thwaites et al., 2013; Feliciotti et al., 2016). The exploration within Parts 2 and 3 of the current chapter will build upon this. Assemblage, therefore, not only holds the potential to equip design decision-makers with a philosophical framework for the creation of new environments, of which street edges are a key component, but also the retro-fitting of existing places (Dovey, 2010). This makes it a responsive philosophy for built environment modification, which often requires the need for temporal change and longevity inline with societal shifts, desires and changeable requirements (Thwaites et al., 2007; Dovey, 2010; Feliciotti et al., 2016). Whilst this is potentially the case, the current uptake of assemblage ideas outside of philosophical realms is relatively limited (Muminovic, 2015).

Aligning with the approach employed within the examination of phenomenological thinking the following will now look to explore issues that has arisen in relation to assemblage ideas. Again, the intention is to build an understanding of its limitations so that the resulting philosophical foundation employed within the current investigation is reflective of current argument and debate.

Language

During their critical assessment of active debates in urban theory Storper & Scott (2016) highlight assemblage as a key concept within current urban thinking. However, they go on to explore some of the issues associated with its philosophical foundations. To begin their analysis, they highlight the vague and often-impenetrable language adopted by the initial philosophical advocates of assemblage, notably Deleuze & Guattari (1987) and DeLanda (2006), which is an issue echoed by Muminovic (2015) and Dovey & Pafka (2017). This has resulted in secondary commentators often having considerably different interpretations of what an assemblage actually is. Within the current investigation the concepts of Dovey (2010) and Dovey & Wood (2015) have mostly been used to aid in navigating the philosophical foundations of assemblage. But, it is often noticeable that their ideas can sometimes differ from the geographical assemblage concepts of MacFarlane & Anderson (2011), for example. Muminovic (2015) accepts however that this complexity exists and advocates that assemblage's contribution may potentially be purely in terms of accepting that places are constituted of interconnected social and spatial parts. This is potentially overly simplistic; however, it is an idea regularly missing within current built environment considerations.

As a result of language issues research and design decision-makers have potentially avoided the use of assemblage thinking, especially at a deeper level than notions of interconnectedness. Its

ideas thus remain relatively under used within built environment discussion. However, people like Dovey and colleagues have started to use assemblage as foundation from which to examine differing contexts, most recently whilst mapping various socio-spatial factors that impact urban environments (Dovey et al., 2018).

Naïve objectivism

Brenner et al. (2011) have highlighted a limitation with assemblage theory based upon its focus towards the presumption of facts. Within the case of assemblages this is the interconnection between people and material objects, highlight how connections across things are supposed to –

> *Speak for themselves rather than requiring mediation or at least animation through theoretical assumptions or interpretive schemata.*
>
> Brenner et al., 2011, p. 233

Similarly, Storper & Scott (2016) discuss this issue detailing how assemblage ideas often lead to a descriptive and anecdotal process of investigation, which is something that has also been levelled at phenomenological approaches.

Within a research context the focus upon connections that are supposed to *speak for themselves* could result in questioning – *how do you study a connection?* If the focus of attention is not the human or the non-human factors within the assemblage it becomes challenging to fully comprehend, or within some research contexts capture and interpret, the shifting interconnections within rhizomatic networks. The same issue relates to design decision-making. With the focus upon socio-spatial interconnections – h*ow do you seek to promote change that focuses upon connections?* This is especially challenging when taking into consideration the next point.

Significance in the inherent complexity of the city

> *The result is a largely indeterminate concept of the city as a complex, variegated, multifarious, open-ended, fluid, unique, hybrid, unruly, nonlinear, etc., etc., aggregate of desperate phenomena tied together in a haphazard mix of casual and contingent relationships.*
>
> Storper & Scott, 2016, p.13

With such a specific focus upon the interconnection between socio-spatial factors, assemblage thinking potentially makes it difficult to elicit what is significant or meaningful within multifaceted urban realms, as detailed in the above quote. This predominantly comes from the rhizomatic nature of its foundations with networks of social and spatial influences being regarded as equal in terms of signficance (Dovey, 2010; Storper & Scott, 2016). As a mind-set it lacks a foundation that mediates what is influential –

In other words, there are no theoretical guideposts in assemblage theory for telling us how to tease out significant relationships or distinguish between the trivial and the important.

Storper & Scott, 2016, p.12

Within a research context this infers that the multiplicity of the world is somewhat flat in terms of social importance, due to the equality within the assemblage networks, yet also incomprehensibly complex. It thus makes it difficult to focus a research investigation as there are no salient points of significance within the environmental assemblage to focus upon. This is alongside the fact that all the points are potentially interconnected with a wide range of multifaceted factors socially, economically, culturally, further compounding the complexity. As Storper & Scott (2016) highlight there is the requirement for theoretical guideposts to focus attention, which within phenomenological thinking is lived human experience. Yet assemblage lacks this focus. In design terms, the issue of significance and complexity has a similar effect. If a design decision-maker is to approach a problem, based upon assemblage foundations, it could become difficult to see where attention should be concentrated. Without points to focus upon there is limited guidance upon where to start or distribute priority.

Assemblage overview

With society entering a new age (Steffen et al., 2007; 2015), the material form of which is inherently socially constructed, assemblage ideas could provide a productive foundation through which to explore the nuances of place(s) like street edges. At its core it focuses philosophical attention away from purely social or spatial factors, placing greater emphasis upon the relationship and interconnections between these dimensions (Dovey, 2010; Dovey & Wood, 2015; Dovey & Pafka, 2017). This is a relatively new way of thinking and could provide an opportunity for progressive ways of understanding how environments such as the urban street edge come into existence. This investigation will build upon this opportunity whilst incorporating such ideas within its philosophical underpinnings. However, as detailed there are issues still inherent within assemblage as a philosophical foundation.

Philosophical foundation - moving forwards

Rather than seeing phenomenology and assemblage as two separate and distinct philosophical strands the current investigation will regard them as inherently entwined, aligning with Dovey (2010). It thus adopts the position that urban street edges are socio-spatial assemblages, building upon Deleuze & Guattari (1987) and DeLanda (2006). Here, social and spatial are interconnected in a segmented and territorialised structure that is continually in state of becoming (Dovey, 2010; Dovey & Wood, 2015). It is, therefore, never static but continually being territorialised and re-territorialised through human adjustments to and within its socio-spatial make-up (Habraken, 1998; Dovey, 2010). This will be explored in greater detail within Parts 2 and 3 of the current chapter. Instead of being flat in terms of significance, however, stemming from assemblage's rhizomatic mind-set, it is lived and experienced through human sensory engagement. This builds upon the phenomenological foundations of Merlau-Ponty (1962). An experiential focus provides opportunity through which salient and significant aspects of the street edge assemblage can be understood, thus addressing issues raised by Brenner et al. (2011) and Storper & Scott (2016). Experience is thus the mediator, and the point of focus, between socio-spatial influences and ultimately the ontological connection between social and spatial within the urban street edge assemblage. The result is a distilled philosophical position that regards -

From the perspective of street inhabitants, urban street edges are experienced as socio-spatial assemblages.

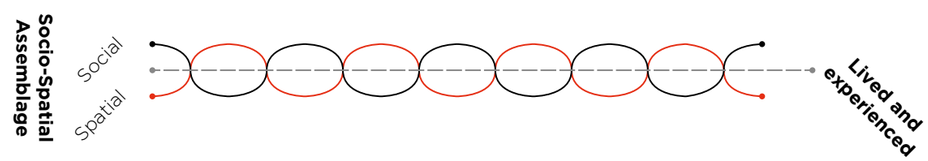


Figure 7 - Urban street edge philosophical foundation

The integration of both phenomenological and assemblage conceptions of place means that, within the context of this current investigation, some of the ontological issues embedded within both of these ways of thinking have started to be addresses. There is the acceptance, however, that issues remain with each philosophical position and an integration of both potentially does not fully resolve such issues. Although, within the context of an inquiry into the urban street edge, the incorporation of both provides a progressive epistemological foundation through which these realms can begin to be examined.

Part 2: Urban street edges as multi-scalar and experientially multi-directional assemblages

The following section will use existing discourse to introduce two fundamental properties of the lived and experienced socio-spatial urban street edge assemblage. In doing so, the often-abstract philosophical concepts discussed so far will start to be focused specifically towards street edge characteristics and how they are engaged by street inhabitants. The discussion will firstly focus upon how urban street edges are not singular, discrete entities. Instead they comprise a range of interconnected and nested scales – they are *multi-scalar* assemblages. It will then highlight the how street edges do not only delineate streets as solely one-directional linking spaces but they have a complex experiential directionality that counters the linearity of the edge and wider street – they are experientially *multi-directional* assemblages. Prior to this, the foundations and justification for these notions will be discussed.

Foundations and justification for multi-scalar urban street edges

Street edges can be considered as a key component of a multi-scalar urban system (Hillier & Hanson, 1984; Feliciotti et al., 2016). They contribute towards a framework of nested socio-spatial realms establishing the overall built environment (Lynch, 1960; Alexander, 1979; Habrken, 1998; Bobic, 2004; Glaser et al., 2012; Feliciotti et al., 2016). Reflecting upon street edges in this way builds upon ideas noticeable within philosophical as well as broader built environment theory.

Philosophically, assemblage discusses the need for multi-scalar understandings (Deleuze, 1980; DeLanda, 2006). Dovey & Wood re-enforce this point –

> … *assemblages at scales of building, street, neighbourhood, city and globe are interconnected; analysis at a single scale can be inherently blind.*
>
> Dovey & Wood, 2015, p. 4

Connections between individual components and scales thus contribute to the way urban street edge assemblages come into being, which counters a singular consideration of these settings as a whole (Dovey, 2010; Dovey & Wood, 2015). Street edges cannot, therefore, be regarded as individual and definable objects within a linear understanding of environmental scales, with such thinking resonating with Alexander's concept of nested *wholeness* (Alexander, 1979).

In its foundations, phenomenology also requires a nuanced consideration of scale, especially its impact upon lived experience. For Merleau-Ponty (1962) the multi-sensory, perceiving human body is the receptor through which the world is interpreted. This focuses phenomenological attention towards the human-scale, peoples' sensory system and thus regularly the immediacy of the inhabited environment (Ingold, 2000; Belova, 2006). Equipped with senses that are able to project beyond the confines of the physical body, however, notably vision, means that the phenomenological built environment is potentially more complex than the relationship between people and the immediate environment around them within close proximity (Hall, 1966; Degen, 2008; Gehl, 2010). Here, the human sensory system has the potential to experience multiple scales and in doing so further promotes the requirement for multi-scalar edge considerations.

Moving away from philosophical notions, multi-scalar ideas have recently been established within progressive built environment explorations relating to street edges (Bobic, 2004; Porta & Romice, 2010; Glaser et al., 2012; Feliciotti et al., 2016). Highlighted throughout is the need for thinking that considers multiple scales, even though the point of focus is regularly a specific scale of an edge / built environment – Bobic (2004) focusing upon block and streets; Porta & Romice (2010) at the plot / building; Glaser et al. (2012) at the plinth / ground floor and Feliciotti et al. (2016) spanning the interconnections from the plot up to district scale. Within these concepts, whilst reflecting assemblage ideas of Deleuze (1980), DeLanda (2006) and Dovey & Wood (2015), edge scales should not be approach as linear and easily ordered. Bobic highlights –

> *... only by observing interrelationships between different entities and scale levels, the knowledge about the character of city structure can be learned. How it is composed, balanced and integrated, where do conflicts occur and what are the driving forces? Answers to these questions could be at best found at the place where different entities and scales become juxtaposed. That place is on the edge.*
>
> Bobic, 2004, p. 54

Glaser et al. (2012) discusses the multi-scalar nature of street edges in a nuanced everyday and human-focused manner whilst discussing street edge *plinths* (building ground floors). Significantly, they highlight how nested edge scales are not only spatially manifested but also socially important, influencing edge engagement and use –

> *The levels cannot be separated from each other, they interact; without enough people living in the area, for instance, or lack of power, a shop can have a fantastic plinth, but still will find it hard to survive. A single building may be well designed (from a street perspective), but if the rest of the street had blind façades it will not function on its own. A street may look great, but if it is not connected to the mainstreams of pedestrians in the city centre, it will be difficult.*
>
> Glaser et al., 2012, p. 17

Such ideas evidence the requirement for multi-scalar street edge thinking, which forwards these realms as a complex interplay and nesting of scales. The intention within the current investigation and chapter is to distil existing ideas and understandings, bringing them together whilst providing a multi-scalar street edge framework that is explicitly phenomenologically focused from the perspective of street inhabitants. Focusing ontologically from such a phenomenological standpoint, whilst adopting assemblage ideas, provides the lens through which the nested edge scales can be conceptualised, refined and potential experiential significance examined. The discussion that follows starts this process. It will conceptually forward street edges as an interconnected assemblage of phenomenologically significant *plots*, *plinths* and *segments*. Prior to this, however, the conversation will consider the importance of multi-directional edge thinking, which will ultimately aid in refining multi-scalar notions.

Foundations and justification for experientially multi-directional urban street edges

Recent attempts have been made to highlight how urban streets are not only functional, transport-focused corridors connecting together urban environments (Jones et al., 2007a; 2007b; 2008). They are more than one-dimensional and experientially one-directional linear spaces. Key within this is the way streets are being increasingly promoted as distinct places of human social and experiential benefit in their own right. This is by no means a new idea with many writers and researchers since the 1960's forwarding the social significance of streets (Jacobs,

1961; Whyte, 1980; Gehl, 1987; Moudon, 1987; Moughtin, 1992; Carr et al., 1992; Mehta, 2013; Mantho, 2014). However, in light of the opportunity for streets to aid in addressing complex urban sustainability agenda, they have started to be re-conceptualised –

> *Over the past decade, there has been an increasing recognition that urban streets contribute in many ways to the economic, environmental and social functioning of cities, and do much more than simply provide the infrastructure for vehicle-based transport systems - they are important public places too. Streets represent around 80% of public space in cities, and most buildings and urban activities front onto streets. So that most urban activity and much urban identity is closely associated with the urban street network.*
>
> Jones & Boujenko, 2009, p. 1

Central within these ideas is the relationship between street and edge and how both influence the street's manifestation as combined a *link* and *place* (Jones et al., 2007a; 2007b; 2008). Links are directional movement corridors for the efficient movement of people and goods around urban areas (one-directional); places are specific destinations where pedestrian-focused and regularly stationary activity occurs (multi-directional). Significant within this is the physical relationship between roads, pedestrian thoroughfares and land uses, which Jones et al. (2008) have explored with the aim of creating a more holistically integrated model, see Figure 8. Such thinking builds upon Moughtin (1992) and noticeably Gutman (1986), who have advocated the need for a more integrated, three-dimensional and multi-directional consideration of streets and thus inherently their edges.

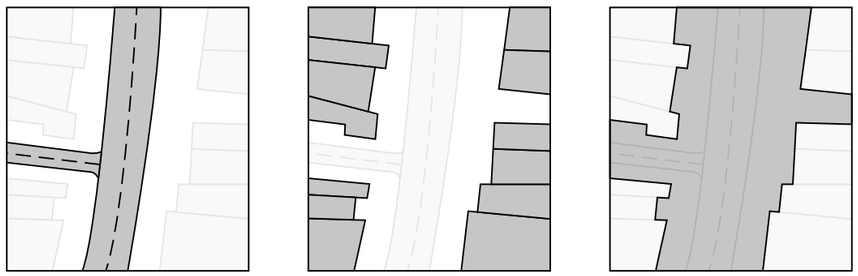


Figure 8 – Integrated street and land use concept

Such ideas are similar to Thwaites et al. (2013) who provide multi-direction edge insight through their *Transitional Edge* concept. Within this, they develop a phenomenologically grounded model that explores how edges and internal spaces can be considered as experientially integrated with the open space adjacent to them, the street for example. This thinking resonates most prominently with the work of Gehl (2010); Gehl et al. (2006); Bobic (2004) and Mantho (2014) who have also argued for a human-focused consideration of street and edge relationship. Even

though Thwaites et al.'s (2013) ideas are not street specific per se, their thinking provides a nuanced insight that can start to be explored in street edge specific contexts. For them, when certain socio-spatial transitional characteristics are present, there is potential for urban edges to phenomenologically impact the directional / location emphasis of these settings providing them with a complex multi-directionality. This aligns with Cullen's (1971) experiential sensations of *here* and *there* towards an understanding that explores transitional *extent* along the edge, *laterality* across it and *locational* significance within it. Building upon these ideas, the multi-directionality of the edge and street is thus potentially more phenomenologically established than a consideration of *link* and *place* whilst going beyond the impact of land use and human functioning towards an explicit experiential focus. However, the way in which the ideas of Thwaites et al. (2013), and likewise the work of others, are developed means that they are not fully integrated into mainstream street edge thinking and especially multi-scalar edge ideas.

Overall, such thinking justifies the opportunity to explore urban street edges as experientially multi-directional assemblages. The discussion that follows will thus seek to build upon such directional / locational notions established in response to *here* and *there* (Cullen, 1971), *link* and *place* (Jones et al., 2007a; 2007b; 2008) as well as *extent*, *laterality* and *location* (Thwaites et al., 2013).

Constructing a multi-scalar and multi-directional urban street edge model

The following section aims to conceptually develop how the urban street edge is phenomenologically engaged as a multi-scalar (an interconnection of nested scales) and multi-directional assemblage (an entity with the potential to influence directional / locational experiential emphasis).

Awareness scales

Before focusing phenomenologically, thus inherently at a more human-scale, it is worth noting that clearly there are scales of the urban street edge that are cognitively constricted in a way that makes people aware of them rather than offering opportunities for true human habitation. This builds upon the understanding that street edges do not sit independently from urban / regional contexts but are part of their multifaceted and nested complexity (Bobic, 2004; Porta & Romice, 2010; Feliciotti et al., 2016).

A scale which people are often aware of is the city district or quarter. For Lynch, districts are a key component in creating a city's image but are fundamentally – *large city areas which the observer can mentally go inside of* (1960, p.66). The emphasis here is upon mentally, highlighting a scale that cannot be occupied and fully engaged because of the proportions and capabilities of the human body. They do, however, remain as something that people are physiologically and cognitively aware of and are essential in terms of cities becoming defined and distinct places. For

some, districts have been considered as a complex and multifaceted network of socio-spatial dimensions. Hillier & Hanson (1984) developed space syntax for mapping such factors whilst highlighting how a multitude of influences impact how people use urban spaces. Recently, Dovey et al. (2018) continued such thinking whilst mapping assemblages comprising social and spatial considerations, often at district and city scales. From a morphological perspective the layout and built structure of districts has been observed through the work of Anderson (1986), Jacobs (1993) and Bosselmann (1998). Here, the way in which buildings and physical structures define open space has been analysed and contrasted across areas of multiple cities. However, these explorations and representations do not capture the way people experientially engage built environments and their edges from a direct phenomenological perspective. Instead they map and detail urban areas that people are aware of when inhabiting urban contexts.

Feliciotti et al. (2016) have forwarded how districts are established through the coming together of sanctuary areas, see also Porta et al. (2014). For them, this is a linking scale, anchoring together large urban areas (districts) to the human-scaled dimensions of street edges. From a phenomenological perspective, however, this scale remains cognitively constructed not physically inhabitable with opportunities to engage with their totality. Providing sanctuary areas and districts with morphological structure is the urban block. When blocks sit adjacent to each other they make-up the built form and spatial structure of urban contexts (Bobic, 2004). This is visualised two-dimensionally within the figure-ground plans of Jacobs (1993) and Bosselmann (1998) and three-dimensionally by Feliciotti et al. (2016).

Like districts and sanctuary areas, blocks in their totality can be thought of as, at some level, mentally constructed. This is because psychological processes are required in order to consider their full proportions and properties. People cannot fully comprehend the extent of a block, except maybe from above. However, blocks do start to phenomenologically differ from larger urban scales as people can begin to engage with them at a human-scale, for example, when standing on a street corner and looking along the edge of a block allowing for a consideration of its length, as visualised by Bobic (2004). Within cities that follow a grid layout this is most apparent with blocks often being the measure of distance between places, for example – walk four blocks that way and you will get there. This potential, as a phenomenological entity, is however only really afforded by the fact that street edges, and the nested scales within them, are constructed upon blocks (Bobic, 2004). Based upon this, it is potentially beneficial to think about blocks more as footprints rather than as three-dimensional built entities, as Jacobs (1993) and Bosselmann (1998) have represented them. This in turn focuses greater attention upon the significance of the urban street edge and its constituent scales that sit upon the two-dimensional layout of the block. As a response such thinking provides greater phenomenological focus as well as a greater understanding of the significance of the three-dimensional built forms that comprise the edge's assemblage, which have been shown to influence urban resilience and functioning (Porta & Romice, 2010; Gehl, 2010; Salat & Bourdic, 2012; Feliciotti et al., 2016).

Figure 9 – Awareness scales of the urban street edge

In relation to the experiential multi-directionality of the urban street and edge, the scales introduced so far can be thought of as nested entities that re-enforce urban environments as a complex and multifaceted network of socio-spatial dimensions, as visualised by Hillier & Hanson (1984) and Dovey et al. (2018). Here, the focus is often upon connectivity, hierarchy and the relationship between built form and the wider-scale human processes that take place within such settings (Mehaffy et al., 2010; Porta & Romice, 2010; Carmona, 2015; Feliciotti et al., 2016). The focus of attention is not upon how such streets and edges are experientially multi-directional through phenomenological engagement. In light of this, the scales introduce so far provide a two-dimensional structure that the socio-spatial assemblage of the urban street edge can nest within.

Plot scale of urban street edges

When physically inhabiting streets and engaging their edges almost all of the human senses are stimulated in some way by the surrounding complexity of the environment (Rodaway, 1994; Degen, 2008; Gehl, 2010; Degen & Rose, 2012; Mehta, 2013). There is thus a phenomenological distinction between the more human-scaled nature of streets and edges when physically inhabiting them compared with the awareness scales that have been introduced so far.

The first scale to be introduced that holds phenomenological significance is the plot. Plots, which Porta & Romice define as – *a fenced portion of land that is entirely accessible from the public space* (2010, p.14), flank the open space of streets and are regularly built upon within urban contexts. Sometimes known as *lots* (Dovey et al., 2016), this scale of the urban environment, and thus street edge, has been considered key within urban analyses for many years (Conzen, 1960; Moudon, 1986; Marshall, 2009; Berghauser Pont & Haupt, 2010). Within this, they have been shown to hold particular significance in terms of a city's daily social and economic functioning (Porta & Romice, 2010; Tarbatt, 2012; Romice & Porta, 2015; Feliciotti et al., 2016).

Figure 10 – Example built plot structure of urban street edge

In combination with each other, built plots provide street edges with three-dimensional morphological structure, influencing significantly an edge's capacity to accommodate a range of facilities whilst also dictating its resilience to change over time (Feliciotti et al., 2016; Dovey et al., 2016). In relation to this, a series of small-scale interconnected plots, for example those within Figure 10, have been generally considered to be more adaptable and flexible in response to societal transitions. For Wood & Dovey (2015), the adaptable morphological structure of these smaller plots influences the capability of an area to accommodate modern, creative industries highlighting the socio-economic influence that this scale of the urban street edge holds. Salat et al. (2014) also discuss this, whilst highlighting how a variability of plot size affords a multiplicity of occupancy, thus providing urban street edges with an array of potential functions. Dovey et al. (2016) echo this whilst exploring the significance of small-lots (plots) upon the diversity and social vitality of transit corridors. Through ideas like these, the plot has been put forward as the fundamental socio-spatial building block of sustainable urban environments (Porta & Romice, 2010; Tabartt, 2012; Romice & Porta, 2015; Dovey et al., 2016). Significant within this socio-spatial consideration is the way plots afford territorialisation, making them often independent components of the urban street edge, which the previous scales introduced so far have not allowed –

> *As each plot is occupied by an independent function and is subject to an autonomous ownership regime, to a large extent plots work as proper modular elements: they are individually, functionally and geometrically independent from other plots while at the same time somewhat connected to each other (as they rely all on the same network).*
>
> Feliciotti et al., 2016, p. 6

Noticeable is how built plots have a considerable impact upon what street edges can potentially offer street inhabitants who phenomenologically engage them. They impact its resilience and adaptability over time, what functions it might house as well as provide a morphological structure that allows opportunity for further nesting of street edge scales. However, such nesting has received limited exploration. The work of Feliciotti et al. (2016); Dovey et al., (2016); Tarbatt (2012) and Porta & Romice (2010) who, whilst providing in-depth and progressive accounts of plot significance, rarely break plots down in any greater detail. They regard plots at the smallest unit of land use within urban street edges (Feliciotti et al., 2016). Such thinking might be due to an emphasis towards morphological considerations rather than experiential motivations. Within

Romice & Porta (2015), however, the discussion provides insight that offers the chance for a nuanced subdivision of plots whilst considering an interdependency of ownership and physical factors –

> *The plot may or not coincide with ownership subdivision: it is of crucial importance in fact to distinguish the unit of development from the unit of ownership.*
>
> Romice & Porta, 2015, p. 2

There is therefore an opportunity to explore how independent social actions, involving ownership and territorialisation, can be established at smaller scales nested within the morphological assemblage that built plots provide. Before this takes place, however, the experiential multi-directionality offered by considering the edge in terms of plots will be examined.

Experiential multi-directionality of street edges established through plots

Without the presence of variable built plots urban street edges are flat, experientially one-directional and grain-less façades (Bobic, 2004; Gehl, 2010). This would result in the adjacent streets being defined predominantly as functional corridors for connective linkage (Jones et al., 2007a; 2007b; 2008; Gehl, 2010). Within such a situation the focus of experiential engagement is away from the inhabited locale through the street edge enforcing a level of phenomenological *thereness* (Cullen, 1971; Ellard, 2015). However, built plots start to breakdown the linearity of the overall street edge, and thus prevailing experiential directionality of the wider urban street. They do this by contributing a level of grain running along an edge's extent (Porta & Romice, 2010; Feliciotti et al., 2016). Here, differing buildings sit next to each other whilst being orientated in a manner that experientially counters forward focused street directionality. Significant within this structure is the opportunity for various in locational emphasis to begin to be manifested within street edges, or phenomenological *hereness* (Cullen, 1971; Thwaites et al., 2013); the beginnings of an experientially multi-directional street edge. Gehl et al. (2006) and Gehl (2010) have explored the importance of this with flat inactive façades, which lack variable detail running along them at a building scale, often disengaging people. This is due to limited points manifesting localised experiential intensity in terms of function as well as material richness. These understandings, therefore, place significant importance upon the way in which plots are organised and established; with a fine-grain edge structure that is plot considerate rather than block focused being forwarded as responsive to everyday human functioning (Porta & Romice, 2010; Tarbatt, 2012; Romice & Porta, 2015).

A street edge that is plot considerate provides opportunity for a detailed understanding of how building setbacks and projections can influence an edge's lateral articulation and continuity (Thwaites et al., 2013). This in turn impacts the spatial expansion and contraction of the adjacent street (Cullen, 1971; Mantho, 2014). For Thwaites et al. (2013) these factors contribute towards an edge's looseness and variability of enclosure. Looseness is categorised by an edge's potential

for experiential rhythmicity when journeying along it its length (Thwaites et al., 2013). This is related to levels of ambiguity and flexibility within the edge both socially and spatially (Franck & Stevens, 2007; Dovey, 2010). Enclosure relates to the edge's ability to define and frame space (Jacobs, 1993; Moughtin, 2003), providing it with opportunities for containment and likewise exposure (Porta & Renne, 2005). Such characteristics inherently have the potential to influence the directional / locational emphasis of an urban street edge, with variations in an edge's lateral articulation, through looseness and enclosure, offering opportunity for points of significant human occupation and territorialisation (Thwaites et al., 2013). However, whilst people are able to phenomenologically engage these edge qualities they are at a scale that makes their significance more morphologically established rather than experientially manifested through human-scaled factors (Bobic, 2004; Gehl et al., 2006). Further scales nested within plots need to be considered towards a stronger comprehension of lateral articulation along an edge's extent and thus its impact on street edge multi-directionality.

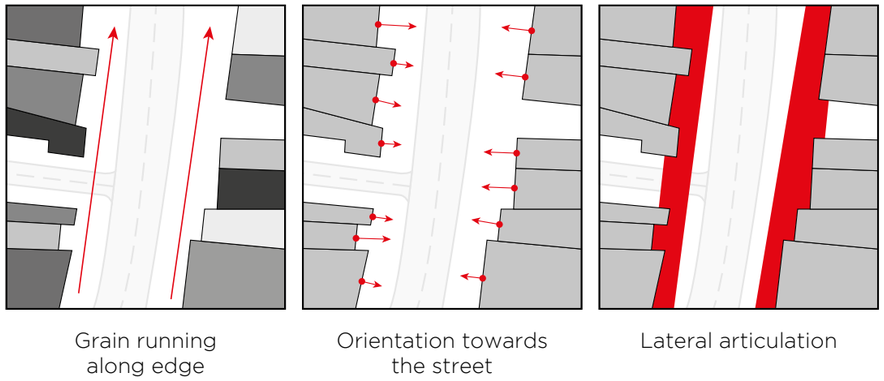


Figure 11 – Experiential multi-directionality of plots

Plots also dictate the vertical expansion of street edges through building height. This further influences a street's experiential sensation of enclosure and the way edges can provide streets with room-like qualities (Porta & Renne, 2005; Ewing & Clemente, 2013). The scale of built plots also influences the morphological depth of street edges. Feliciotti et al. (2016), discuss the significance plot depth with small-scale plots that have long tails (depth) benefitting urban resilience. However, morphological depth remains an under explored built environment and street edge dimension. Representations of plot depth can be seen with the street sections of Jacobs (1993) and more recently Mantho (2014).

As breifly discussed is the way multi-directional edge thinking, at a plot scale, has the potential to also impact the experiential directionality of the wider street. Significant here is the way plots, and the buildings upon them, orientate towards the open space of the street (Porta & Romice, 2010; Feliciotti et al., 2016). This impacts how the space adjacent to plots is experientially manifested as each built plot defines, to some extent, the character of the space adjoining it, see Figure 12 (Gehl et al., 2006; Thwaites et al., 2013). A singular building along an edge, characterised through block-based urbanism, thus often phenomenologically defines the adjacent street in a singular manner (Gehl, 2010; Porta & Romice, 2010). This is in contrast to an edge comprising a series of buildings, characterised through plot-based urbanism (Porta & Romice, 2010), which has the potential to break this singularity and thus also directionality (Buchanan, 1988; Gehl, 2010; Mantho, 2014). The street within the latter situations does not only act as a linear *link* but as a space with greater opportunity to hold individual locationally specific and experientially multi-directional *places* within it (Jones et al., 2007a; 2007b; 2008). This is manifested through points of significant *hereness* in response to the adjacent street edge and its plot structure (Cullen, 1971; Gehl et al., 2006; Thwaites et al., 2013). As before, however, to fully understand the potential of this multi-directional influence the street edge needs to be broken down into scales nested within the morphology of built plots.

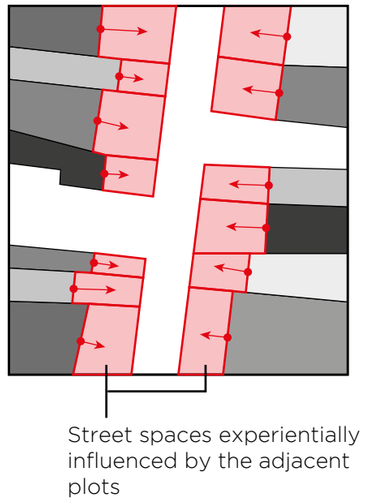


Figure 12 – Plots impacting the grain of the street

Plinth / plot ground floor scale of urban street edges

Focusing solely at built plot scale potentially fails to address the true nature of phenomenological engagement with urban street edges and the way scales nested within plots might be experientially significant (Bobic, 2004; Gehl et al., 2006; Gehl, 2010; Glaser et al., 2012). When inhabiting modern city centre streets the buildings that are constructed upon plots, establishing an edge's three-dimensional morphology, sometimes dwarf people in terms of physical scale (Gehl, 2010; Glaser et al., 2012). They are often structured in a way that makes engagement with them, in relation to their totality on a regular everyday daily basis, unrealistic –

> *If you stand on Forty-seventh Street and Fifth Avenue this Wednesday afternoon you'll be surrounded by a torrent of people. Some are rushing uptown for a meeting or downtown to grab*

a drink … There will be visitors gazing upwards – something New Yorkers never do – on their way from one landmark to another. If you imitate a tourist and look up, you'll see two great ridges of skyscrapers framing the shimmering valley that is Fifth Avenue.

Glaeser, 2011, p. 3

Glaeser's observation highlights how people going about their everyday lives rarely look up at a whole building. Only tourists and people who purposefully gaze upwards for a reason focus their attention at this built scale. Often you have to *imitate* them in order to look at buildings in their entirety. Sussmann & Hollander (2015), whilst aligning with ideas forwarded by Gehl (2010) and Goldhagen (2017), discuss how such phenomena is established through the way human-beings are anatomically and cognitively structured. We often look down and around at the aspects of the environment surrounding us. Barker & Loper re-enforce this –

And while we have cleverly devised ways to build upward, humans did not fundamentally evolve to look upward. Despite the detailed aerial imagery so common in architecture and urban design, we do not see, interact with, or experience spaces from a bird's eye perspective.

Barker & Lopez, 2014, Web

As a result, there is justification for street edges to be broken down and considered at nested scales beyond a singular built plot. This has started to be explored in greater detail recently, both academically (Bobic, 2004; Gehl, 2010; Glaser et al., 2012) and within wider urbanist and real-estate discourse (Baker & Lopez, 2014; Grant, 2014). One progressive approach is to think of the urban street edge in relation to its structure of ground floor *plinths* (Glaser et al., 2012).

The word plinth relates to the base or foundation upon which a column or structure sits. However, Glaser et al. (2012) use the term to mean the ground floor of a building. Beyond implying a structural significance, plinth is a term that will be adopted during the current investigation to aid in breaking down urban street edges into a finer level of detail that is potentially more phenomenologically responsive.

Figure 13 - Example plinth structure of urban street edge

During their exploration of plinths, Glaser et al. (2012) accept that there is the requirement for edge thinking at a building (built plot) scale. But, they argue that the predominant focus of attention, in terms of street edge human engagement, should be upon plinths rather than the overall building. Spatially plinths break down plots providing street edges with a level of vertical grain or layering, as seen within Mantho's work (2014). Importantly, in terms of this grain, plinths start to distinguish the realm of urban street edges that is directly accessible from the street, not just physically but also experientially (Gehl et al., 2006; Gehl, 2010; Glaser et al., 2012; Thwaites et al., 2013). Plots therefore provide the dominant morphological structure of the urban street edge (Porta & Romice, 2010; Feliciotti et al., 2016), with Glaiser et al. (2012) forwarding that the experiential properties of plots are dominated by their plinths –

The ground floor may only be 10% of a building, but it determines 90% of the building's contribution to the experience of the environment.

Glaser et al., 2012, p. 12

Street edge thinking that takes into consideration a plinth scale offers greater opportunity to be responsive to the way these realms are engaged at human eye-level during everyday situations (Gehl, 2010; Glaser et al., 2012; Sussmann & Hollander, 2015; Ellard, 2015; Goldhagen, 2017). This is especially important when focusing, as the current investigation is, from the perspective of street inhabitants. However, whilst establishing plinths as an essential concern in terms of edge engagement, Glaser et al. (2012) do not explicitly seek to break plinths down in any greater detail. Whilst inferring that plots (morphological) and plinths (experiential) are at some level independent entities they continue to highlight a distinct relationship between the scale of plots and the plinths within them, as highlighted within Figure 13. Here, plots provide a footprint for the scale of a plinth. Realistically, as they suggest but never fully establish, there is often a finer level of horizontal grain manifested within and running along plinths. In order to develop this further, this current investigation will later look to explore a further street edge scale that is nested within plinths – the urban street edge segment.

Experiential multi-directionality of street edges established through plinths

In relation to the experiential multi-directionality of urban street edges, plinths play a similar role to the plots, with a built plot's morphological structure influencing the proportions of these ground floor realms (Glaser et al., 2012). They continue to, therefore, provide street edges with grain running along their length (Gehl, 2010; Pora & Romice, 2010) and establish a level of lateral articulation (Thwaites et al., 2013). In combination, this provides opportunity for locationally specific qualities to be manifested within edges, thus breaking the linear directionality of the edge and street, as shown within Figure 11. These factors are, however, dictated to a greater extent by the morphology of the built plots than the plinths nested within them. Where plinths do play a significant role, which plot-focused considerations do not fully address, is within the way they bring such multi-directional potential down to a more human-orientated level. Through

equipping street edges with a greater level of vertical grain the phenomenological impact of the factors discussed are re-affirmed at a level that is potentially more responsive to the nature of human edge experience (Gehl, 2010; Glaser et al., 2012; Sussmann & Hollander, 2015; Ellard, 2015; Goldhagen, 2017). Plinths, therefore, compress the vertical expansion of the edge, concentrating engagement towards the *city at eye level* (Gehl, 2010; Glaser et al., 2012).

Like the built plot scale, plinths continue to provide opportunity for streets to establish a spatial structure that has a greater level of grain running along them and thus suppress the directional emphasis of the street, see Figure 12. Yet as before, this is focused more intensely due to the phenomenological emphasis of the edge now being at a human-scale.

Segment scale of urban street edges

So far, the discussion has focused predominantly upon morphological, although socially influenced, considerations and their impact upon the multi-scalar and multi-directional manifestation of urban street edges. The next scale to be introduced, however, highlights a distinct shift whilst promoting a stronger territorial and experiential emphasis at the *segment* scale.

The current investigation, building upon existing conceptual ideas, will forward urban street edge segments as the socio-spatial sub-division of plinths. Within this, the proportions of these segments can directly relate and be defined by the plinths within which they sit, or in contrast a plinth, and thus the ground floor of a single plot, can be made up of multiple urban street edge segments, see Figure 14. This is responsive to previous discussion explored through Glaser et al. (2012) and the relationship between plot and plinth scales. It is also reflective of notions raised by Romice & Porta (2015), with the development of street edge segments adding detail to the exploration of the interdependency of territorial ownership and physical edge form (developed morphology). Similarly, the development of street edge segments is responsive to Habraken's (1998) territorial considerations through levels of *control* and Alexander's notion of nested *wholes* (1979).

Figure 14 - Example segment structure of urban street edge

Building upon such foundations, urban street edge segments will be conceptually established

within the current section through exploring two currently unconnected yet theoretically consistent notions that converge, beyond similarities in their naming, when philosophically and theoretically investigated. Firstly, philosophical *segmentarity*, embedded within assemblage thinking (Dovey, 2010), provides an initial platform for exploration. Territorialisation and re-territorialisation plays a key role here whilst influencing and providing stability within these often-fluid urban realms. Alongside this, the foundations of experiential segments, developed within Thwaites & Simkins' (2007) *Experiential Landscape* and Thwaites et al.'s (2013) *Transitional Edge* theories, aid in establishing an explicitly experiential consideration that is phenomenologically manifested. Building upon and incorporating such territorial and experiential considerations helps to establish, at a conceptual level, the potential phenomenological significance that the ground floor segment scale holds within the edge's multi-scalar assemblage. Importantly, such notions are reflective of the philosophical foundations of the current investigation, developed within Part 1 of the current chapter.

It is worth highlighting at this point that the term *segment* has also been used within wider built environment discussion before. This is notably at broader scales, for example during Space Syntax analyses and the production of axial mappings (Hiller & Hanson, 1984). Within these, as shown within Porta et al. (2014), segments are often considered as a length of street between significant nodes. Segment is, therefore, used as a term when seeking to portion-up the complexities of urban environments into manageable parcels for in-depth analysis. Such thinking is not dissimilar to the ideas being explored within the current investigation. Here, the term segment is used to comprehend the multifaceted socio-spatial complexity of street edges. Inherently the ideas being developed within the current investigation, therefore, complement these larger scale segment analyses whilst providing a concept of segments with a finer, more human-scaled level of detail in contrast to current built environment and segment thinking.

Territorial segmentarity

From the street inhabitant's perspective, the segments that comprise an edge's ground floor can often be defined relatively easily in physical terms. Here, their spatial division is observable through walls and pillars as well as variations in materiality. This thinking resonates with Bobic's (2004) examination of street edges. Sometimes such a division is established through an edge's plinth structure (Glaser et al., 2012), but not always. Significantly, such material qualities and variations are not only physically established, in terms of structural requirements, but are often influenced by how such realms have been inhabited and manipulated through territorialising practices. Portions of the street edge have been appropriated and used to establish distinct and personalised realms. Within assemblage thinking such ideas are forwarded in relation to *segmentarity*, which sees the complexity of variable socio-spatial factors stabilised through socially manifested territorialising practices (Deleuze & Guattari, 1987; Dovey, 2010) –

Far from thinking of the world as a collection of beings who then have desires, Deleuze insists

that life begins from flows of becoming or desire, which then produce relative points of stability.

Colebrook, 2002, p. 66

Such territorialising stability makes significant and establishes what could potentially be a continuous and fleeting flow of social actions within spatial contexts through a permanence that has the opportunity to be short term or more sustained over time (Dovey, 2010). This can work in two ways whilst transferring these ideas into a street edge context.

Firstly, territorialisation, manifested within appropriation and personalisation, influences a segment's material and spatial manifestation. Such adjustments are most prominently undertaken by those who own / rent a given segment in order for it to reflect its function at that point in time. In terms of Habraken's (1998) *controls*, *form* is adjusted and personalised to serve the needs and desires of those who own / manage these spaces. This begins to define segments as distinct territorialised realms (*places*). For Habraken as well as Altman (1975) and Karrholm (2012) this means that urban environments, and noticeably street edges, are more than just physical *form*. They are a collection of socio-spatial places that people have created in line with their everyday needs and desires, which is a point resonating with Colebrook's (2002) previous quote. The result is ground floor spaces within street edges, independent of their plot or plinth morphologies, that are territorially manipulated to reflect variable functions, e.g. cafés, shops, restaurants, housing, estate agents, pubs etc. Ultimately, street edge ground floors are personalised and appropriated and thus territorially segmented (Dovey, 2010).

Beyond influencing the material and spatial manifestation of segments, the concept of segmentarity also allows for an experiential consideration that is territorially manifested (Dovey, 2010). Here, people territorialise and re-territorialise segments through inhabiting and engaging with their characteristics and qualities, a notion resonating with Whyte (1980); Jacobs (1993); Gehl et al. (2006); Gehl (2010); Thwaites et al. (2013) and Mehta (2013). This can be fleeting, for example looking through the window of a segment and engaging with the opportunities it affords inside; through to more sustained periods of occupation, like having a drink in a café or even dwelling within a segment. Through this, segmentarity considerations are provided with an experiential focus, established within the way people territorially occupying urban streets and their edges.

Established through these notions is a shift in emphasis away from predominantly physical and morphological considerations, which are noticeable at the broader street edge scales. This is towards an understanding manifested through distinct social and experiential considerations, providing a conceptualisation of urban street edge segments with a greater level of phenomenological focus. Here, social processes, manifested within segment territorialisation are required to i) establish these socio-spatial realms through territorial appropriation and personalisation, and then ii) experientially engage with them through territorial habitation and engagement. Dovey alludes to this with his integration of ideas –

This dimension intersects with the material/expressive dimension in that territories are inscribed through a mix of material and expressive boundaries.

Dovey, 2010, p. 17

Experiential segments

Alongside the points already raised whilst examining territorial segmentarity, Thwaites & Simkins (2007) provide a nuanced insight into peoples' experience of edge realms through their conceptualisation of *experiential segments*. In the following, whilst exploring a segment's experiential manifestation, a justification for segment consideration within a multi-scalar urban street edge model will continue to be forwarded.

Conceptually, for Thwaites & Simkins (2007), segments are established in response to the way locational significance becomes manifested during a phenomenological transition between realms. For them, segments are thus experientially created at the point where adjoining realms meet and in many situations overlap. Importantly, such thinking supports assemblage notions forwarded at a philosophical level as forwarded within Part 1 (Dovey, 2010). Here, the focus of attention is not specifically upon the distinct realms themselves but often the point at which they meet and the manifestation of this connection (Thwaites & Simkins, 2007; Thwaites et al., 2013) –

Because segments occur when adjacent realms overlap, they tend to carry attributes of both realms, but also develop those uniquely their own.

Thwaites et al., 2013, p. 105

Exploring such thinking in a street edge context, it is noticeable that a segmented relationship continually takes place across the edge's indoor-outdoor gradient (Gehl et al., 2006; Speck, 2012; Thwaites et al., 2013; Dovey & Wood, 2015). Here, open space sits next to and often experientially merges with the internal space of the street edge. For example, when doors of a shop open allowing sensory engagement to transition across the edge; chairs come out of a café creating an ambiguity about where the edge starts and finishes; people straddle the edge watching the activity of the street creating a complex realm of intense social interaction (de Jong, 1967; Gehl, 2010; Glaser et al., 2012; Thwaites et al., 2013; Metha, 2013). The importance of these processes in response to transitional edge / zones has been documented in wider built environment theory for some time, with a focus towards their social significance (Jacobs, 1961; Lynch, 1960; Cullen, 1971; Alexander, 1979; Bentley, 1985; Habraken, 1998; Frank & Stevens, 2007; Gehl, 2010). In detail, Gehl et al. (2006), building upon the foundations of Lopez (2003), have highlighted the experiential importance of an indoor-outdoor realm's transitional quality. Within this, see Figure 15, the focus of attention is upon the point where open space and building connect, with the most socially and experientially significant location being when the overlap creates an ambiguity of realm division. This notion resonates with Thwaites et al. (2013) and the foundations of

looseness within Franck & Stevens (2007). The way in which the interface is addressed is also central to the edge typologies of Bobic (2004) and Dovey & Wood (2015). Both focus upon the importance of a complex and multifaceted gradient spanning indoor and outdoor, as well as public-private, along with subsequent social and experiential significance.

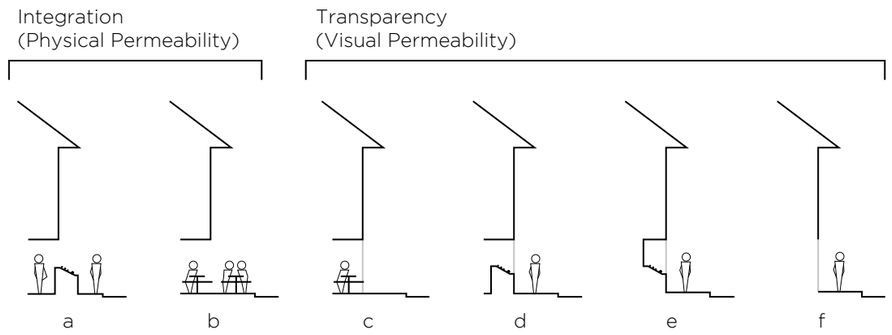


Figure 15 – Street edge (segment) typology sections, adapted from Gehl et al. (2006)

Not only is an experientially manifested segmentation of realms noticeable across the urban street edge but also along it (Thwaites et al., 2013). This is established through the way differing realms (segments) sit adjoining each other in a series along an edge's extent. The importance of this has been established by Gehl (2010), whilst exploring the grain that runs along edge ground floors. He links such a structure to phenomenologically focused measures manifested within time, distance and movement, observing how in good quality shopping streets –

> *All over the world the same rhythms are found in active shopping streets: 15 to 20 shops per 100 meter / 328 feet of street means that new experiences for pedestrians every four to five seconds.*
>
> Gehl, 2010, p. 76

Within such a situation, shops, which are only one way that segments can be territorially appropriated to serve a given function, individually occupy an area of around 5-7m in length. Whilst walking along a street edge structured in such a manner there is the potential for different qualities and opportunities to rhythmically engage the street inhabitant every few seconds. Inherently, a level of significance is subsequently placed upon the relationship between such ground floor realms (segments) of an edge and how they come together in a series. This is something explored by Karrholm (2012) within his work upon *territorial complexity* and *serial collectives*, whilst also resonating with Habraken's (1998) *understanding control* and Bobic's (2004) *collective interfaces*. Experientially such collectives are significant as they break down the urban street edge in such a way that begins to allow for fluctuations in experiential intensity along an edge's extent to be considered (Thwaites et al., 2013). Here, the experientially segmented directional / locational emphasis of the edge can shift and be considered on a close-knit segment-by-segment basis, influencing the edges multi-directional emphasis at a phenomenologically responsive level. Directly in response to such ideas, whilst discussing experiential segments, Thwaites et al. (2013) describe –

> *An overall emphasis here seems to be on socio-spatial factors that act to slow down the experience of continuity along the extent of a transitional edge by providing localised and stationary significance. Such stationary experience is linked to the capacity of a transitional edge for social absorbency, connected to the extent to which inhabitants can territorialise through occupation, appropriation and personalisation of spaces defined where adjacent realms overlap.*
>
> Thwaites et al., 2013, p. 113

Significant within the above quote is the way territorial appropriation and personalisation is key within establishing the localised intensity across a collective of urban street edge segments. Such a perspective aligns with conceptual ideas already forwarded, further establishing the requirement for segment consideration, whilst also tying together experiential segment concepts (Thwaites & Simkins, 2007; Thwaites et al., 2013) and territorial segmentarity (Dovey, 2010).

Experiential multi-directionality of street edges established through segments

To some extent the multi-drectional thinking in response to an edge's segements has already started. However, the following will look to further explore such ideas. For Thwaites et al. (2013) segments influence –

> *... the extent to which directional sensation is emphasised or diminished… Segments can be classified in part, then, in relation to their capacity to decrease predominant directional sensation by emphasising awareness of 'here'.*
>
> Thwaites et al., 2013, p. 105

At the core of segment thinking is an understanding of how they can provide street edges with opportunities for a complex and variable experiential multi-directionality, significantly at a human-scale. This has potential to phenomenologically suppress the dominant linear directional emphasis of the street, diminishing its *thereness* (Cullen, 1971). In turn, such factors can potentially impact the intensity with which the edge is engaged, heightening the significance of segment considerations within a multi-scalar edge model. For Thwaites et al. (2013) this takes place through attributes responsive to *laterality* across the edge, *locality* within it and *extent* along it.

The laterality across indoor-outdoor edge realms is important in the formation of segments, which establish at the experiential intersection of spaces (Thwaites & Simkins, 2007; Thwaites et al., 2013). Significantly, such a characteristic is most socially and experientially responsive when indoor and outdoor become laterally ambiguous (Bobic, 2004; Gehl et al., 2006; Franck & Stevens, 2007; Thwaites et al., 2013; Mantho, 2014). Here, segments that face and engage the

street provide opportunity for human occupation as well as experience to project into the edge as well as engage with features that protrude from it, as visualised by Gehl et al. (2006) within their typology sections, see Figure 15. Bobic (2004) refers to this as a *street room* that dissects the street and edges laterally across it. For Matho (2014), such characteristics make street and edge experientially inseparable with both holistically intertwined. In relation to the multi-directionality of the urban street edge, the lateral breaking of the edge shifts the phenomenological emphasis away from the forward-focused experiential dominance of the street, complementing this linearity with potential for engagement across the street edge (Gehl, 2010; Thwaites et al., 2013). When combined with the lateral articulation of an edge's plot structure, created through building setbacks and projections, a crinkled and less easily defined relationship between edge and street is inherently created (Franck & Stevens, 2007; Glaser et al., 2012; Mantho, 2014; Dovey & Wood, 2015).

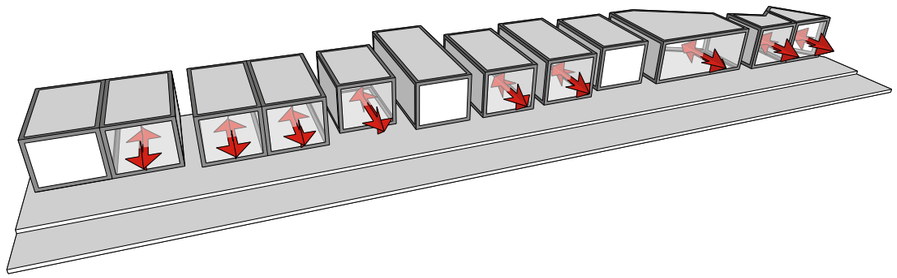


Figure 16 – Laterality of segments across the street edge

The laterality of a segment across the street edge also creates potential for points of locational experiential significance to be nested internally within the street edge (Gehl, et al., 2006; Gehl, 2010; Thwaites et al., 2013). For Thwaites et al. (2013) this is whilst establishing, within itself, a complex realm like little else that spans indoor and outdoor considerations, in turn gaining locational significance from both. The directional emphasis of the street edge, in response to this, is consequently dictated less by the linear / direction delineations of the street. But, it is reactive to the level of grain running along the edge, which can comprise variable opportunities for localised experiential intensity (Thwaites et al., 2013). This is due to the ability of this urban street edge scale to house a series of variable adjoining territorialised segments (Bobic, 2004; Karrholm, 2012; Thwaites et al., 2013), thus differing points of notable locational *hereness* (Cullen, 1971). These locational qualities, manifested through territorialising processes of appropriation and personalisation, are explored further with Part 3 whilst introducing segment *affordances*.

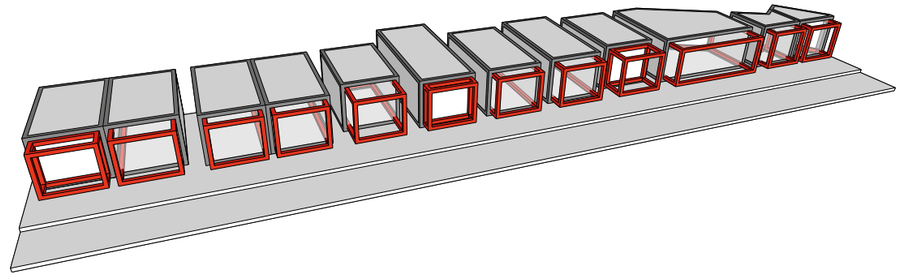


Figure 17 – Locality of segments within the street edge

Understanding that urban street edges have an infrastructure that reflects the adjacent street, as well as their scalar plot and plinth morphology, inherently means that they are realms with linearity, as discussed throughout (Jacobs, 1993; Bobic, 2004; Jones et al., 2007a; 2007b). The acceptance, however, that there are localised points of experiential significance within a series of adjoining segments brings to the fore a more complex and fluctuating consideration of an edge's experiential extent (Thwaites et al., 2013). The directional emphasis along an edge's extent, which manifests *thereness*, is therefore provided opportunity to be punctuated by points of experiential intensity, established through locational significance and sites of experiential *hereness* (Cullen, 1971). This understanding furthers the way an edge's multi-directionality is established across its whole length (totality of the edge), whilst also tying together the significance of a series of segments into an assemblage of shifting multi-directional intensity with variable points of directional / locational emphasis along it. This connection across edge segments is visualised within Figure 18.

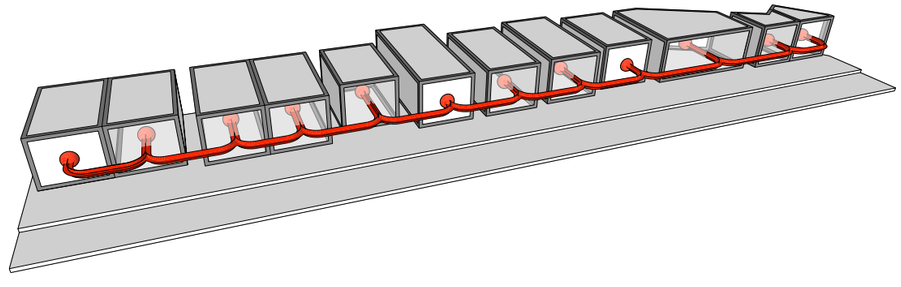


Figure 18 – Extent of segments along the street edge

Interconnected segment model spanning territorial, experiential and material

The segment exploration within this current investigation has sought to conceptually develop, examine and justify the existence of a segment scale nested within the edge's multi-scalar

assemblage. It has done this through reflecting and drawing together existing discourse whilst developing a conceptual foundation that highlights how they are territorially, materially and experientially manifested. In brief –

> Segments are embedded within the ground floor, plinth scale of urban street edges. Territorial practices, established through segmentarity (Dovey, 2010) influence their material and spatial composition though appropriation and personalisation. Likewise, territorial occupation and inhabitation provides the platform through which they are phenomenologically engaged. Significant here is how the experiential sensation of a transition between adjoining realms, along and across the urban street edge, establishes the experiential significance of a segment due to its impact upon the directional / locational emphasis of the urban street edge (Thwaites et al., 2013). Such transitional qualities are inherently related to a segment's territorially established spatial and material manifestation and the relationship between segmented realms as they come together in a series within a street edge.

Whilst complex, this socio-spatial relationship can be distilled into a visualised segment model encompassing these interconnected factors, see Figure 19.

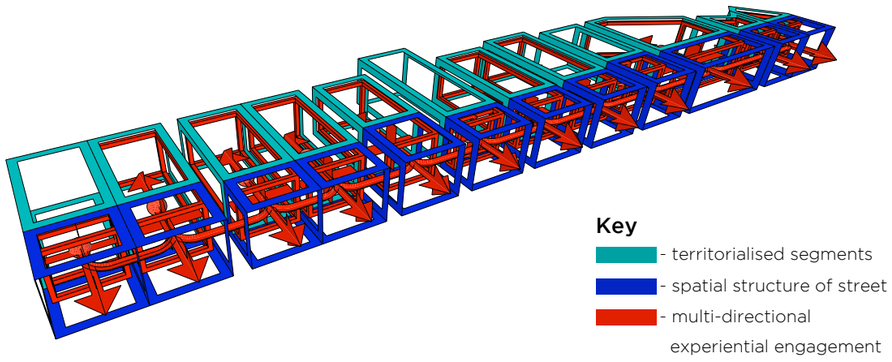


Figure 19 – Combined segment model

Combined multi-scalar and multi-directional urban street edge model

The discussion has sought to conceptually explore how interconnected scales of urban street edges come together within its phenomenological manifestation, notably - built plots, plinths and segments, see Figure 20. They span physical and territorial edge considerations, individually, as well as together, influencing how the edge is engaged as a multi-directional assemblage. Through this, attempts have been made to highlight how street edges can be considered as more than just singular entities that delineate streets as directional links connecting together areas of urban environments.

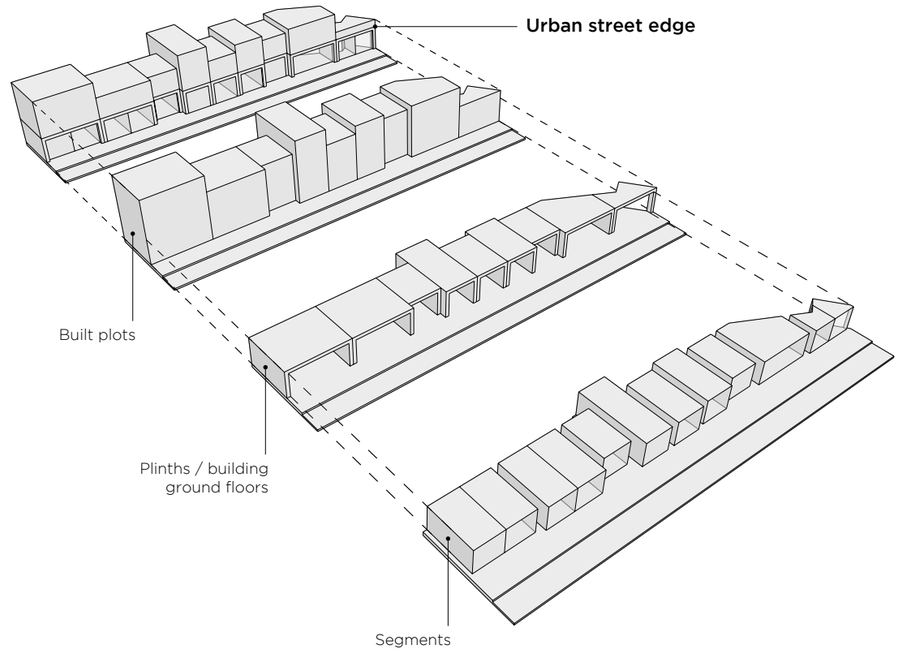


Figure 20 – The multi-scalar urban street edge assemblage and its nesting of scales

Significant within the discussion is how the segment scale of the urban street edge's assemblage has been conceptualised as experientially significant, with the ability to influence the experiential intensity within which edges are engaged. It is, therefore, anticipated that these realms, and how they come together within an edge, hold considerable phenomenological importance for people inhabiting the urban street and engaging its edges. A focus upon understanding the experiential importance of these realms could ultimately provide the foundations for addressing issues with current urban street edges (Chapter 2) as well as provide insight into how to answer – *How might we be able to create more experientially engaging urban street edges?* In conclusion, building upon the philosophical position developed earlier, the current chapter has been able to conceptually establish -

From the perspective of street inhabitants, urban street edges are experienced as socio-spatial assemblages. These assemblages comprise a nesting of scales, which provides them with a complex experiential multi-directionality influencing their directional / locational emphasis. Nested within them is an experientially and territorially significant scale – the segment, which when combined within edge ground floors have the potential to impact the intensity with which street edges are engaged.

Part 3: The phenomenological significance of territorialised urban street edge segments

> *We commute, commune, eat, shop, share, and play amidst buildings and at ground level. Doing so, we are immersed in the first 20 feet of the vertical space around us. So why aren't we designing it better?*
>
> Baker & Lopez, 2014, Web

Taking inspiration from the above quote, the intention is now to focus upon urban street edge segments in greater detail. So far, the investigation has sought to use existing conceptual ideas whilst bringing the discussion of segment significance into a coherent argument that focuses upon progressive territorial and experiential considerations. The aim of the current section is to now explore in greater detail territorialisation's influence upon segments, especially how –

> *... when people personalize their territories, they clarify individual and group territories, make the environment more attractive and complex, and set the stage for interaction.*
>
> Mehta, 2013, p. 61

It has not been fully explored in the previous conversation how such territorialisation benefits people inhabiting the street and establishes realms that have the potential to be experientially rich and convivial with a multiplicity of experiential opportunity. The discussion will therefore examine how territorial appropriation and personalisation transfers into material attributes, through the development of segment *affordance*s. These affordances subsequently have the potential to impact opportunities for phenomenological engagement with these ground floor edge realms. During the discussion the qualities, which provide segments with potential for locational significance (*hereness*) and thus points of experiential intensity will be introduced. This is whilst being responsive to the way segments often require laterality across the edge in order to enable such locational significance (Bobic, 2004; Gehl et al., 2006; Gehl, 2010; Thwaites et al., 2013; Ewing & Clemente, 2013); along with the way territorialised segments come together within the ground floor of an edge along its extent (Bobic. 2004; Karrholm, 2012; Thwaites et al., 2013). Following such an exploration, the focus of attention will then shift towards exploring the everyday territorial practices of street inhabitants. Such social actions can be fleeting or prolonged, as well as a single instance of inhabitation or a repetitive process (Gehl, 2010; Mehta, 2013).

The rationale for undertaking such steps is to establish a detailed conceptual understanding of segments, which is materially focused yet still grounded in response to experiential and territorial considerations. This can subsequently be empirically explored during fieldwork detailed within Chapter 6. Through this, evidence can be attained examining the conceptual notions put forward, whilst potentially providing answers for the question that underpins this current investigation as well as the quote above from Baker and Lopez (2014).

Ownership, appropriation and personalisation within territorialisation / re-territorialisation

The territorialisation of urban street edge segments, through personalised ownership, has the potential to create a built environment that people have multifaceted feelings and connections towards (Newman, 1972; Mehta, 2013). Here, people have invested not only time and money into the adaption of the environment but also effort and a level of emotion (Mehta, 2013, Thwaites et al., 2013). For Habraken (1998) this means that the built environment is more than just physical *form*; it is a collection of socio-spatial *place*s that people have created in line with their everyday needs and desires. This thinking resonates with Colebrook's assessment of Deleuzian assemblages - *life begins from flows of becoming or desire, which then produce relative points of stability* (Colebrook, 2002, p. 66). In order to examine such social actions, along with the resultant socio-spatial manifestation of places, Thwaites et al. (2013) have established an anatomy of terms responsive to everyday human territorialisation. This encompasses *mine*, *yours*, *theirs* and *ours*. Such thinking shifts often-complex territorial concepts into everyday language, which has recently whilst using insights from this current investigation been applied to an edge context through the development of *microenvironments* (Thwaites et al., in review). Within this is advocated the requirement for urban settings that promote territorial processes responsive to *mine* and *ours* – places that people feel they can inhabit, engage and establish connections towards. This is opposed to realms that enforce feelings of *yours* and *theirs* – places that people feel they cannot occupy and engage (Thwaites et al., 2013). Reflecting upon these ideas in relation to urban street edge segments and the territorial processes involved within their material manifestation (appropriation and personalisation) it is possible to conceptually categorise segment territorialisation in two different ways.

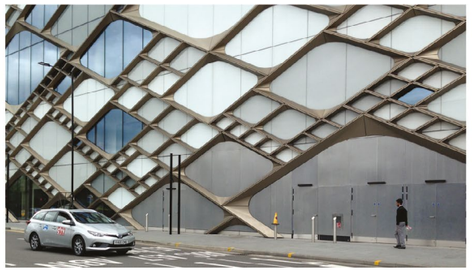
Firstly, territorialisation can physically separate public from private, defining ownership in a harsh and often materially hard way (Madanipour, 2003). Here, the focus is upon refuge rather than exposure (Sennett, 1990) and hide over reveal (Dee, 2001; Thwaites et al., 2013). In the context of urban street edges this can be seen, at an extreme level, through impermeable blank walls that delineate *mine* from *yours* (Thwaites et al., 2013). The negative impact of this has been observed by Bobic (2004); Gehl et al. (2006); Franck & Stevens (2007); Gehl (2010); Dovey (2010); Kickert (2016) and was explored during real-world issues discussion within the current investigation, see Figure 4. In terms of examining human engagement with urban street edges, and specifically segments, this will be called *negative segment territorialisation*. Here, negativity is reflective of this current investigation's phenomenological ontology and the way in which such edges suppress experiential engagement (Gehl et al., 2006; Gehl, 2010). Reviewing this in regards to the previous discussion undertaken, such territorialisation restricts the potential for lateral processes to project across edges, limiting locational potential and opportunity for points of distinct experiential intensity. Street edges within these situations, therefore, nullify multi-directionality, focusing the street solely as a *link* (Jones et al., 2007a; 2007b; 2008). As a consequence, this restricts the experiential merging of street and edge and potential of occupa-

tion spanning both (Bobic, 2004; Thwaites et al., 2013; Mantho, 2014).

In contrast, segments can be territorialised in a way that embraces the relationship between indoor and outdoor. Here, territoriality is more related to the communication of information and the promotion of sensory experiences (Hall, 1966; Becker & Coniglio; 1975; Greenbaum & Greenbaum, 1981; Karrholm, 2012). Within these situations, a segment's specific type and function, as well as the projection of these factors, dominates over the segregation of internal space from the public (Sennett, 1990); exposure is more important than refuge and reveal dominates hide (Dee, 2001; Thwaites et al., 2013) Here, the definition between *mine* and *yours* is far more ambiguous and *loose* (Franck and Stevens, 2007; Dovey, 2010). In terms of urban street edge engagement, and in response to previous notions, this will be called *positive segment territorialisation*. Here, the potential for a more experientially multi-directional edge is created, with laterality increased and thus opportunity for points of locational significance. Singular directionality is suppressed, with street and edge allowed experientially and physically to merge to a greater extent. For examples see Figure 21.

Positive segment territorialisation

Territoriality is related to the communication of information and the promotion of sensory experiences.



Negative segment territorialisation

Separating the public from private, defining ownership in a harsh and often materially hard way.

Figure 21 – Examples of positive and negative segment territorialisation

Such edge categorisation aligns with Gehl et al.'s (2006) conceptualisation of passive and active façades as well as recently Kickert's (2016) edge examinations. In territorial terms it also resonates with Altman (1975). For him there are differing categorisations of territoriality – primary, exhibited by the way realms are often closed off from the public and privatized, and secondary, where places require a level of membership and are thus selectively accessible. Altman's third level of territorialisation relates heavily to experientially engaging street edges and is more open in terms of public accessibility. Negative territorialisation of urban street edge segments is, therefore, aligned with Altman's primary and secondary notions, positive territorialisation relates to his third, public territories.

Detailed so far is the way urban street edge segments, and thus a collective of segments along an edge's extent, can either experientially engage or disengage people in response to how they have been territorialised either positively or negatively. The following will forward, however, that it is not so much the process of territorialisation (appropriation and personalisation) that street inhabitants engage with but the material and physical products / results of such territorialising processes. Evidence for this can be seen across existing built environment literature (de Certeau, 1984; Frers & Meier, 2007; Gehl, 2010; Ewing & Clemente, 2013) as well as the findings from interviews exploring urban environment perception (Lynch & Rivkin, 1959; Degen & Rose, 2008; 2012). Building upon these points, and to further explore the result of territorial appropriation and personalisation, this current investigation will forward that such actions establish *affordances* within the urban street edge, aligning with Chiesi (2015).

The foundation of affordances

The holistic human-environment concept of affordance provides opportunity to explore how humans, and animals, ecologically perceive and behave within the world through considering how it can comprise a range of opportunities and threats -

> *Affordances of the environment are what if offers the animal, what it provides or furnishes, either for good or ill…. I mean by something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment.*
>
> Gibson, 1979, p. 127

From such a foundation a number of fields have gone on to use affordance thinking, of particular interest to the current investigation architectural theory, design and practice (Maier et al., 2009). Whilst exploring this concept, Maier et al. arrive at a categorisation of affordance that spans two socio-spatial levels – *artefact-user affordances* (AUA) and *artefact-artefact affordances* (AAA). For an AUA to exist they highlight that there must be both human (social) as well as physical / spatial / material properties noticeable, which individually do not provide opportunity for behaviour or engagement –

> *Individual properties of either the artefact (color, density, size, etc.) or the user (strength, age, height, etc.) are not in and of themselves affordances, but taken together can determine whether a specific affordance exists.*
>
> Maier et al. 2009, p. 397

However, certain attributes / qualities must first be present within the environment prior to potential engagement. They subsequently use an example that is intrinsically linked with the street edge and segments; windows –

> *The affordance of visibility through a window is one type of interaction, while the behavior of a person looking through the window is a different type of interaction, but the two are related because the window must (first) afford visibility before it can (second) ever actually be gazed through.*
>
> Maier et al., 2009, p. 397

These ideas highlight how affordance is unreservedly socio-spatial, with the requirement of a relationship across both human behaviour / engagement as well as property of the environment for an affordance to occur. There is also, however, the understanding that a spatially / materially manifested affordance must first exist prior to being engaged (Maier et al., 2009). In terms of territorialised segments developed previously, they must first be adapted and personalised prior to being engaged.

To explore the relationship between different components within the environment Maier et al. (2009) put forward the idea of artefact-artefact affordances (AAA). This importantly accepts, building upon AUAs, that an affordance within the material environment does not need to be engaged for that affordance to exist. Such an understanding sees built environments, and thus urban street edge segments, containing numerous affordances and subsequently a wealth of opportunity for human engagement. The notion of AAAs also takes into consideration that the physical and material components of the environment regularly interact with each other, aligning with philosophical assemblage thinking (Dovey, 2010). At a simple level this allows structures to remain standing, for example buildings are afforded stability through structural foundations, however, such thinking also suggests opportunity for AAAs to impact human-environment interactions in a more nuanced manner. Looking back to the example of the window, and its affordance for gazing through (an AUA), the potential for entering the building that was gazed into is fulfilled by a door (another AUA). The relationship between the windows and door can subsequently be regarded as an AAA with both working together as material components in the creation of a wider affordance, potentially within a positively territorialised segment within the context of the current investigation. Such a consideration resonates with Alexander's (1979) thinking whilst highlighting socio-spatial processes and the relationship between objects involved within the making of a cup of coffee

Beyond the ideas introduced is also the key notion that affordance thinking shifts the focus of attention away from a setting's specific function, the function of a segment for example, towards a more fluid and open to interpretation of use and significance –

> *The catalogue of affordance is interminable because the very notion of affordance allows us to get rid of the problematic notion of 'function': the object itself is no longer seen as having one or more functions, but rather the subject is the one who discovers affordances in the object. This completely inverts the perspective: our capacity to individuate opportunities in spaces becomes key, rather than some objective qualities that predetermine its function(s).*
>
> Chiesi, 2015, p, 78

Places, such as urban street edge segments, thus start to be seen as an assemblage of affordances rather than a spatial setting for a given function. This is key as it moves beyond the potentially prescriptive, and thus restrictive, notion of what a segment should functionally house or what its constituent parts should potentially be (Chiesi, 2015). It also promotes focus upon the creation of affordances rather than the manifestation to territory, either positive or negative. Whilst being spatially focused affordance thinking, therefore, allows for a more open and responsive framework for comprehending how settings are established and engaged. In response, the segment affordances introduced in the following section are not prescriptive or tied down to specific functions but provide a framework for how an urban street edge segment might be experientially engaging.

Building upon the ideas introduced, the current investigation regards affordance thinking as the conceptual mediator spanning territorial appropriation of segments and the resultant physical and material manifestation of these realms. Significantly, such thinking resonates with this current investigation's phenomenological and assemblage foundations as well as the way in which segments can be territorialised in contrasting ways, either positively or negatively.

Territorially established affordances within urban street edge segments

Urban street edge segments, as they have been forwarded within this current investigation, can potentially comprise of a range of affordances that require activation through the actions and behaviours of people inhabiting the street (Maier et al., 2009; Chiesi, 2015). The intention is to now explore and define these potential affordances. In order to do this, phenomenological and assemblage notions; the multi-scalar and multi-directional discussion; territorial considerations; affordance thinking as well as wider existing built environment ideas will be used to inform the segment affordances detailed.

In the following, three open and interconnected opportunities for affordance within urban street edge segments will be introduced – *distinctiveness* (potential to be identifiable and memorable); *transitional quality* (ability to influence engagement across and along the edge's division of realms)

and *sensory complexity* (capacity to encourage multi-sensory engagement). A level of *temporality* subsequently influences all of these. Each of these affordances has established literary foundations within progressive built environment debate.

Segment distinctiveness

The *distinctiveness* of a segment relates to its ability to be identifiable and at some level memorable. Often such characteristics are associated with the term *imageability* (Lynch, 1960). However, imageability has differing meanings across a range of fields, especially linguistics. Therefore, distinctiveness has been selected for use within the current investigation. It also provides a non-technical term common in everyday language.

Imageability (distinctiveness) is not often discussed within the context of street edges specifically. Although, built edges have broadly been examined as a key contributor towards peoples' perception of and engagement with urban contexts (Stevens, 2006; Ewing & Clemente, 2013; Thwaites et al, 2013). These ideas regularly build upon the work of Lynch and his *Image of the City* (1960), which seeks to distill notable characteristics portrayed by a city and its landmark features. At a more human-scaled and phenomenological level, whilst seeking to develop a number of metrics for liveable places, Ewing & Clemente (2013) regard imageability as -

> *The quality of a place that makes it distinct, recognisable and memorable. A place that has high imageability when specific physical elements and their arrangement capture attention, evoke feelings and create a lasting impression.*
>
> Ewing & Clemente, 2013, p. 5

Clearly properties of certain streets, and their edges / segments, influence distinctiveness (imageability). Many of the writers and researchers introduced throughout the current investigation have discussed certain qualities that make them engaging places that create a lasting impression. Here Jacobs' (1993) examination of *Great Streets* provides insight. Within this he details characteristics that make streets such as the Champs Elysees in Paris and Las Ramblas in Barcelona memorable and *great*. However, looking at these and other streets, whilst taking in conversation from wider debate, highlights that it is often challenging to distill and describe what makes places like these distinctive, beyond their individual qualities and overall *sense of place* (Ewing & Clemente, 2013; Cresswell, 2015). Whilst attempting to define requirements for great streets, Jacobs accepts this –

> *There is a tendency to arrive at requirements for great streets that are so general that they can include or exclude almost any street, depending on the whim of the observer. It is one thing to say, for example, that a great street needs definition, but quite another to be explicit about what constitutes that quality. Explicitness is striven for, alas not always achieved.*
>
> Jacobs, 1993, p. 270

It is, therefore, difficult to categorise and highlight commonalities in what makes such street's *great*, because they are individually distinct places in their own right. Reflecting upon this in response to street edges, and segments specifically, it becomes increasingly challenging to define distinctive characteristics, especially whilst considering the potential multiplicity of socio-spatial aspects that can comprise their assemblage (Jacobs, 1961; Glaser et al., 2012; Thwaites et al., 2013). Likewise, Ewing & Clemente (2013) and Stevens (2006) highlight how distinctive qualities are often created through the coming together of differing and variable material aspects of the environment, which people engage and interpret subjectively. Therefore, to prescribe what distinctive segments might contain is potentially restrictive, especially in response to affordance thinking (Chiesi, 2015). However, reflecting upon what Ewing & Clemente (2013) forward in their previous quote, notably – *when specific physical elements and their arrangement capture attention*, could provide a potential opportunity for exploring segment distinctiveness in a responsive and encompassing manner. Within this, the focus is upon *capturing attention*.

Attention is a cognitive process, associated with human perception of a given stimulus experientially engaged whilst suppressing interaction with wider information – it is what we are overtly concentrating on (Kahneman, 1973). Importantly over recent years the study of attention, notably visual attention, has received heightened interest across a range of fields aligning with built environment research (Nobre & Kastner, 2014; Fawcett et al., 2015). Visual attention is a process heavily associated with the focus of gaze and its distribution in response to information (Fawcett et al., 2015), aspects of urban street edges for example. Central to the study of visual attention is an understanding of how it is driven by variable aspects of the surrounding multi-sensory environment (Tatler & Land, 2015; Spence & Ho, 2015). Significantly, based upon empirical studies, evidence has been established that these environmental aspects might be, allowing for broad categorisation (Fawcett et al., 2015). In response, classification focused upon *saliency* has been shown to be valid (Itti, 2005; Rothkopf et al., 2007; Cerf et al., 2008; Borji, 2012).

The foundations of saliency thinking align with the conceptualisation of distinctiveness introduced earlier. It allows for an understanding of how a particular object / entity, or attribute of an object /entity, within a setting is noticeable and captures attention thus potentially gaining perceptual significance (Itti, 2005; Rothkopf et al., 2007). For Lynch (1960), landmarks such as churches are salient features of an urban context that contribute to a city's imageability / distinctiveness. Importantly, in response to the current investigation, saliency studies in the field of visual cognition have recently focused upon more everyday situations and stimulus, not landmark buildings (Itti, 2005; Rothkopf et al., 2007; Cerf et al., 2008; Borji, 2012). These align to a greater extent with the everyday ubiquity of urban street edges and what distinctive multi-sensory aspects within their assemblages are potentially salient and capture attention. In order to do this, saliency has been categorised in two ways – *high-level*, sometimes known as top-down, and *low-level*, also called bottom-up.

High-level saliency relates to target objects that aid or are of interest when seeking to fulfill a giv-

en desire, activity or whilst within a certain mind-set (Itti, 2005; Borji, 2012). This regularly makes them relatively easily definable components of a given scene. Within the context of street edge segments such components would relate to the function of a segment and importantly the way in which it projects itself to the street through its features as well as the objects housed within it – signs, walls, doors, windows and the productions / features on show, people, faces, posters and the text on them, for example. Low-level saliency on the other hand relates to the constituent and component parts of such objects and features, thus their materiality, as well as the relationship between them (Itti, 2005; Rothkopf et al., 2007; Cerf et al., 2008; Borji, 2012). It, therefore, encompasses factors such as: colour, texture, orientation, intensity, transparency, permeability, motion and flicker, see Figure 22.

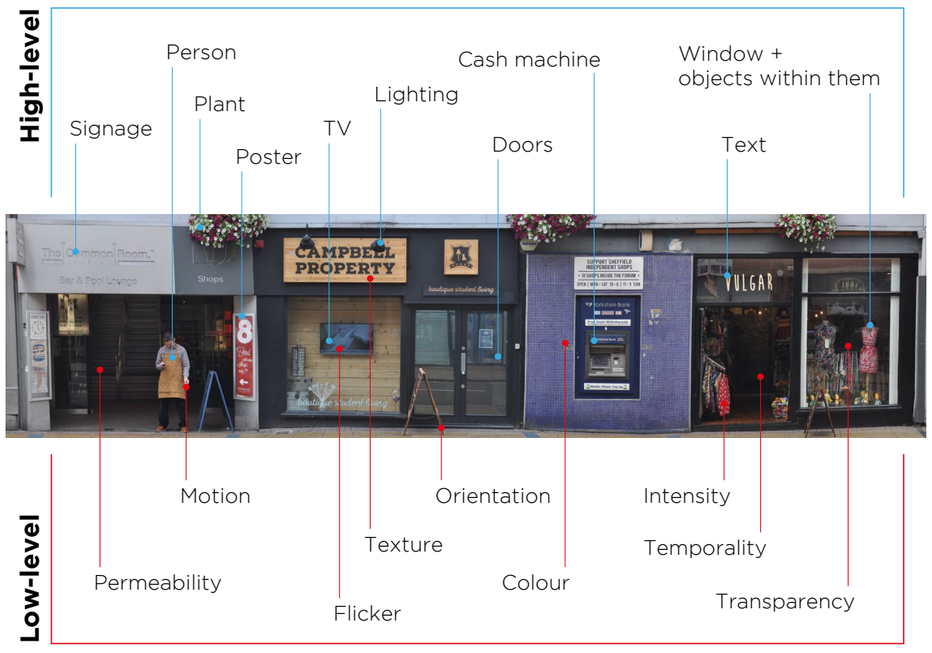


Figure 22 – Segment distinctiveness

Within the field of human and notably visual cognition both high-level and low-level aspects of a scene have been shown to influence where people direct their visual attention (Itti, 2005; Holqvist et al., 2011; Fawcett et al., 2015; Duchowski, 2017). This has allowed for insights to be gained about what is cognitively and perceptually significant in relation to a given object or entity. Such an understanding, in relation to the current investigation, could subsequently allow for an intricate reading of how distinctive aspects of a segment (high and low factors) come together to influence peoples' engagement with it. In response, it would be anticipated that positively territorialised segments (ones that engage people within the street) contain distinguishable high-level aspects within their manifestation. Likewise, they would also portray notable low-level

drivers of engagement. In doing so, they would manifest the segment as notably distinctive, providing an affordance with which people can engage across a wide range of everyday activities and desires. Within such situations, an interesting and engaging shop window is potentially able to capture attention and engage people regardless of what they are doing in the street. Negatively territorialised segments on the other hand are expected to portray a lack of definable high and low-level features and in turn have a limited distinctiveness. The potential for engagement would, therefore, be limited; for example, a blank concrete wall is often disengaging no matter your desire when inhabiting the street.

Forwarding segment distinctiveness in this way aligns with Gehl et al.'s (2006) notion of passive and inactive edges. It also relates to ideas explored by Glaser et al. (2012) as well as Thwaites et al. (2013) through their edge explorations. However, it begins the process of categorising what edge qualities might promote or restrict engagement in open and responsive terms, whilst being founded upon sound empirical insights gained through cognitive psychology and visual cognition studies. Conceptualising the distinctiveness of territorialised street edge segments in this way also avoids a prescriptive consideration of what their manifestation might comprise, which could lead to a narrow-minded description of their qualities. With segments being such complex socio-spatial assemblages a list of what makes them distinct places would be inherently limited. Instead, thinking of their distinctiveness in terms of high-level and low-level factors, engaged through a range of phenomenological processes whilst inhabiting the street, means that the opportunity for intrinsic multiplicity of affordance and variability of potential quality is embedded within distinctiveness' conceptual foundations.

Segment transitional quality

It has already been forwarded that urban street edges, especially at the segment scale, can be experientially more multi-directional than a linear façade that delineates the street as a one-direction link. This can become manifested through the sensational transition between adjacent realms (Gehl et al., 2006; Thwaites & Simkins, 2007; Thwaites et al., 2013), whether laterally across or along the extent of edge segments. The ideas explored earlier did not, however, discuss in any great detail how such transitional properties are established. This will be undertaken within the current section whilst exploring the segment affordance of *transitional quality.*

The lateral transitional quality of edges, across the division of outdoor street and indoor building, has been examined by a number of researchers notably in relation to transparent and permeable edge characteristics (Ewing & Clemente, 2013). *Transparency* is considered as the potential for sensory experience, notably vision, to project across realm divisions thus experientially merging inside and outside, often through windows and glazed areas (Thwaites et al., 2013). This can take place whilst street inhabitants look into edges and segments and likewise whilst those inhabiting edges look outwards. Its significance upon urban experience has been widely documented, especially within a street context by Jacobs (1993); Porta & Renne (2005);

Gehl et al., (2006); Gehl (2010); Glaiser et al. (2012) and Mantho (2014). Throughout, this work is detailed how a more engaging urban environment is one that is regularly transparent allowing people to project their gaze into adjacent spaces.

Permeability is experientially more open than transparency, with transparency often involving physical realm divisions through glass, for example. It relates more to the open / closed relationship between spaces and peoples' ability to physically transition between them through access and embodied occupation (Madanipour, 2003; Thwaites et al., 2013). It is thus heavily related to the linkage of street and edge and the potential for interconnected spatial continuity of indoor and outdoor (Thwaites et al., 2013, Mantho, 2014). The significance of an edge's lateral permeability has been well documented by Gehl et al. (2006). This is highlighted within their ground floor edge typologies as shown within Figure 15. For them permeability influences the level of activity that an edge can hold and the way in which those inhabiting streets experience such activity through multisensory engagement beyond just visual interaction. Gehl (2010) further highlighted permeability's significance within his active frontage concepts. Highly permeable places, for Franck & Stevens (2007), encourage a level of *looseness*. Here, the division of space and thus definition of potential activity is ambiguous and fluid making them more socially and experientially responsive. Permeable edges are also essential within the conceptual ideas of Thwaites et al. (2013) allowing for *high-intensity edge*s and *portal* like structures to establish, which again encourage human habitation, social interaction and sensory engagement.

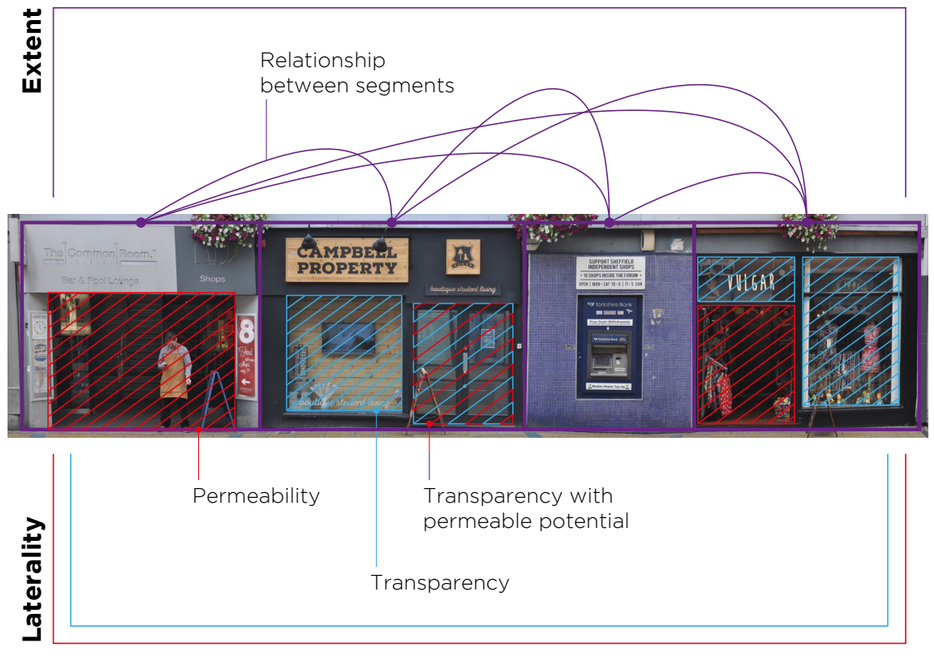


Figure 23 – Segment transitional quality

Overall, existing discourse highlights how often the most engaging urban edges are those that are highly transparent and permeable along their ground floors. Relating to this, and the previous discussion, is how positively territorialised segments engage the street and project their qualities and functions to street inhabitants. They are thus often transparent, allowing visual experience to enter in to and out of them. They are also, to some extent, often permeable allowing physical access as well as wider multi-sensory and embodied experience; Gehl et al.'s (2006) passive edges. In contrast negatively territorialised segments are often shut off, limiting experience and access across their lateral gradient; Gehl et al's (2006) inactive edges. In line with this, it is noticeable how the lateral transitional quality of segments has the potential to enable or suppress the wider affordances manifested within these realms, aligning with Thwaites et al. (2013). This highlights how the affordances being explored within the current investigation are holistically interconnected, often requiring each other to exist. The discussion later will build upon this.

Beyond the potential for segments to encourage or discourage a level of lateral transitional quality across them, in turn influencing their locational potential and *hereness* (Cullen, 1971; Thwaites et al., 2013), the relationship between segments along an edge's extent also manifests a transitional quality. However, such an affordance is challenging to examine and consider on a segment-by-segment basis. This is because it is potentially impacted by the relationship between adjacent territorialised segments along an edge; the wider affordances established within them; as well as the morphological infrastructure provided by the plot and plinth scales of the edge. This links this transitional affordance with the significance of coherence, localised expression and looseness across a series of edge segments rather than the locational qualities of single segments (Franck & Stevens, 2007; Thwaites et al., 2013). The transitional quality of extent along an edge, therefore, responds to the way that these territorialised realms contribute towards the overall edge, aligning with Karrholm's (2012) notion of *serial collectives* and Habraken's (1998) socially based conception of *understanding*. Like distinctiveness, therefore, the transitional quality along an edge can potentially be thought of more as a product. Here, territorialised realms (positively or negatively) coming together and affording engaged as a collective rather than individual segments experienced as separate entities (Figure 23). Such thinking reflects observations by Gehl (2010), as well as others (Bobic, 2004; Glaser et al. 2012; Speck, 2012) who discuss how differing and variable realms adjoin and contribution to an overall edge providing it with a multiplicity of opportunity.

Segment sensory complexity

When people experientially engage urban environments it is often more than just their vision that interacts with the wide array of qualities on display (Rodaway, 1994; Degen, 2008; 2014; Middleton, 2010; Degen & Rose, 2012). Many of our senses are phenomenologically involved and engage the surrounding multi-sensory assemblage of socio-spatial affordances cross-modally (Degen, 2008; 2014; Spence & Ho, 2015). For Rapoport –

There is another reason why the environment cannot be treated like a perspective, slide or even film – too much stress on visual result, with a corresponding neglect of the multi-sensory nature of phenomena.

Rapoport, 1990, p. 184

It is therefore essential that segment thinking is focused towards more than just visual engagement, opening up towards a consideration that responds to the multi-sensory complexity of true urban settings. Rapoport (1990) discusses such sensory complexity in response to the way humans phenomenologically engage the world and the amount of multi-sensory differences in the environment that people are exposed to over a duration of time. Ewing & Clemente also discuss this –

Humans are most comfortable receiving information at perceivable rates. Too little information produces sensory deprivation; too much creates sensory overload. Rapoport contrasts the complexity requirements of pedestrians and motorists. Slow-moving pedestrians require high-levels of complexity to hold their interest. Fast-moving motorist will find the same environment too chaotic. The commercial strip is too complex and chaotic at driving speeds yet, due to scale, yields too few noticeable differences at pedestrian speeds.

Ewing & Clemente, 2013, p. 122

When inhabiting the street and engaging with street edge segments people therefore require a level of sensory complexity in order to keep them engaged and continually capture their attention (Gehl, 2010; Glaser et al., 2012). A lack of this, with qualities and affordances that are too few or too similar; too predictable and expected; and potentially too unordered, will not provide people with a rich, engaging and coherent environment to inhabit and use (Ewing & Clemente, 2013; Goldhagen, 2017).

Thinking about such ideas in terms of human senses, many accept that vision is the dominant sense used to decipher the shifting nuances and complexity of the world (Berger, 1972; Jay, 1993; Jenks, 1995; Rose, 2001). As a result, much has been written about the visual complexity of urban environments and how this contributes to the richness of places (Ewing & Clemente, 2013; Johansson et al., 2016; Noland et al., 2017). Within a street and edge context this can be seen within the work of Jacobs (1993), who discusses the importance of differing material surfaces over which light can bounce and engage the eyes. Gehl (2010), as well as Cullen (1971), Alexander (1979) and Bosselman (1998) have all also discussed the significance of visual engagement with street aspects / components. In detail, the shape, articulation and ornamentation of buildings has been explored by Stamps (1998; 1999), Heath et al. (2000) and Lindal & Hartig (2013). All were found to be influential on façade perception albeit from a detached, non-phenomenological perspective. Similar work has also been carried out by Nasar & Hong (1999) looking into street signscapes and visual preferences in wider urban street scenes across differing contexts (Nasar, 1984). These studies are, however, limited in terms of capturing an encompassing multi-sensory and shifting everyday account of phenomenological street and edge engagement. This is essential if we are to understand their true complexity (Rapoport, 1990).

Moving beyond vision, whilst reflecting upon the wider sensory human body, the work of Degen (2008) provides a nuanced insight captured during her exploration of public life and sensory experiences of Manchester and Barcelona. The following will use this work, along with the ideas of others, to introduce how street edges and their segments can engage each of our senses and how territorialisation can impact how such sensory qualities are manifested.

In terms of touch, Degen (2008) highlights we continually feel the surface of the ground below us when walking within an urban environment. This makes us aware of temperature and texture. Likewise, we feel wind that moves our hair and the sun on our faces, re-enforcing our sense of seasonality. Within streets and edges our hands brush past people and doorways as we enter edge segments and we lean up against the edge when taking a break or looking into it (afforded by its transitional quality). For her this means –

The tactile sense involves a twofold process, since at the same time that we touch we are touched. Through this the surrounding environment becomes alive and a textured part of an overall bodily experience.

Degen, 2008, p. 42

Positivity territorialised segments have the potential to encourage touch, often making them places that people want to stop and linger near and within (Glaser et al., 2012; Thwaites et al., 2013). In doing so, they are where we chose to sit, stay and engage thus connecting people to the physical materiality of the environment (Gehl, 2010; Thwaites et al., 2013). Negatively territorialised segments, however, encourage us to rush past them often limiting the opportunity for touch as a sense that engages edges. Gehl (2010); Montgomery (2013) and Ellard (2015) observed this through the impact of concrete building edges, which even though textural, lack qualities which people want to touch for prolonged periods of time.

The everyday noises of the city are always around us and are difficult to shut out, unlike vision where we can shut our eyes (Degen, 2008). Significantly, our engagement with sound has the ability to rapidly change our perception of and emotional connection to a place (Degen, 2008) – the sound of a car horn, a crying baby or the voice of a friend. These noises instantly shift how we feel within and use spaces. Hearing is linked to distance and proximity (Hall, 1966; Gehl, 2010). The further we are from the source of a sound the quieter it gets. Surface materiality and spatial proportions also impact how sounds echo and reverberate around spaces, with tight urban streets and edges enclosing sound but wide-open settings allowing it to dissipate (Degen, 2008; Mantho, 2014). As a consequence, the permeability of environments, and particularly street edges, provide opportunities for sound to project between realms and capture attention. Here, sounds provide opportunity to experientially enrich settings (positive segments) or

re-enforce its sterility (negative segments). However, as detailed sound is not always positive, giving it nuanced qualities that can significantly impact how urban environments are engaged (Degen, 2008).

Urban smells have only recently been explored in detail, often through *smellscape* studies and mappings (Henshaw, 2013; McClean, 2016). Prior to this, their impact has regularly been overlooked as a driver of urban experience (Henshaw, 2013). It is a sense that can encourage a heightened intimacy between subject and object and like sound it is difficult to shut out with limited boundaries. Some odors are able to dissipate huge distances, especially in certain wind directions, impacting peoples' perception of whole urban areas (Degan, 2008; Henshaw, 2013). Smells are, however, also influenced heavily by thresholds (Degan, 2008; Gehl, 2010; Henshaw, 2013). Here, passing from outdoor to indoor, through lateral permeability, can afford new aromas during the transition – entering a restaurant or bakery, for example. Smells can also project beyond the edge where they were created filling the adjacent space with scent. This is often a notable factor affecting peoples' differing perceptions between Western and Eastern urban contexts, with the latter often comprising streets and edges characterised by heady aromas (Mehta, 2009). Much like sound, therefore, the way segments have been positively or negatively territorialised can impact the opportunity scents have to emanate from an edge and thus influence its multi-sensory complexity.

The taste of a street and its edges is often challenging to consider but can on occasion be experienced through pollution and the thickness of the air in smoggy areas (Degen, 2008). Here the enclosure of the street established through its edges again impacts how such intensity is contained (Mantho, 2014). Linked to the edge are the functions of segments and how they might provide opportunities, whilst being positive territorialisation, for taste through the food and drink they offer. This relates heavily to the culture of the city and its districts, thus providing segments with differing tastes linking to the wider urban scales explored earlier. For example, Brick Lane in East London is well known for its *Curry Houses*. This inherently engrains peoples' experience and perception of its segments with a very specific taste. Overall, however, limited work explores the impact of taste upon urban street and edge experience.

Lastly, reflecting upon vision again, it is the most subjective of our senses as we are able to direct it where we wish (Jay, 1993; Jenks, 1995). In doing so, it is often not dictated by *proxemics* (Hall, 1966) or the distance of edge qualities because of the way we can project beyond the sensory affordances close by (Lynch & Hack, 1984; Gehl, 2010). For Degen (2008) it allows us to comprehend the passing of time and helps us to decipher the complexity of the environment. Significantly, this is in conjunction with our other senses cross-modally. A positively territorialised segment is expected to be visually rich and interesting, capturing attention through providing something with which to engage. Negatively territorialised segments, on the other hand, suppress such potential. Much of the factors introduced in relation to such visual stimulation have been discussed within the distinctiveness section whilst exploring saliency. Vision will also be

discussed in greater detail later within the methods framework later (Chapter 4).

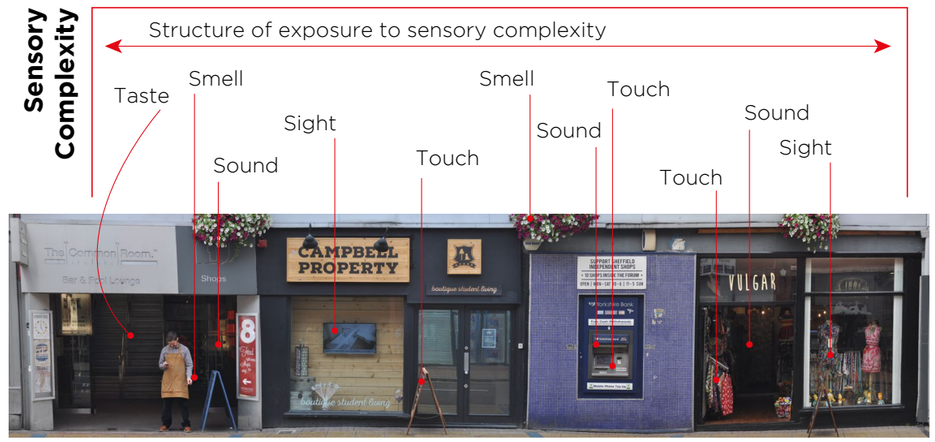


Figure 24 – Segment sensory complexity

Figure 24 provides an overview of the sensory impact of segments and how the individual sensory affordances come together to create a level of multi-sensory complexity that the street inhabitant can experientiall engage (Rapoport, 1990; Ewing & Clemente, 2013). It has again been hinted at throughout that sensory complexity as a segment affordance is linked with the other affordances of distinctiveness and transitional quality. Therefore, it is again as much a product of these other affordances. This further ties segment affordances into a holistically interconnected assemblage, influencing how a segment is experientially engaged also in response to how it is ahs been territorialised. See Figure 25, whilst also introducing the influence of temporality.

Segment affordance temporality

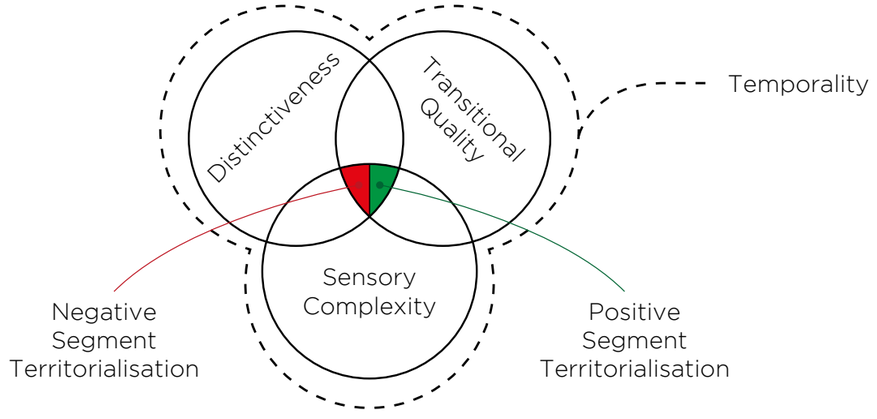


Figure 25 – Combined segment affordances and their temporality

Streets are spaces used by people for a range of functions that are regularly characterised by the daily rhythms of urban contexts (Lefebvre, 1992; Bobic, 2004; Temelova & Novak 2011; Wunderlich 2008; 2013). As a result, the socio-spatial affordances introduced so far are all to some extent temporal and synced to the regular ebb and flow of the city and its streets. The dominant cycle of day and night inherently influences segment facilities through the way they regularly close in the evening and thus change the affordances manifested within them (Lefebvre, 1992; Bobic, 2004; Mehta, 2013). Here, as doors are closed and windows shuttered for the night the lateral transitional quality of a segment in shifted, creating a greater level of directional emphasis along the edge rather than across it. Its multi-directionality changes. This in turn influences the sensory complexity and distinctiveness of the segment. In the morning, when opened again these affordances return and can afford engagement by the people inhabiting the street once more. Such a process highlights how at some times of the day segments can be positively territorialised, engaging people in the street, and at others negatively, disengaging them. Bobic (2004) has observed such temporality in street edges during his exploration of Amsterdam streets across differing times of day, highlighting how edges change on an hourly basis and most significantly between day and night.

Sensory complexity is also influenced by temporality, changing over time in-line with the function of a territorialised segment. For example, the smell of the bakery is most prominent when new produce is bought out; the sounds of the kid's nursery is loudest at home time; the touch of the bar stools is only possible when the café is open (Wunderlich, 2008). Distinctiveness varies through the adaption of features and attributes within a segment, for instance the re-organising of a shop window with new objects; the setting out and removal of chairs; and busyness through gatherings of people impacts distinctiveness, as observed by Gehl (2010); Glaser et al. (2012) and Thwaites et al., (2013). Such temporality is not so much related to the rhythms of the street but aligns with ideas forwarded within assemblage thinking, notably, how places are in a continual state of *becoming* as they are territorially re-made (Dovey, 2010).

Notions of becoming accept, at a fundamental socio-spatial level, that people change individually and as a society. As a result, people seek to adapt and re-territorialise their surroundings in relation these shifts (Dovey, 2010). In turn, places like urban street edge segments naturally change, thus engraining them with an almost continuous fluid territorial and material temporality (Bobic, 2004). Significantly, at the segment scale this re-making and re-territorialisation can often take place on a regular basis through the simple adaptation of components within them – *affordance temporality*. At this level, buildings do not need to be knocked down and remade or walls built. But, a display in a shop-window can easily be remade; doors can be opened; tables and chairs can be set out in a different configuration, as observed by Whyte (1980) and Mehta (2013). Through these processes, the ownership of a place is continually being reinforced through territorial adaptations. Significantly, in relation to street inhabitants, such changes provide something new to engage as they walk through streets; regular territorial actions make – *the environment more attractive and complex, and set the stage for interaction* (Mehta, 2013, p. 61).

The affordance temporality introduced is at the level of an already established and territorialised segment. Beyond this affordance change, segments can also transform over time through shifts in their function; wider *segment temporality*. With segments often, but not always as discussed within the problems section (Chapter 2), being an easily adaptable scale of street edges, new functions and facilities can territorially appropriate them over time. In doing so, the dynamic of an entire edge and street can change, with a new segment function and thus new affordances having an almost catalytic effect upon the wider environment (Bobic, 2004; Gehl, 2010). Again, this provides people with something new to engage, yet at a larger scale than a change to the affordances of an existing segment.

Urban street edges are continually influenced by the re-territorialisation of their segments (Bobic, 2004). It would be anticipated that positively territorialised segments would engage with such temporality, being remade regularly and thus providing people with new and adapted affordances with which to experientially engage. These segments rarely remain the same and can be considered as being in a continual state of territorial *becoming* (Dovey, 2010). Negatively territorialised segments, on the other hand, are anticipated to be less changeable over time. They are static regardless of daily cycles or processes of re-territorialisation (Dovey, 2010); Gehl's (2010) inactive edges.

Bringing the affordances together

Thinking about the ground floor of urban street edges in terms of segments, which people have the territorial power to manipulate and change, provides the potential for a nuanced socio-spatial conceptualisation of street edges. Here, territorial actions not only offer opportunity for people to foster complex emotional connections towards places manifested within these edges through ownership (Habraken, 1998), but such actions also establish street edges that have the ability to engage street inhabitants (Thwaites et al., 2013; Metha, 2013). This has been conceptually explored through thinking about segments in terms of how they are positively (engaged the street; location emphasis) or negatively (disengages the street; directional emphasis) territorialised. Rather than think in these positive and negative terms, however, the conceptual developments introduced have forwarded the importance of interconnected affordances. This shifts the focus away from ideas relating to territorial ownership toward personalisation and appropriation that encourages engagement (Thwaites et al., 2013; Metha, 2013). The phenomenologically significant affordances of distinctiveness, transitional quality and sensory complexity as well as their temporality have been put forward as drivers of this. By thinking about the segments of an edge in response to these territorialised affordances, this current investigation believes, whilst using and building upon evidence from existing discourse, that these qualities offer potential insight into how to create more experientially engaging urban street edges.

Occupation and habitation towards territorialisation / re-territorialisation

The focus of this last section of the current chapter is upon the urban street inhabitant. In order to activate the experiential qualities of urban street edges, and the affordances manifested within their assemblage of segments, these realms need to be occupied, engaged and thus territorialised through habitation (Canter, 1977; Tuan, 1977). Much has been discussed about these processes throughout, notably through the introduction of phenomenological thinking and the combining of this with assemblage ideas within Part 1. It is worth reiterating, however, that without such human lived phenomenological processes settings such as urban street edges would not gain experiential significance as definable and district places (Merleau-Ponty, 1962; Dovey, 2010). Returning to the foundations of affordance thinking - *Individual properties of either the artefact … or the user … are not in and of themselves affordances, but taken together can determine whether a specific affordance exists* (Maier et al., 2009, p. 397). In other words, without people using and engaging the urban street edge and its segments the affordances manifested within them or the edge as a whole it wouldn't exist.

The way in which the urban street and edge is territorially inhabited has often been considered in response to the activity / mind-set that the inhabitant is engaged with (Gehl, 2010; Mehta, 2013). Thinking about such complex and shifting everyday human processes is, however, something that urban design and planning has struggled with (Punter & Carmona, 1997). Gehl (2010) distills such actions by categorising urban activity in terms of optional, necessary and social. Significantly, this distillation allows for a consideration of the duration of time that a setting is territorialised for; the experiential processes involved within the territorialisation; the reason for such territorialisation; and the commonality of such territorialisation, i.e. is it a one-off or repetitive process of occupation. Such thinking also resonates with Lofland (1998) and Mehta (2013) who have explored everyday urban activities and their influence, notably from a social perspective, focusing upon describing postures as well as human behaviours and activities.

Optional activities relate to open-ended tasks that do not regularly focus upon a goal or distinct reason for territorialisation, for example, promenading whist window-shopping; break-time wandering; or sitting to relax and enjoy qualities of the environment (Gehl, 2010). Here, choice and desire play an influential role in where occupation takes place. Through these activities, territorial habitation can be sporadic and unpredictable. It can also sometimes be influenced to a greater extent by the affordances of the surrounding environment than the reason for being there, for example where best to sit to catch the sun or what a shop is selling that grabs attention (Whyte, 1980; Gehl, 2010; Metha, 2013). In contrast, necessary activities are more purposeful and often must be carried out, for example, going to work; collecting the kids from school; buying food (Gehl, 2010). They are regularly goal orientated, which in turn influences the location and duration of territorialisation. Here, choice is limited as a task must be fulfilled and thus the duration, location and commonality of such territorialisation is regularly well defined. Lastly, social activities involve group territorialisation and communication (Gehl, 2010, Mehta, 2013). They, therefore, require the presence of other people and often people that are known, however, not always. Such an activity sits between the territorialised nature of optional and necessary. It must occur in a location than can accommodate more than one person and it is heavily influenced by the reason for the social meeting, for example, is it a business meeting or coffee with a friend. Often, in terms of urban street edges, social activates are more optionally focused as people choose to meet up; talk; eat; drink; and enjoy themselves together (Gehl, et al., 2006; Gehl, 2010).

Inherently all these differing activity groupings are temporal and rhythmical, notably when necessary with the same tasks often playing out at certain times of the day and on a regular basis (Lefebvre, 1992; Temelova & Novak 2011; Karrholm, 2012). The street and edge are, therefore, continually being territorialised and re-territorialised through occupation whether fleeting or prolonged; re-occurring or a one-off instance (Mehta, 2013). Here, people do not live, eat, sleep, play, work in the same place but move around territorialising different realms based upon the activity being carried out at a certain point in time (Whyte, 1980; Jacobs, 1993; Gehl, 2010; Dovey, 2010). The urban street and its edges are just one realm that everyday lived activities, whether optional, necessary or social, play out.

Existing evidence suggests that human engagement with and experience of urban street edge assemblages, from the phenomenological perspective of the street inhabitant, beings with these everyday lived actions. As a result, social processes provide opportunity for edges and particularly their segments to attain experiential significance. Based upon these ideas urban street edges and experiential engagement with them can subsequently be conceptualised as follows –

Street inhabitants experience urban street edges as socio-spatial assemblages, where by the everyday actions they are undertaking and physical characteristics of the street edge influence their engagement with these realms. These assemblages comprise a nesting of scales, which provides them with a complex experiential multi-directionality influencing their directional / locational emphasis. Nested within them is an experientially and territorially significant scale – the segment. When combined within edge ground floors segments have the potential to impact the intensity with which street edges are engaged. This is through their territorially established affordances of distinctiveness, transitional quality and sensory complexity, as well as each affordance's shifting temporality.

Conceptual edge framework - moving forwards

The conceptual edge framework (CEF) developed, as a result of the ideas introduced and examined within the current chapter, will now be used as a foundation for working hypotheses as well

as subsequent research questions. Prior to this, however, the chosen investigation methodology will be discussed and its use justified – real-world mobile eye-tracking along with its associated analytical techniques. Rather than detail research questions earlier within the investigation, the intention has been to establish in-detail what progressive ideas require specific examination, through the development of the CEF (Chapter 3), then explore how such ideas might be examined through progressive methodological techniques (Chapter 4). This provides a combined theoretical and methodological understanding that subsequent hypotheses and research questions can build upon (Chapter 5), which can then be examined within the real-world complexity of everyday urban streets (Chapter 6).

Chapter 4

Methodological framework

The intended methods for capturing, visualising and analysing people's phenomenological engagement with urban street edges will be introduced within the current chapter. Highlighted throughout is the rationale for the methods selected, in response to the conceptual edge framework (CEF) and particularly its ontological and epistemological foundations (Chapter 3, Part 1). Part 1 of the current chapter details problems associated with existing methodological techniques used to study peoples' experiential engagement with urban realms. This builds upon the knowledge issues already described within Chapter 2, examining how data collection methods have potentially restricted an in-depth understanding of edge and wider urban experience. The aim is to subsequently use such insight to introduce the methods to be employed within the current investigation. This starts with an exploration of recent methodologically-progressive philosophical ideas, which seek to shift phenomenological thinking in a more pragmatic and research focused direction (Part 2). This is in order to address issues that have restricted its use as a philosophical foundation for research. A methodological framework is then established during Part 3, which focuses upon *vision* to explore how urban street edges are experienced at the overlap of socio-spatial considerations. Such thinking forms the theoretical underpinning for the introduction of the chosen data collection technique – *real-world mobile eye-tracking* – along with an exploration of visualisation and analytical tools to be used whilst empirically articulating how street edges are experienced (Part 4).

Part 1: Problems and issues with existing methods

Knowledge and practice issues relating to urban street edges have already been explored (Chapter 2). Beyond this, there are also notable methodological problems that have potentially contributed to our limited empirical understanding of how these realms are experientially engaged from a direct perspective.

Limited methodologies that capture direct and first-hand experiential insights

There are a number of ways to examine peoples' engagement with urban environments across a range of differing scales (Gehl & Svarre, 2013; Harvey & Aultman-Hall, 2016). At an in-the-world scale, experience of urban settings has often been attained using observational methods and interviews along with subsequent mappings and qualitative visualisations (Gehl & Svarre, 2013; Mehta, 2013; Harvey & Aultman-Hall, 2016). These approaches regularly emphasise human-scaled considerations and have contributed greatly to our understanding of built environment experience as well as urban edge engagement. It is evident, however, that whilst being human-focused such methods are regularly implemented from a detached human-environment position. Interviews, as used by Lynch & Rivkin (1959); Rose et al. (2010) and Degen & Rose (2012), for example, require the verbal articulation of often-complex experiential and sensory phenomena. As a consequence, such a method potentially fails to capture the rich multiplicity as well as real-world nature of human urban engagement. This is because people regularly struggle to describe the experiential impact of potentially nuanced and overlapping social and spatial

factors that may impact their engagement with the world (Nisbett & Wilson, 1977; Kusenbach, 2003) –

> *People tend to suppress that which they cannot express. If an experience resists ready communication, a common response among activists ("doers") is to deem it private - even idiosyncratic - and hence unimportant.*
>
> Tuan 1977, p.6

Observational techniques, notable within the work of Whyte (1980); Gehl (1987; 2010); Jacobs (1993); Duneier (1999); Stevens (2006); Temelova & Novak (2011); and Mehta (2009; 2013), amongst others, also have methodological shortcomings. Like interviews, such an approach can provide nuanced understanding of urban engagement. However, overall such a method offers relatively limited insight into the embodied nature of phenomenological urban experience. This is due to the method's third-person perspective upon capturing experiential phenomena (Kunsenback, 2003). Rather than comprehending what is cognitively and perceptually taking place within someone's thoughts, or understanding how their body is phenomenologically reacting to the world around them through its network of senses, these methods rely on observable and often easily recognisable behavioural traits. Significantly, this makes such observational methods susceptible to observer bias (Kunsenback, 2003). It could, therefore, be argued that this has constrained the knowledge we have of urban experience. This is due to a focus towards overt human actions and movements rather than the interconnected and direct nuances of socially and spatially manifested urban sensory engagement (Tuan, 1977) –

> *In the large literature on environmental quality, relatively few works attempt to understand how people feel about space and place, to take into account the difference modes of experience (sensorimotor, tactile, visual, conceptual), and to interpret space and place as images of complex - often ambivalent – feelings.*
>
> Tuan 1977, p.6

These established in-the-world methods of observation and interview have recently been complemented with data collection approaches that seek to use new technological developments (Montgomery, 2013; Ellard, 2015; Goldhagen, 2017). Advanced photographic techniques, building upon the work of pioneers such as Whyte (1980), have looked to use time-lapse photography to gain detailed understandings of how everyday social actions play-out within urban contexts (Simpson, 2012; Wunderlich, 2013). The focus of attention with this method is still, however, to some extent upon easily observable behavioural traits. A first-hand account of urban experience using photography can be seen more clearly within the work of Baibarac (2015), with urban experience being captured through photos taken by participants during *awareness walks*. However, such an approach still requires participants to think in a way that might not be totally aligned with the characteristics of everyday experience (Tuan, 1977). During the awareness walks of Baibrac (2015) Global Positioning Systems (GPS) tracking was also used to monitor

photo locations. The increased adoption of this location capturing technique can be seen following a noticeable *motilities turn* in urban planning (Sheller & Urry, 2006). It has subsequently been used in apps to explore how people spend time in variable urban contexts (Ellard, 2015; Yip et al., 2016) and also within street surveys (van Langelaar & van der Spek 2012). Such a method, however, to some extent still restricts a phenomenological and sensory account of direct urban engagement. It provides insight into peoples' location, but following this interpretation is often required to comprehend the reason for such habitation. Alongside this motilities turn can also be seen the rise of mobile cognition approaches through the adoption of techniques regularly used in cognitive science and psychology (Ladouce, 2017). These work by recording brain activity, often through mobile electroencephalograph, or mobile EEG (Mavros et al., 2016), as well as body dynamics, such as eye-movement through mobile eye-tracking (Ladouce, 2017; Uttley et al., 2018). However, as will be detailed, especially in relation to mobile eye-tracking outdoors, such approaches are still at a stage of infancy with methodological considerations still being examined (Ladouce, 2017; Uttley et al., 2018). Whilst this is the case, clearly new technological advancements and techniques are becoming more useable whilst aiding in the capture and interpretation of the multifaceted nature of urban experience and engagement (Ellard, 2015). The current chapter will build upon this later.

Alongside in-the-world approaches have also been the development of larger scale explorations often focusing upon over-arching urban and social phenomena (Harvey & Aultman-Hall, 2016). These have been made possible through, amongst other things, improvements in computer processing; advancement in geographic information systems (GIS) and the open-sources availability of *big data* (Ellard, 2015; Harvey & Aultman-Hall, 2016). In relation to urban streets and their edges, such explorations regularly focus upon the mapping and quantification of measures that impact upon factors such as density; connectivity; land-use; access; crime and economics at the scale of the street in relation to district or city in which it is situated (Dovey & Ristic, 2015; Dovey et al., 2018). Using measures and approaches like these can be seen within the development of space syntax (Hillier & Hanson, 1984); access measures (Talen, 2002); urban networks and hierarchy patterns (Mehaffy et al., 2010; Porta et al., 2014) as well as wider urban assemblage analyses (Dovey & Ristic, 2015; Dovey & Pafka, 2017; Dovey et al., 2018).

Whilst providing insight into the wide-scale social-spatial workings of urban environments the larger scale analyses introduced continue to limit an experiential and notably direct account of street and edge engagement. Such an issue is often caused by the adoption of measures that are limited in their ability to capture the innate variability of urban contexts, as well as the multiplicity with which these settings are phenomenologically engaged by people on a routine basis (Marshall, 2005; Thwaites et al., 2013). Here, the methods adopted often loose a comprehension of the fine-grain spatial and material dimensions of urban settings as well as what human actions play out within them (Marshall, 2005; Griffiths et al., 2008). As a consequence, environments are considered at a scale that is often disconnected in relation to people, their sensory system and cognitive processing; limiting the their social and experientially responsive

to the phenomenological complexity of everyday environments (Lofland, 1998; Thwaites & Simkins, 2007; Mehta, 2013; Ellard, 2015; Ladouce, 2017). For example, priority is often given to the street as a socio-spatial entity in itself and its relationship to a city as a whole, as seen within the recent work of Carmona (2015) and UN-habitat (2013), see Figure 26.

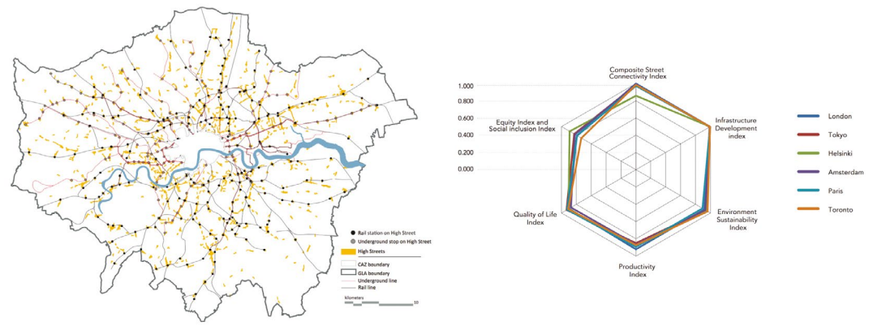


Figure 26 – Measures at a scale that is disconnected from phenomenological street and edge experience Carmona (2015) and UN-habitat (2013)

A top-down overview of streets and urban contexts is, therefore, prioritised over how such settings are phenomenologically lived. Griffiths et al. (2008), whilst discussing streets within the context of movement in certain morphological layouts, discuss such issues –

> *They try to relate patterns of built form to movement behaviours rather too deterministically, without really addressing this relation at the human scale at which the urban grid is actually encountered – whether by pedestrian or vehicle. Broad categories of urban morphological types based on land use or density characteristics will struggle to capture the complex street level dynamics that generate movement patterns.*
>
> Griffiths et al., p.1174, 2008

Across the issues raised, evidenced by the arguments of others, it is noticeable that there are a number of problems associated with existing methodological approaches when seeking to examine human experience of urban environments. Underpinning much of the problems introduced is the way that it has been challenging to find an approach that is able to capture first-hand what it is like to experientially engage settings, like urban street edges, from a direct phenomenological perspective. Returning to a quote used within the introduction of this current investigation –

> *There is ample opportunity for a more empirical, efficient, and widespread measurement of physical characteristics and human experiences within urban streetscapes.*
>
> Harvey & Aultman-Hall, 2016, p.155

Limited methods that provide empirical evidence for pragmatic decision-making

Building upon the methodological issues detailed so far, and the previous quote by Harvey & Aultman-Hall (2016), is the fact that there are limitations associated with existing methods in relation to how they are able to capture empirically robust insights. Significantly, this impacts the way such knowledge can pragmatically influence decision-making, which this current investigation is attempting to achieve whilst questioning – *how might we be able to create more experientially engaging urban street edges?*

There has been lengthy examination of the empirical and scientific foundations of urban design and planning theory, with Marshall (2012), whilst building upon the critique of Cuthbert (2007), highlighting –

> *It is not just that often we do not know whether a particular theory or hypothesis is true or not, but that urban design does not even seem interested in its scientific validation. This is not to say that urban designers do not appreciate good evidence when it is available; rather, it seems that urban design in general does not insist that the scientific, empirical, evidence bases for its theories' underpinning assumptions are correct, consistent and up-to-date.*
>
> *Urban design seems to settle for: (i) reliance on classic treaties as a source of wisdom rather than more scientific findings; (ii) treating hypothetical suggestions and assertions as if facts; (iii) selective reporting and combining original scientific knowledge in an unscientific way; and (iv) criticising urban design theories mainly from their normative stance rather than their scientific validity.*
>
> Marshall, 2012, p. 264

Further debate has examined these points raised (Dovey & Pafka, 2016; Marshall, 2016 with subsequent Hack, 2016 and Talen, 2016; Foroughmand Araabi, 2017), and even though some have argued that progression has been made towards more scientifically grounded and evidence-based theory (Batty, 2013; Romice & Porta, 2015), there is still greater scope for further advancement (Harvey & Aultman-Hall, 2016). This is especially when reflecting upon our current knowledge of urban street edge engagement (Chapter 2).

A difficulty associated with empirically capturing and explaining urban experience is that it can be inherently variable (Lincoln & Guba, 1985; Thwaites & Simkin, 2007). This makes findings often challenging to distil in a pragmatic manner that remains phenomenologically responsive (Wylie, 2007; Ihde, 2008; 2009). Levitas (1986) highlights this when detailing –

> *… where the planners and architects need to create for mass use comes into conflict with the psychologist's emphasis upon individual differences.*
>
> Levitas, 1986, p.227

Some have argued that when attempts have been made to capture, extract, quantify and distil everyday urban phenomena, especially experience, and then use the knowledge attend in evidence-based decision-making the result has been the creation of an overly-utilitarian environment (Taylor, 1991; Thwaites & Simkin, 2007; Gehl, 2010; Glaser et al., 2012; Thwaites et al., 2013). Here the inherent variability of people and society is sterilised by the focus toward cost-benefit and overly-rationalised Modernist thinking (Taylor, 1991; Gehl, 2010). However, when decision-making is variability accepting, it has been difficult to refine ideas towards useable pragmatic outcomes (Wylie, 2007; Ihde, 2008; 2009; Dovey, 2010). Overall, it has been challenging to find a methodological foundation and approach that can capture a detailed and responsive account of how urban contexts, such as the urban street edge, are experienced by an array of people and then persuasively articulate these understandings in a socially responsive way amenable to wider decision-making discourse (Cuthbert, 2007; Dovey, 2010; Marshall, 2012; Thwaites et al., 2013; Foroughmand Araabi, 2017). The intention of the current investigation is to attempt to address this by adopting and advancing methodological techniques that capture and articulate the multiplicity with which urban street edges are engaged, whilst position such insights in a pragmatic manner that can impact decision-making. In doing so, the approaches employed will begin to address points raised by Marshall (2012) and Harvey & Aultman-Hall (2016). The first step towards making this possible is through the adoption of a new philosophical standpoint.

Part 2: Shift towards post-phenomenology

The current section intends to start addressing some of the methodological limitations previously examined. This is done through the development of a progressive philosophical foundation that transitions the philosophical underpinnings of the conceptual edge framework (Chapter 2, Part 1) into a more pragmatic, methods accepting approach. Here, *post-phenomenology* will be used to provide a platform from which to build.

At its core, post-phenomenology continues to regard lived experience and its inherent richness as significant, re-enforcing the phenomenological notions of Husserl, Heidegger and Merleau-Ponty (Ihde, 2008, 2009). Within such an ontological framework, which is inherently multiplicity accepting, it subsequently employs ideas from Deweyan pragmatism. This equips its phenomenological underpinning with a mind-set that is focused to a greater extent towards the empirical exploration and distillation of real-world phenomena. Here, it accepts that whilst it is advantageous to describe the complex multiplicity of the world it doesn't really benefit anybody especially if we are looking to make it a better place (Aagaard, 2017). Ihde (2008, 2009) is the most prominent philosopher to undertake such a transition during his explorations of technology and technoscience (see also Zwier et al., 2016). However, the benefits of such philosophical development have also been explored within geographical (Lea, 2009; Ash & Simpson, 2016); pedagogical (Aagaard, 2017) and landscape research contexts (Martin, 2017).

Through thinking in a more pragmatic manner, post-phenomenology seeks to address some of the issues regarding the subjective exploration of experiential essences at the heart of phenomenology (Wylie, 2007; Ihde, 2008; 2009). Rather than being a philosophical position concerned solely with the description of human consciousness, its practical focus seeks to provide a more objective insight into real-world phenomena that can be socially as well as spatially manifested (Ash & Simpson, 2016). This gives it more balanced material-accepting stance (Aagaard, 2017). Significantly this aligns its foundations with assemblage theory, towards a holistic and lived socio-spatial ontology, or organism/environment model according to Ihde (2009) that builds heavily upon the phenomenology of Merleau-Ponty (1962). Within this, the philosophy continues with the acceptance of a variable and rich multiplicity of human processes embedded within lived experience, recognising the importance of embodiment and concurrent interpretations of the world. However, it situates this within a more reflective and importantly analytical framework (Ihde, 2008; 2009). This is due in part to its focus upon mediation, rather than the interpretation of meaning along with the description of essence, which is at the heart of phenomenology (Aagaard, 2017). Here, mediation acts as an epistemological foundation that focuses more on capturing and understanding the relationship between subject and world, thus their interconnectedness, without a singular emphasis upon the description of human consciousness. Again, this further aligns post-phenomenology with assemblage notions (Dovey, 2010), as well as the progressive philosophical ideas forwarded within the current investigation (Chapter 3, Part 1).

The incorporation of pragmatism seeks to provide post-phenomenology with a degree of inherent usability, notably within a research context through its focus towards capturing and analysing empirical, evidence-based insights. Within this is the intention to not only make apparent the variability of lived experience but also elicit functional real-world outcomes (Ihde, 2009). It is considerably more focused towards doing and output than phenomenology, especially methodologically (Ihde, 2008; Ash & Simpson, 2016). Significantly, this provides post-phenomenology with a stronger epistemological foundation for undertaking research (Aagaard, 2017).

Importantly, in relation to the current investigation, post-phenomenology is also a technology accepting philosophy. This is thanks to its initial formation being structured towards an exploration of technology's significance within the world and how technology mediates socio-spatial relations (Ihde, 2008; Aagaard, 2017). This makes it an approach that is open to new ways of capturing an understanding the world, which is a perspective forwarded by Ellard (2015) and Goldhagen (2017) within a built environment research context whilst also aligning with Ladouce et al.'s (2017) mobile cognition approaches. The importance of this will become clear when the chosen methodology within this current investigation is introduced (Part 3).

Overall, it is noticeable how post-phenomenology seeks to address some of the issues that have plagued phenomenological thinking (Chapter 3), as well as methodological issues that have potentially restricted the in-depth, empirical capture and comprehension of urban experience. It provides a philosophical foundation that focuses upon the significance of embodied experience

whilst examining experiential insights gained towards pragmatic and distilled output that can impact real-world situations.

Part 3: Vision and the use of real-world mobile eye-tracking

Equipped with a grounding of post-phenomenological thinking, the aim is to now highlight how human experience of urban street edges can be captured and examined. There are two predominant factors to explore in relation to this, building upon the points already detailed. Firstly, how *vision* can be used to understand how street edges are engaged from a direct perspective and how vision is often holistically integrated with peoples' wider network of senses. Secondly, the way vision can be captured through the use of *mobile eye-tracking* within the everyday realities of outdoor urban streets.

The significance of vision and subsequent opportunities

> *… the visual is central to the cultural construction of social life in contemporary Western societies.*
>
> Rose, 2001, p. 6

The above quote by Rose, along with her extensive work on visual culture, highlights explicitly how vision plays a significant role whilst people engage and interpret the world around them. Jay (1988; 1993) developed the term *ocularcentrism* to emphasise vision's importance to everyday human functioning and Berger (1972); Ingold (2000) and Findlay & Gilchrist (2003) have echoed similar ideas. For Jenks, this has meant that –

> *… looking, seeing and knowing have become perilously intertwined so that the modern world is very much a 'seen' phenomenon.*
>
> Jenks, 1995, p. 1-2

The reason for such ocularcentrism is potentially twofold. Culturally, modern society is becoming increasingly centred upon visual experience or experience where wider human senses are noticeably secondary (Jenks, 1995; Rose, 2001). We are, as a consequence, becoming reliant on visual stimulation within a visual world and when such stimulation is absent we often feel disengaged or anxious (Rose, 2001; Ellard, 2015). Beyond this, it is far easier to engage our eyes than any other sense, with vision working at a level of intensity and precision that far exceeds any of our other senses –

> *Having some eighteen times more nerve endings than the cochlear nerve of the ear, its nearest competitor, the optic nerve with its 800,000 fibers is able to transfer an astonishing amount of information to the brain, and at a rate of assimilation far greater than that of any other sense organ. In each eye, over 120 million rods take in information on some five hundred levels*

of lightness and darkness, while more than seven million cones allow us to distinguish among more than one million combinations of color. The eye is also able to accomplish its tasks at a far greater remove than any other sense, hearing and smell being only a distant second and third.

Jay, 1993, p. 6

In terms of investigating human engagement with urban street edges, this ocularcentrism provides an opportunity. There is the potential to explore variations in the distribution of vision; the intensity of gaze and subsequent focus of visual attention, to comprehend how socio-spatial factors influence peoples' engagement with these realms. Significant within this is how vision is the sense that people can most easily direct in response to the environment around them and the social task they are engaged with (Jay, 1988; 1993; Ingold, 2000; Belova, 2006; Degen, 2008). It is thus a sense that it is responsive to the potential multiplicity of street characteristics and actions. It also provides a platform through which engagement with street edges can be comprehended without the need for the verbal articulation of experience – *what can you smell?* or, the measure of potentially disconnected experiential factors – decibel measure of street activity (Jay, 1988; 1993; Ingold, 2000). This addresses issues raised by Tuan (1977) and Kunsenback (2003) earlier whilst providing potential for a direct and holisitc insight into street edge experience –

My gaze, my touch and all my senses are together the powers of one and the same body integrated into one and the same action.

Merleau-Ponty, 1962, p. 317

The embodied nature of vision has been explored by Belova (2006) and recently Abrams & Weidler (2015). During these studies, which align with the sensory foundations of Merleau-Ponty's (1962) phenomenology who is quoted above, vision is continually integrated with bodily movements; reactions to the surrounding environment and significantly it is often combined with wider sensory stimulation. This is important with urban street edges being very much multi-sensory realms, which was as introduced through the segment affordance discussion (Rapoport, 1990; Degen, 2008). Understanding vision can thus also provide the beginnings of an insight into how the sounds, smells and feel of urban streets and edges are manifested and engaged through cross-modal sensory interaction (Spence, 2011; Spence & Ho, 2015) –

In our everyday perception most of us 'see' aided by the interplay of all the senses.

Degen, 2008, p. 42

The cross-modality of vision, in response to audio stimulation, has been explored empirically by Quigley et al. (2008). They highlighted how gaze is likely to be drawn towards the source of sound within real-world settings. Visual targets are also regularly identified quicker when combined with audio signals (Frens et al., 1995). Beyond audio, a relationship between vision and smell has also been documented (Gilbert et al., 1996; Morrot et al., 2001) as well as with touch (Martino and Marks, 2000). Ultimately, vision does not sit separate from wider sensory stimulation or the embodied phenomenological nature of urban experience but is often holistically entwined with it (Belova, 2006; Degen, 2008). This further highlights the significant potential of using vision to understanding peoples' engagement with a multi-sensory as well as socially and spatially manifested setting such as the urban street edge.

Capturing visual engagement through eye-tracking

Building upon the opportunities forwarded, a question subsequently arises – *how can we capture visual engagement with urban street edges?* For this, a novel data collection technique will be introduced – real-world mobile eye-tracking. The use of this method builds upon previous research undertaken whilst exploring the technique's capabilities within outdoor urban settings (Simpson, 2014; Ladouce et al., 2017 Uttley et al., 2018). These studies detailed how the method performed in the complexities of these forever-shifting environments, concluding that it could offer great opportunities for researchers interested in human experiential engagement with everyday urban contexts.

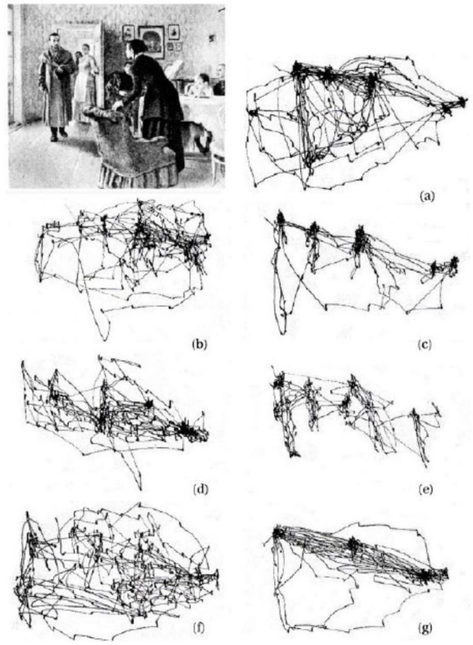


Figure 27 – Yarbus using eye-tracking in 1967

Tracking eye-movements provides quantifiable information on gaze distribution from which an understanding of human perception and cognition is possible (Holmqvist et al., 2011; Duchowski, 2017). The allocation of gaze on a stimulus, and thus visual engagement with it, tends to reflect overt attention and from this the experiential significance of certain aspects of a scene can be inferred (Findlay & Gilchrist, 2003; Rothkopf et al., 2007). Its use dates back to the 19th Century

(Huey, 1898) and whilst relatively primitive then, the technology has developed considerably over recent years becoming less intrusive and more cost effective.

Figure 27 highlights visualisations from an early eye-tracking study, undertaken by Yarbus in 1967 (within Land & Tatler, 2009). It shows how study participants viewed the same picture whilst being given differing instructions / tasks. Following this, a wide range of eye-tracking investigations have been undertaken with the tracking of eye-movements providing quantified insight into human gaze distribution, allowing for an understanding of human visual perception and cognition within varying lab-based and real-world situations (Holmqvist et al., 2011; Duchowski, 2017).

Broad research areas such as environmental and cognitive psychology, sports science, landscape research, wayfinding and marketing have used eye-tracking within the laboratory to investigate peoples' visual engagement with stimuli while research participants are static (e.g. Cristino & Baddeley, 2009; Wiener et al., 2012; Nordh et al., 2013; Dupont et al., 2014; Pihel et al., 2015) and mobile (e.g. Marigold & Patla, 2007; Bernardin et al., 2012; Vansteenkiste et al., 2013). Within an urban design context, a static laboratory-based application of eye-movement tracking has recently been used to assess peoples' gaze distribution on photographs of urban settings in combination with surveying visual preference (Noland et al., 2017). Significantly, this study demonstrated the utility of eye-tracking to urban researchers and designers interested in assessing peoples' visual engagement with urban environmental stimuli. It has also been used to analyse how people visually engage with building façades when viewing photographs of individual buildings front-on (Lebrun et al., 2016). However, whilst providing insight into how eye-movements are directed in relation to various built environment photographs these studies provide a relatively limited account of realistic visual engagement with everyday urban settings. This is due to the challenges associated with replicating the dynamic complexity and multi-sensory nature of real-world settings within the laboratory (Ladouce et al., 2017; Uttley et al., 2018).

There are relatively few studies reporting mobile eye-tracking data recorded outdoors (Uttley et al., 2018). However, recent technological advancements, notably the development of lightweight and discrete eye-tracking glasses, provides scope for exploring visual human-environment engagement outside of the laboratory (Ladouce et al., 2017). This equipment allows study participants to be placed in situations representative of everyday scenarios in real-world urban settings. In doing so, the wearer has control over what they look at and experience three-dimensionally in a true-to-life, multi-sensory environment. This is because this type of eye-tracking –

> *… immerses the wearer in true-to-life reality, affording full navigability and exploratory possibilities of a given real-world setting. Within such a context the wearer can move around; be reactive and respond to the environment in accordance with their desires and needs; direct their attention as they see fit on a second-by-second basis. This is in accordance with the often shifting and changeable nature of real-world complexities.*
>
> Uttley et al., 2018, p. 375

Foulsham and colleagues (2011) found that there are differences in gaze distribution between laboratory and natural environments, emphasising the need for studies to be conducted in realistic and notably outdoor contexts, which Ladouce et al. (2017) re-enforce –

> *In particular, the use of laboratory-based experiments in which stimuli are artificial, and response options are fixed, inevitably results in findings are less ecologically valid in relation to real-world behaviour.*
>
> Ladouce et al., 2017, p.1

Recently, using mobile eye-tracking outdoors has provided insight into a range of different everyday urban actions, e.g. how people visually attend to and negotiate differing paths and stairs (Marius't Hart & Einhäuser's, 2012); how people distribute gaze differently across night and day (Davoudian & Raynham, 2012; Fotios et al., 2014); and how people use maps during real-world wayfinding (Kiefer et al., 2013; Koletsis et al., 2017). The current investigation intends to build upon these precedents.

Real-world mobile eye-tracking will be used within the current investigation. In terms of the previous post-phenomenological conversation, the tracking of gaze, as people visually engage with varying urban street edges under differing tasks (to be discussed and defined in Chapter 6), will provide the methodological tool that captures the interconnectedness of subject and world (Ihde, 2008; 2009; Aagaard, 2017). Here, the focus is explicitly upon experiential considerations and how socio-spatial factors influence edge engagement. To the knowledge of the lead researcher, no studies have used such a technique to dissect the holistically intertwined socio-spatial nature of peoples' engagement with real-world urban places (Simpson, 2014; 2018). As a method it could, therefore, provide a new empirical and direct insight into human experience of urban street edges and in turn address methodological issues raised earlier within this chapter. However, whilst there are a number of opportunities offered by the technique, it is beneficial to accept that there are potential limitations in relation to real-world mobile eye-tracking and that measures need to be put in place to mitigate such factors.

Looking and seeing - capturing gaze and its relationship with attention

A key foundation of eye-tracking's effectiveness is the premise that by understanding where someone is looking we can understand cognitive processes (Holmqvist et al., 2011; Duchowski, 2017), particularly visual attention –

> *Under most circumstances, the direction of gaze reflects ongoing computations and can be used to infer the moment-to-moment cognitive processing that subjects are engaged in.*
>
> Rothkopf et al., 2007, p. 1

This builds upon Just & Carpenter's (1980) eye and mind hypothesis. However, it needs to be

accepted that the relationship between looking and seeing, and thus eye and mind, might not always be fully aligned –

> *Although it is clear what particular point gaze is directed to in a scene, the inference about what is processed at each moment in time is not so easily accessible. That is, if a subject fixates a particular object in a scene, it is not clear which features are being processes. Although human self-awareness seems to suggest a continuous perception of object identities and features, considerable evidence demonstrates that this may not be what is in fact represented.*
>
> Rothkopf et al., 2007, p. 1

An everyday example of such a disconnect is noticeable in mindless reading. Here your eyes move along a line of text without actually processing the content of the words (Reichle et al, 2010). Within real-world urban situations, such as when visually engaging streets and edges, people are subjected to a wide range of dynamic stimuli. This potentially makes it challenging to comprehend whether someone's attention is focused upon what they are looking at or if they are cognitively processing other stimuli; objects in their periphery or what they have pervious seen, for example (Uttley et al., 2018). The relationship between real-world settings and human actions within them are also so complex that peoples' attention might be absorbed by non-visual influences, like avoiding other people whilst walking and navigating the street or planning future actions (Hausdorff et al, 2005).

Whilst gaze distribution often aligns with cognitive processing (Liversedge & Findlay, 2000; Finlay & Gilchrist, 2003; Hunt & Kingstone, 2003; Rothkopf et al., 2007), it is beneficial to accept that a potential disconnect between looking and seeing sometimes exists (Hausdorff et al, 2005; Uttley et al., 2018). As a consequence, a number of measures will be put in place in order to limit this potential cognitive separation, these are detailed within the methods (Chapter 6).

Eye-movement measures for real-world mobile eye-tracking

The human eye moves in a number of ways in response to the environment being engaged and the task at hand (Finlay & Gilchrist, 2003; Rothkopf et al., 2007; Holmqvist, 2011). Eye-tracking captures these eye-movements and allows us to understand where gaze is being distributed, from which a comprehension of visual attention and engagement is possible, as discussed before. In order to understand such distribution of visual engagement, eye-movements that are captured through eye-tracking are often separated into specific categories. These are normally *fixations*, when the eye is stationary and fixed upon a target, and *saccades* along with *smooth pursuits*, where the eye is moving and re-adjusting itself (Holmqvist et al., 2011; Duchowski, 2017). Regularly within eye-tracking studies, comprehension of where fixations are being directed in response to a stimulus provides the most reliable insight into cognitive processing. This is because when peoples' eyes fixate information is taken on board. However, within outdoor moving situations, where the human body is in perpetual state of re-adjustment whilst journeying

through the environment and light conditions continually change around them, fixation definition if often challenging (Evans et al., 2012; Vansteenkiste et al., 2015; Tomasi et al., 2016). Current mobile eye-trackers and eye-movement definition algorithms regularly struggle to separate out fixations from the mass of eye-tracking data within such circumstances and thus alternative approaches are required, which are equally valid ways to assess eye-tracking data (Vansteenkiste et al., 2015). The methodological implications of this will again be discussed in Chapter 6.

Overall, the current investigation believes, building upon the foundations of previous studies, that through the use of vision and mobile eye-tracking a new empirical and direct insight into urban street edge experience can be gained. The technique will be used within the current investigation, to capture how people visually engage with urban streets and specifically their edges whilst they journey through these complex socio-spatial realms. Whilst there are methodological aspects that require attention, the technique still has much to offer. Importantly, considerations have been stated so that mitigating actions can be undertaken to help address the potential limitations raised. From this grounding, the intention is to now highlight how the analysis of eye-tracking data will be approached.

Part 4: Analysis and visualisation framework

Eye-tracking within the laboratory has often been used to capture an empirical account of how people visually engage with various stimuli in an objective and rigorous scientific manner (Ladouce et al., 2017). This is through the control of experimental parameters towards the analysis of quantifiable measures using quantitative statistical techniques (Holmqvist et al., 2011; Simpson, 2014). As previously explored, however, such investigations regularly fail to immerse study participants within situations that align with the shifting complexity and inherent diversity of true-to-life settings like urban streets (Foulsham et al., 2011; Ladouce et al., 2017; Uttley et al., 2018). Within these real-world situations variability and study parameters are often difficult to control and as a result some eye-tracking as well as wider quantitative approaches are challenging to use (Uttley et al., 2018). More variability accepting interpretive and qualitative analytical eye-tracking techniques do exist, such as scan paths and heat-maps (Holmqvist et al., 2011). These are potentially more responsive to the changeability of these conditions whilst not restricting the richness of the data collected (Nordh et al., 2013; Simpson, 2014; Noland et al., 2017). However, within many research contexts, and subsequent publications where rigorous analyses and distilled outputs are often required, these techniques are not regularly used due to a lack of refinement and the need for considerable interpretation. They are adopted to provide an overview / example of how gaze is distributed but not frequently used within the in-depth analysis of the data collected. As a result, current analytical approaches for eye-tracking data regularly seek to capture, extract, quantify and distil insights away from the multiplicity of real-world situations, which potentially dis-aligns such analyses from the socio-spatial and phenomenological complexity of true-to-life urban engagement.

The current investigation is founded upon phenomenological and assemblage thinking, which can often be considered as interpretivist and anti-Cartesian ways of viewing the world (Lincoln & Guba, 1985; Cresswell, 2015). The complexity of real-world places founded upon the inherent diversity of context and the multiplicity of everyday processes that take place within them are seen as factors that cannot be abstracted from the locale within which they are established. Research insights, therefore, need to be captured and understood in direct response to the real-world situation they are manifested, aligning with Thwaites & Simkins (2007) and the thinking of Lincoln & Guba (1985). The transition within the current chapter (Part 2) towards a post-phenomenological mind-set does, however, begin to forward the notion that at some level focused analytical approaches are required that provide pragmatic and distilled insights, albeit grounded within an acceptance of real-world multiplicity and richness (Ihde, 2008, 2009).

The following will look to discuss how the data captured during the current investigation will be explored in response to the points raised. This is done whilst forwarding a mixed methods framework of analysis and visualisation. This seeks to use advanced mapping and representational techniques, which are qualitative in nature, providing an overview of the richness of data collected, as well as insight during their production. This is in combination with in-depth quantitative analyses making for post-phenmenological, mixed methods approach.

Mapping and visualisation

Building upon the philosophical, theoretical and methodological ideas discussed, the current investigation intends to integrate with the noticeable transition towards the visually engaging and stimulating graphical articulation of socio-spatial factors. The reason for this is two fold: *process* and *product*.

Over recent years there has been heightened interest in the potential of data visualisation. This is especially in the way it allows everyday phenomena to be articulated in a manner that does not require extensive knowledge of the information being presented (Rose, 2001; Lima, 2011; McCandless, 2012; www.seeingdata.org; www.visualcomplexity.com). Through this, visualisations seek to engage and enable the viewer rather than alienate them. Within an urban context this shift is noticeable through renewed attention towards visually engaging mapping techniques (Kent & Vujakovic, 2017), especially in an area of interest to the current investigation – assemblage thinking (Dovey & Pakfa, 2017; Dovey et al., 2018). This builds upon a long and established history of mapping complex socio-spatial urban factors (Appleyard, 1981; Hillier & Hanson, 1984; Jacobs, 1993; Corner, 1999), whilst seeking to use new technological advancements such as geographic information systems (GIS) and computer aided design (CAD) (Thwaites & Simkins, 2007; Dovey et al., 2018). For Dovey & Pafka (2017) visually representing the functional mix of urban environments provides insight into their assemblage of *live*, *work* and *visit*. Appleyard (1981) mapped social connections between people within spatially different residential street in response to traffic flows. Bosselmann's (1998) mappings detail movement in relation to distance

and time within variable urban contexts. Thwaites & Simkins (2007) use mapping to establish a visual language that makes tangible meaningful experiential connections between people and places, which is similar to Henshaw (2014) in collaboration with McClean (www.sensorymaps.com) who provide a visual assessment of *smellscapes*. All seek to engage the viewer whilst making tangible what has the potential to be challenging to describe social and experiential phenomena within specific spatial contexts.

A shift towards the creation of engaging data visualisations is highly significant, especially within the context of the current investigation when reflecting upon of who might potentially view and interpret the visualisations produced. Even though providing new empirical knowledge of how urban street edges are engaged, within an academic research context, the insights gained also intend to be used to inform design decision-making and practice. Many designers / planners often work visually, analysing, designing and representing interventions through graphical means (Dee 2001). Likewise, the insights gained might help inform those who regularly personalise and appropriate the urban street edge (segment owners, see Chapter 3, Part 3). Through working visually, therefore, insights intend be able to empower and enable. This is whilst de-mystifying potentially complex processes in a manner than engages the viewer who potentially has limited in-depth knowledge of the multi-faceted influencing factors (Corner, 1999; Rose, 2001; McCandless, 2012). This in turn may also offer opportunity for measures and/or terminology to be developed in accordance with new understandings (Thwaites et al., 2013). This is significant when reflecting upon points raised by Degen –

> *Arguably the hardest challenge has been to find a language to write about these more visceral, corporeal and emotional qualities that comprise urban life. The difficulty lies not so much in how to communicate sensory, visceral experiences verbally but more importantly in how to translate these non-linear and non-narrative moments of experiences and being in the world.*
>
> Degen, 2014, p. 98

In response to the above, mapping and visualisation of real-world eye-tracking data may have the potential to provide a language, which in itself captures non-linear moments of urban experience. Such techniques could make visible the holistic experiential connection between people and the environment around them that is impossible to capture via other means. To date such an exploration using eye-tracking data is limited (Uttley et al., 2018). The methods within Chapter 6 will discuss this further through introducing the processes employed during the visual mapping of eye-tracking data.

Moving beyond a focus upon final output / product, Corner (1999), whilst building upon the philosophy of Deleuze & Guattari (1987), describes the significance of exploratory actions undertaken during mapping –

> *Mapping is neither secondary nor representational but doubly operative: digging, finding and*

exposing on one hand, and relating, connecting and structuring on the other.

Corner, 1999, p. 225

For such thinkers, graphical visualisation of complex phenomena does not involve tracing and thus simply reproduction. But, involves actions that tease-out insights that would otherwise be challenging to comprehend and articulate without the creative mapping processes undertaken –

What distinguishes the map from the tracing is that it is entirely oriented toward an experimentation in contact with the realm. The map does not reproduce an unconscious closed in upon itself; it constructs the unconscious… the map has to do with performance, whereas the tracing always involves an 'alleged competence'.

Deleuze & Guattari, 1987, p. 12

Such quotes highlight how the significance of mapping is as much within the insights gained during the production of a representation as it is the final product. When seeking to comprehend the multifaceted nature of visual engagement with urban street edges the mapping of fleeting and often-invisible human-environment interactions, manifested within the distribution of gaze, could therefore be insightful. This is whilst offering opportunity to move beyond the exploration of insights that are challenging to articulate via observation and verbal descriptive means (Tuan, 1977; Nisbett & Wilson, 1977; Kusenbach, 2003) –

In making visible what is otherwise hidden and inaccessible, maps provide a working table for identifying and reworking polyvalent conditions; their analogous-abstract surfaces enable the accumulation, organization and restructuring of various strata that comprise an ever-emerging milieu.

Corner, 1999, p. 225

The mapping process offers opportunity to gain insight into the complex interplay of factors that potentially impact everyday assemblages and how they are experientially engaged (*various strata that comprise an ever-emerging milieu*). It makes visible and tangible what people cannot articulate verbally and in doing so could provide new understanding of the edge's socio-spatial make-up. The current investigation will build upon such ideas whilst exploring new mapping and visualisation techniques that seek to establish understanding of the complex everyday multiplicity of human engagement with urban street edges.

Quantitative insights

The previous discussion has highlighted the opportunity that visual processing of experiential eye-tracking data offers. Whilst this is the case, a post-phenomenological research framework (Ihde, 2008; 2009) and the ongoing need for new empirical and evidence-based urban environment knowledge (see Part 1; Cuthbert, 2007; Marshall, 2012), means that mappings and visualisations will potentially benefit from validations established through more quantitative means. A mixed-methods approach therefore provides opportunities for an integration of both..

Detailed earlier is the way indoor eye-tracking has often been used to capture eye-movements in response to controlled study variables whilst using statistical analyses (Holmqvist et al., 2011). There is thus a precedent for such a quantitative analytical approach. However, within the context of outdoor mobile situations, where eye-tracking has not been commonly used, the analyses employed need to be able to take into account factors that span multiple shifting and temporal social and spatial considerations. In response, the intention is to set out how this might be possible, aligning with a similar approach employed by Pihel, et al. (2015) within their lab-based eye-tracking investigation. During this study, statistical processes incorporated multiple influences upon visual engagement through the use of a linear mixed-effect model. This allows for multiple fixed and random factors to be considered within an analysis, limiting the abstraction of the data from the variable multiplicity manifested within it (Bates et al., 2014). In doing so, the impact of a single factor upon visual engagement, for example the edges of differing streets, can be understood whilst not disregarding the impact of wider effects, i.e. variable activities of the street inhabitant as well as the potentially differences caused by their personality. Through this, the visualisation and mapping of eye-tracking data can be complemented and potentially provided greater significance through statistical justifications.

Methodological framework – moving forwards

The current chapter has established the methodological foundations for how to go about studying peoples' experiential engagement with urban street edges. Attempts have been made to analyse existing issues impacting how these and wider build environment realms are currently studied. From this, philosophical advancement has taken place through the introduction of post-phenomenology, along with methodological as well as analytical considerations discussed. This has taken place whilst introducing the potential of real-world mobile eye-tracking along with associated analytical opportunities, which can capture and elicit an empirical and direct account of how street edges are visually engaged. Building upon this, the aim is now to introduce the research questions of the current investigation.

Chapter 5

Research questions

The research questions for the current investigation are arranged in a series of parts. Each part looks to address specific points put forward within the conceptual edge framework (CEF – Chapter 3). This is alongside the understanding that everyday phenomenological experiences of urban street edges can be examined through understanding visual engagement with them, captured and articulated whilst using mobile eye-tracking and associated analytical techniques.

Each individual part begins by adapting aspects of the CEF into a working hypothesis from which research questions are devised. The initial question within each part looks to encourage the visual exploration and representation of data in-line with the visualisation discussion within Chapter 4, Part 4. Through this, the intention is to gain insight into the data collected through the act of producing mappings and visualisations. This is whilst also working towards the presentation of an engaging insight and expansive overview of the experiential phenomena being analysed. Following this, focused questions explore urban street edge engagement in a more quantified manner towards distilled empirical insights. In doing so, the approach seeks to work within a post-phenomenological framework of analysis combining a comprehension of variable lived experience with rigorous inquiry. The insights gained subsequently provide opportunity to examine the working hypotheses and thus notions developed within the CEF. From this, points can be raised that start to address the knowledge and practice aims and objectives forwarded within Chapter 2.

Part 1: Urban street edges as socio-spatial assemblages

Part 1 explores the overarching phenomenological foundations of urban street edge engagement in terms of how visual engagement with these assemblages is socio-spatially manifested.

Hypothesis – Visual engagement with urban street edge assemblages will be influenced in combination by both the variable edges of differing street settings (spatial factors) as well as the activity of street inhabitants (social factors).

Part 1.1 (Visualisation)
How does who we are, where we are or what we are doing influence what we look at when walking down the urban street?

Part 1.2
Are there differences in the amount of visual engagement with urban street edges between i) street inhabitants undertaking different social tasks; and ii) different urban streets?

Part 1.3
Are the edges of streets that are visually engaged to a greater extent whilst undertaking optional tasks also visually engaged to a greater extent whilst undertaking necessary tasks?

Part 2: Urban street edges as nested multi-scalar and multi-directional assemblages with experientially significant segments

Part 2 is more spatially focused, whilst remaining socially considerate, exploring where and how visual engagement is distributed upon urban street edges. This is in order to understand how the scales of the edge's nested multi-scalar assemblage are visually engaged, in-line with its experiential multi-directional manifestation (directional / locational emphasis). In response to the CEF, it is anticipated that the ground floor of the urban street edge, comprising segments, will hold particular phenomenological significance.

Hypothesis – Visual engagement will be focused upon the ground floor of urban street edges – its segments – regardless of social task. It will also vary along the length of a street edge, especially in response its ground floor segments, highlighting variable points of experiential intensity and thus shifts in the edges directional / locational emphasis.

Part 2.1 (Visualisation)
Where is visual engagement distributed on urban street edges?

Part 2.2
Are there differences in the amount of visual engagement on urban street edge quadrants (lower and upper floors on different sides of the street) between i) street inhabitants undertaking different social tasks; and ii) different urban streets?

Part 2.3
Where is visual engagement distributed across urban street edge ground floors in response to their segments?

Part 2.4
Are urban street edge segments that are visually engaged to a greater extent whilst undertaking optional tasks also engaged to a greater extent whilst under necessary tasks?

Part 3: The experiential influence of affordances territorially manifested within segments

Part 3 examines why certain territorialised segments are more experientially engaging than others, notably, in regards to how the affordances forwarded within the CEF are manifested within them.

Hypothesis – Visual engagement will be focused most intensely on segments that portray individually and collectively the territorially established affordances of distinctiveness, transitional

quality, sensory complexity and a level of temporality.

Part 3.1 (Visualisation)
How does visual engagement with urban street edge segments vary in response to their physical and material manifestation?

Part 3.2
How does visual engagement with urban street edge segments vary in response to their distinctiveness, manifested through high-level and low-level saliency?

Part 3.3
How does visual engagement with urban street edge segments vary in response to their lateral transitional quality, manifested through transparency and permeability?

Part 3.4
How does visual engagement with urban street edge segments vary in response to their transitional quality of experiential extent along a street edge?

Part 3.5
How does visual engagement with urban street edge segments vary in response to their sensory complexity?

Part 3.6
How does visual engagement with urban street edge segments vary in response to the temporality of their affordances?

Research questions – moving forwards

The intention is to now set out the investigation undertaken to test the hypotheses forwarded and answer the questions detailed. This is through the use of real-world mobile eye-tracking and analytical techniques introduced within the methodological framework (Chapter 4).

Chapter 6

Research investigation

The processes employed to examine the thesis hypotheses and answer constituent research questions, detailed within Chapter 5, are set out within the following chapter. Part 1 introduces the main study variables; Part 2 discusses data collection using mobile eye-tracking glasses; Part 3 explores data handling and the procedures of data processing, visualisation and quantitative analysis.

Part 1: Study variables

As detailed throughout, a key foundation of the current investigation is to capture an empirical insight into peoples' experiential engagement with urban street edges. With such an understanding the intention is then to address the study aims and objectives ultimately towards answering the overarching question – h*ow might we be able to create more experientially engaging urban street edges?* Building upon the ideas and theory used in the development of the conceptual edge framework (Chapter 3) and subsequent hypotheses along with research questions (Chapter 5), there are three key variables that require consideration in order to examine urban street edge experience –

i) differences in the physical and material characteristics of the streets and edges engaged;
ii) the variable activities and tasks being carried out by people within such streets;
iii) the differing people inhabiting the street, undertaking these activities whilst engaging the environment around them.

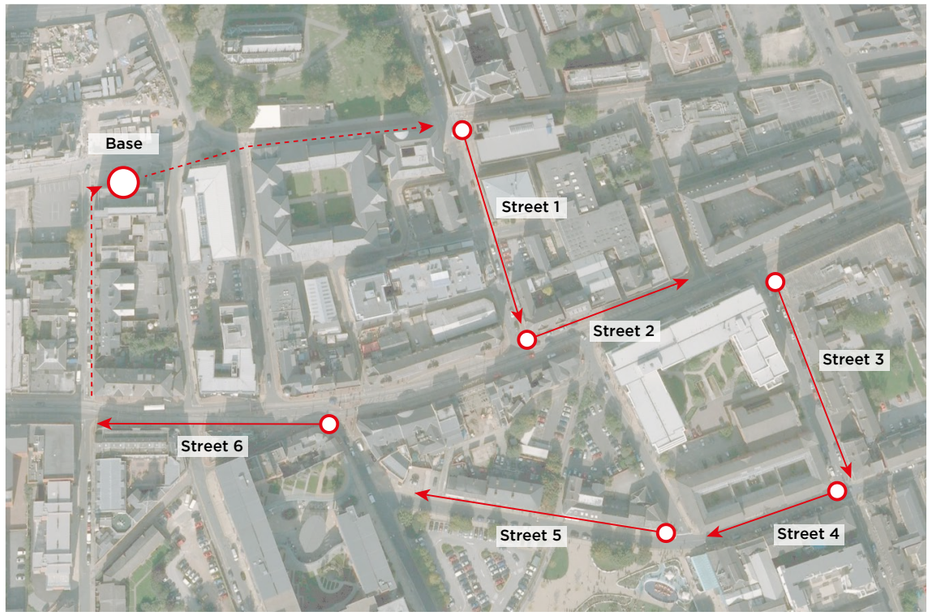
The following will look to discuss these variables in detail. Firstly, the discussion will explore the choice and reason for the selection of the differing streets and edges. Next, the common everyday social processes and tasks that play out these streets will be explored. From this, the discussions will then focus upon the study participants and how they were recruited to take part within the investigation.

Streets and street edges

The selection of streets and thus edges to be investigated was established upon a number of criteria. The overarching intention was to expose study participants to a varied range of urban street edges and subsequently capture their engagement with these differing realms using mobile eye-tracking. In order to cover a wide range of differing streets and edges the investigation was run across two routes within the city centre of Sheffield (location introduced within Chapter 1). Each route comprised six streets; therefore, twelve streets along with their street edges were examined in total. Due to the considerable amount of data collected when using eye-tracking the examination of twelve streets and edges was deemed sufficient for understanding how people experientially engage with these realms. The timeframe of the overall investigation also influenced the amount of data to be collected with coding and analysis of outdoor mobile eye-tracking data taking a considerable amount of time. These processes are detailed within Part 3 of the current chapter.

Each route was established close to a site where eye-tracker setup, briefings and debriefings could be undertaken easily and efficiently. Two base sites were subsequently chosen – ICOSS Building (Interdisciplinary Centre of Social Sciences) at the University of Sheffield and The Crucible Theatre. Both were easily accessible and had the required space from which to run the eye-tracking studies. With these two bases established a selection of six streets within the surrounding urban areas of these locations was made. Six streets was an appropriate amount for each study participant to walk, taking around 30-40 minutes. It also achieved an optimal balance between capturing a sufficient amount and diversity of gaze data, whilst avoiding the potential for disengagement in participants due to overloading their involvement with too many street exposures. This was important, in an attempt to mitigate the impact of a separation between gaze distribution and cognitive attention (Holmqvist et al., 2011). By keeping the study participants engaged with the investigation, and not boring them, the aim was to address the issue of a disconnect between looking and seeing as discussed within Chapter 4. Six walked streets per participant was also considered not to be too few, making the study participant's involvement worthwhile (ethical consideration). In total these actions provided a considerable data set of 144 walked streets with which subsequent analyses could be undertaken.

Building upon the notions forwarded and developed within the conceptual edge framework (CEF – Chapter 3), the streets and edges selected were required to highlight noticeable variations in the physical and material properties of their edges. There was particular attention paid to variation in the functions and material characteristics of the territorialised segment scale of each edge and how these where nested into the wider scales of the street edges (plinths and plots). Beyond this, the streets had to follow easily navigable routes so that a single study participant could walk the different streets without any need for wayfinding. This might have impacted how the street edges were engaged. Lastly each street had to have a definitive start and end point, such as a street corner / junction with another street, for ease of navigation. Twelve streets and their edges were selected based upon these criteria. These where across two routes (Streets 1-6 and 7-12). Figures 29.1 and 29.2 highlight these routes and the constituent streets.



Walked Route and Base Location

Street 1

Street 2

Figure 28.1 – Route 1a

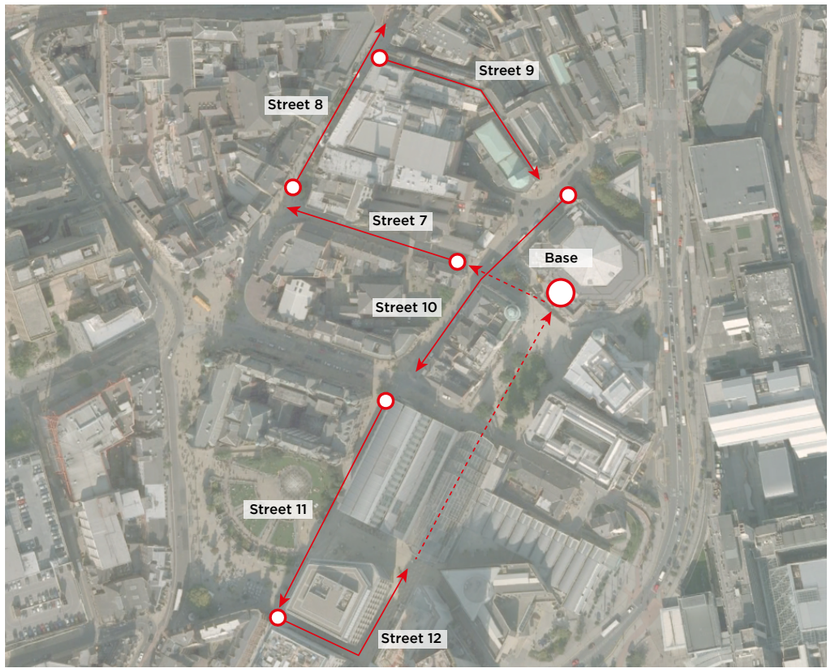
Street 3

Street 4

Street 5

Street 6

Figure 28.2 – Route 1b



Walked Route and Base Location

Street 7

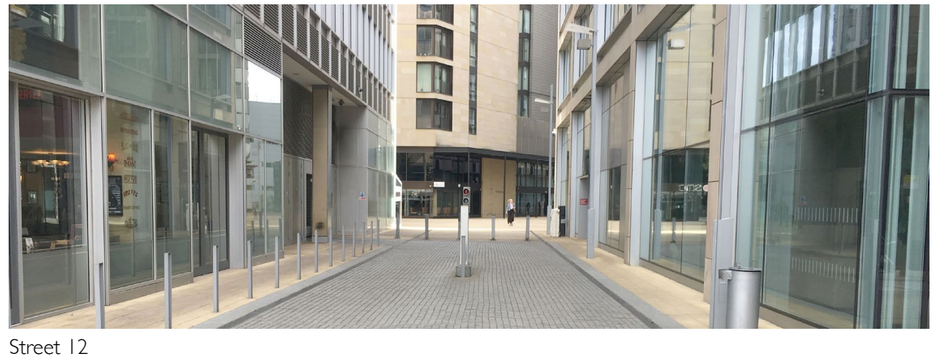
Street 8

Figure 29.1 – Route 2a

Street 9

Street 10

Street 11



Street 12

Figure 29.2 – Route 2b

Social processes / tasks

Rarely do people freely walk down urban streets without any intentions, goals or desires (Mehta, 2013). They are often occupied with a range of activities stemming from their everyday needs whether optional, necessary or social (Jacobs, 1961; Gehl, 2010). During the development of the CEF such everyday actions were highlighted as significant. This was especially in response to combined socio-spatial considerations within the way social processes and behaviours can impact on the way street edges are potentially experientially engaged. Rather than just openly walking the streets selected it was, therefore, important for the study participants to be undertaking everyday tasks as they journeyed through these spaces.

The use of everyday tasks also helped keep study participants engaged with the investigation and the activity at hand. This was again significant whilst helping to mitigate a potential disconnect between gaze distribution and cognitive attention (Chapter 4). In eye-tracking studies the use of tasks has been shown to be important since the early use of this equipment, see Figure 27 (Yarbus, 1967; Rothkopf et al., 2007; Homlqvist et al., 2011). Here, different tasks / briefings influence how a stimulus is viewed, aligning with how tasks potentially influence how urban street edges are engaged.

Onsite observation within the 12 study streets was used to document noticeable behaviours and activities of street inhabitants. This was in order to define the tasks to be given to the study participants. The observations were conducted whilst taking into consideration Gehl's (2010) optional, necessary and social activity framework and Metha's (2013) list of street activities. From this, a wide range of observable street activities were documented, which were subsequently refined into a final selection for use within this current investigation. These fell into two groups – optional and necessary – aligning with Gehl (2010). Social activities were not selected for use within this current investigation, even though such actions were observed within the study streets (people chatting with friends, walking in pairs or groups etc.) This was because social activities might have felt forced and artificial for the study participants compared with the true nature of everyday street socialising. The study, therefore, focused upon predominantly individual walked activities spanning optional and necessary actions. Six tasks were subsequently selected so that each study participant could carry out a different task on a different street, again keeping them engaged with the activity at hand.

The tasks selected formed the foundation of briefing cards, to be discussed within following data collection section (Part 2). Table 1 highlights the selected tasks and their associated briefing text; Table 2 shows their distribution across the different participants and streets.

Task	Task group	Briefing text
Rush to work	Necessary	You are close to being late for work. Hurry to make sure you don't miss the meeting you had planned.
Drop off	Necessary	A friend has asked to borrow something and you have agreed to drop it off with them. They said they would be waiting for you on the street corner.
Wander to the bus	Necessary	You have finished all you need to do in the city centre and are on the way to catch the bus. You don't know when it will leave but you are not in any hurry as you know they depart regularly.
Break-time stroll	Optional	You are dawdling on your hour break and have decided to take a stroll to get some fresh air.
Coffee with a friend	Optional	You are on your way to meet a friend, who is always late, for coffee and cannot remember if you said to meet in a certain place.
Window-shopping	Optional	You have kindly been given some money for your birthday and are out window-shopping to find something to spend it on.

Table 1 – Tasks and briefings

Investigation Block 1 - Randomised

Participant	Street 1	Street 2	Street 3	Street 4	Street 5	Street 6
	Mappin	West	Westfield	Division	Devonshire	West
1	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 2 - Wander to the bus
2	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Optional 2 - Window shopping
3	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 3 - Coffee with a friend
4	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 3 - Drop off
5	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Optional 2 - Window shopping
6	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Necessary 1 - Rush to work
7	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 1 - Break time stroll
8	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 3 - Coffee with a friend
9	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Necessary 1 - Rush to work
10	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 3 - Drop off
11	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 2 - Wander to the bus
12	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 1 - Break time stroll

Investigation Block 2 - Randomised

Participant	Street 7	Street 8	Street 9	Street 10	Street 11	Street 12
	Norfolk Row	Fargate	Chapel Walk	Norfolk Street	Norfolk Street (P)	St Paul's
1	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 1 - Break time stroll
2	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 2 - Wander to the bus
3	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 3 - Drop off
4	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Necessary 1 - Rush to work
5	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 3 - Coffee with a friend
6	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 1 - Break time stroll
7	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Necessary 1 - Rush to work
8	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Optional 2 - Window shopping
9	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 3 - Drop off
10	Optional 1 - Break time stroll	Necessary 3 - Drop off	Necessary 2 - Wander to the bus	Optional 2 - Window shopping	Necessary 1 - Rush to work	Optional 3 - Coffee with a friend
11	Necessary 1 - Rush to work	Optional 1 - Break time stroll	Optional 3 - Coffee with a friend	Necessary 2 - Wander to the bus	Necessary 3 - Drop off	Optional 2 - Window shopping
12	Necessary 3 - Drop off	Necessary 1 - Rush to work	Optional 2 - Window shopping	Optional 3 - Coffee with a friend	Optional 1 - Break time stroll	Necessary 2 - Wander to the bus

Table 2 – Distribution of tasks across participants and streets

Study participants

Participant recruitment took place through opportunity sampling and the use of a volunteers list held by the University of Sheffield. This list is often used within wider psychology studies and contains academic and non-academic staff, as well as students at the university. An ethically approved email (ref – 003001) was sent out to all people on this list, detailing a rough outline of the study, without providing them with a full account of what the investigation entailed. This was important and followed common practice in psychology and especially eye-tracking studies (Holmqvist et al., 2011). If participants had known the full details of the study it might have influenced the realistic nature of the data collected. This is discussed further within data collection section of the current chapter whilst introducing the cover story (Part 2). Each participant was offered £20 to take part within the study, which was funded through an ESRC Research Training Support Grant (RTSG) associated with the investigation.

In total 24 adults (12 male, 12 female), with a mean age of 35 (s.d. = 10, range 21-61) were randomly selected, from a large number of respondents, to take part in the study. Prior to random selection, academic staff were excluded from the initial invitation in order to gain a sample that did not have a bias towards higher levels of education. A mix between male and female participants was also desirable so this was taken into consideration. All participants had normal to corrected-to-normal vision via contact lenses and did not know the intentions of the study at the time of participation. All had prior knowledge of the study streets and had walked them before. The participants were split into two groups with half walking the streets 1-6 and the other half streets 7-12.

Part 2: Data collection – Real-world mobile eye-tracking investigation

With the streets and edges selected, tasks defined and participants recruited the real-world mobile eye-tracking investigation could take place. This is detailed in the following, along with a consideration of ethics procedures.

Pilot

Prior to data collection two pilot studies were undertaken to check the processes to be employed within the main investigation. These pilots used the same streets, tasks, apparatus and procedures as the main study and aided in the refinement of the data collection procedures employed. No considerable modifications were made following piloting but subtle adjustments were made to the task briefing points at the start of each walked street.

Apparatus

A SMI Glasses 2.0 Mobile Eye-tracker (see Figure 30; Senso Motoric Instruments, Teltow, Germany, www.smivision.com) was used within the current investigation. Inside these lightweight and unobtrusive glasses is housed a front facing camera, which records a video of the environment in front of the wearer, and two rear facing cameras, under each eye record videos of the wearer's pupils. The information from these videos is then processed within SMI's BeGaze software to give a single video output. This has the front facing video with gaze location superimposed on top (shown within Figure 30 by the red cross hairs). Each participant wore this mobile eye-tracker as well as cap in an attempt to limit the influence of sunlight on data loss, consistent with previous real-world eye-tracking studies (Kiefer et al., 2013; Simpson, 2014).

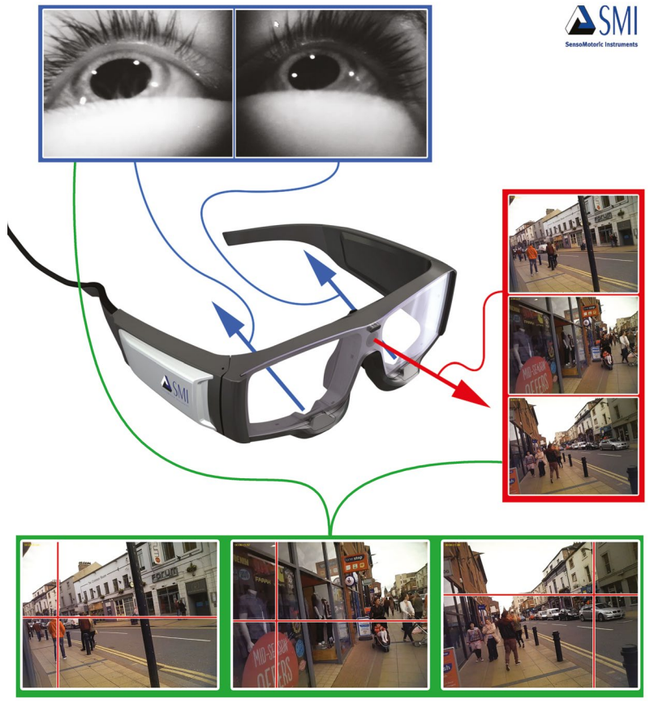


Figure 30 – Mobile eye-tracker and camera configuration

Procedure and Ethics

Data collection was undertaken during August 2015, which was outside of university term time. This was important as it provided consistency, with some of the study streets often being subjected to temporal shifts on an hourly basis at lecture change-over time. Such change-overs impacted significantly the number of people within the study streets, so in order to mitigate this factor the summer break was used for data collection.

The study participants were met individually at one of the base locations depending on the route to be walked (Figure 29). Following a briefing, consent forms were signed. Within this briefing, the full scope of the investigation was not revealed and the full extent of data to be collected was not discussed. A cover story was adopted. Within many eye-tracking experiments cover stories are used so that the gaze data obtained is as true-to-life as possible (Holmqvist et al., 2011; Duchowski, 2017). If from the outset the study participants were informed that the investigation was seeking to assess what they look at in urban streets, the insights gained could potentially have been impacted by them knowing that their gaze was being tracked. Therefore, an appropriate process of cover story and initial consent prior to data collection then retrospective consent after de-briefing was adopted. This process was approved by The Department of Landscape's Ethics Committee at the University of Sheffield (ref – 003001).

Following initial briefing and the signing of consent forms, participants were fitted with the mobile eye-tracker. A three-point calibration of the tracker was then undertaken. During this, they were asked to look at three specific points in the room, the centre of a clock for example. The tracking of the eye-tracking glasses was subsequently adjusted in relation to this. This calibration was checked, and if required due to inaccuracies, undertaken again. This completed setup ready for data collection.

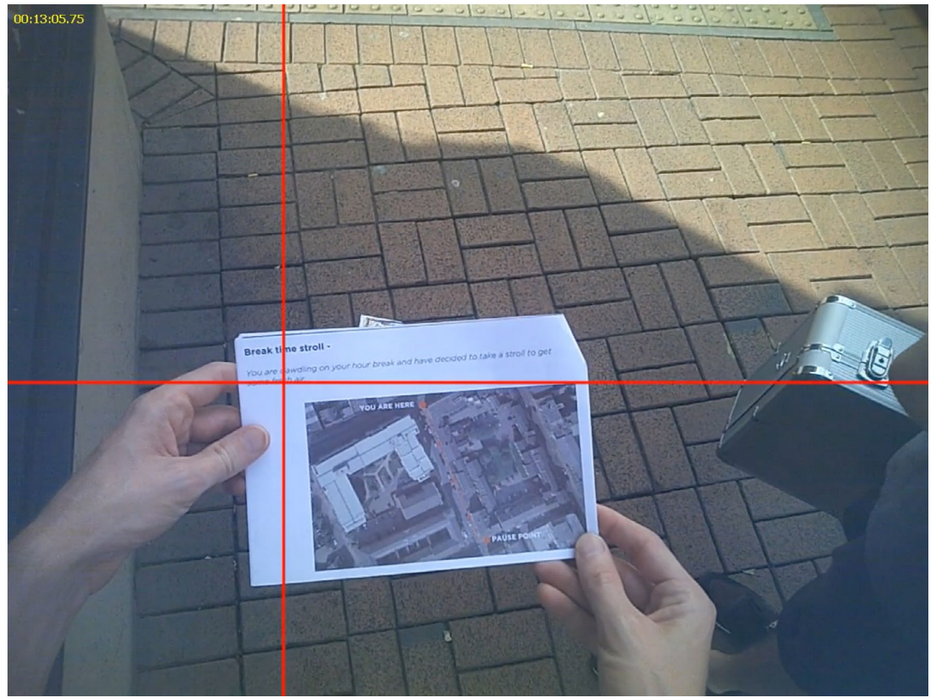


Figure 31 – Task card reading

Each participant was asked to walk a route along specified streets; six in total, see Figures 29.1 and 29.2. Prior to walking down each street, they were requested to read a task card, see Figure 31. This was intended to introduce a social action into the study and place the participant within the mind-set of an everyday activity to carry out on the street. This was discussed within Part 1, see Table 1. Throughout the study, the participant's reading of these task cards also acted as additional eye-tracker calibration check-points. These allowed for tracking accuracy to be assessed following data collection and adjusted accordingly.

During the walks the lead researcher shadowed the participants. This was primarily to administer the tasks to be carried out whilst walking each street. Also, for safety reasons and if issues cropped up during data collection. In addition to this, the researcher was fitted with a camera (mobile phone) on their chest, which recorded a video of the location of the participant as they walked down the street. The data from this was used within the subsequent visualisation techniques employed (see Part 3).

Each participant walked six streets and carried out different tasks on each street (three optional and three necessary, see Table 1 and Table 2). After this they were taken back to the base location and the eye-tracker removed. An ethically approved de-briefing was then undertaken (ref – 003001). This explained the full reason for the investigation and the true nature of the data collected. Following this, retrospective consent was taken. If a participant was unhappy with the use of their data within the investigation, following this de-briefing, the data was deleted. However, all who took part within the study had no objections to the use of their data after finding out the full intentions of the investigation.

An interview was subsequently undertaken with each participant. This used their eye-tracking output video as an elicitation device; aligning within an approach discussed by Holmqvist et al. (2011). Here the intention was to discuss potential reasons why they looked at certain aspects of the urban street edges engaged with the aid of the video. This process also allowed for a strengthened understanding between gaze distribution and cognitive attention to be fostered. Whilst these interviews were not transcribed and used within subsequent analyses (due to timing and scope) they did provide the lead researcher within an initial insight into the nature of people's engagement with the urban street edges visually engaged. The eye-tracking / interview approach also helped inform a case study within a published methods-focused book chapter (Uttley et al., 2018). Following the interview data collection was complete and the participant paid £20.

The eye-tracking data (video) and interview data (audio) was never associated with the name of the study participants who were allocated participant numbers (1-24) for ethical reasons. This meant that all the data was anonymous. The data was stored on a password protected hard drive only accessible to the lead researcher and supervisor team.

Part 3: Data handling and analysis

Following collection, the eye-tracking data was processed and coded. This was prior to visualisation and analysis in order to gain empirical insights that could be used to answer the research questions posed (Chapter 5).

Data processing, coding and loss

Once each participant's eye-tracking data for individual streets was exported as a video. Each video frame indicated their location of gaze for a tenth of a second (see Figure 30 for output examples and gaze location shown by the red cross-hairs). Dwell duration upon pre-defined areas of interest (AOIs) was subsequently coded using VideoCoder (Foulsham et al., 2011). Within the current study, the AOIs were street edges, ground, sky, people, objects (street furniture, moving and static vehicles, other objects within the street scene) and adjacent realm (any gaze that fell outside of the boundaries of the street currently being inhabited). These AOIs were chosen as they provided opportunity to analyse visual engagement with specific street components detailed within contemporary urban design and planning literature (NACTO, 2013; GDCI, 2017). Significantly, the AOIs did not overlap allowing all gaze allocation, and thus visual engagement within the streets, to be assigned to a single AOI. Coding the data in this way overcame issues regarding eye-movement definition within outdoor moving situations, as the raw eye-tracking video was used instead of automated classification of eye-movements as fixations, when the eye is static, or saccades, when the eye is being adjusted and moving (Evans et al., 2012; Vansteenkiste et al., 2015; Tomasi et al., 2016). Once coded, a log of sequential dwell durations on the predefined AOIs, was exported. With this, subsequent analyses could be undertaken providing insight into where the participants' visual engagement was focused.

Variations in data quality were anticipated, as tracking accuracy in outdoor investigations is regularly lower when compared with laboratory-based eye-tracking (Holmqvist et al., 2011). Data quality did indeed vary slightly but data loss was generally low, resulting in a mean tracking ratio of 93% (s.d. = 6%, range = 68%-99%). All eye-tracking data collected was used in the subsequent analyses.

Data visualisation

The methodological framework (Chapter 4) details how visually engaging and stimulating data visualisation techniques play a key role in the current investigation. Here the production of visual material is considered part of the process of gaining an understanding of the data collected. This is in accordance with the creation of a product that provides insight into the phenomena being displayed (Corner, 1999). The approaches detailed in the following provide an overview of the visualisation techniques developed and employed within this current investigation. During the Results (Chapter 7) there is further discussion of how the techniques detailed were applied whilst addressing the research questions forwarded.

Street DNA

The time-coded log exported from VideoCoder was visualised in the form of *Street DNAs*, or *Street Dynamic Narrative Articulations* (Simpson, 2018). Such a technique was developed during Simpson (2014) whilst building upon an approach employed by Rothkopf et al. (2007). This used MATLAB (MATLAB, R2014a) to make legible the often challenging to comprehend coded output from VideoCoder. The Street DNAs visualise the list of dwell durations (numbers) as a series of stacked coloured bars resembling a DNA sequence. These sequences could then be arranged into various groups to gain a qualitative insight into visual engagement with the different AOIs of the urban streets and importantly street edges.

Three-dimensional gaze mapping

The current investigation sought to map / model how gaze interacts with urban street edges in three-dimensional space. To do this, the video recording of the participant's location within the streets was used. This was taken from the camera mounted on the lead researcher who shadowed the study participants, as detailed within Part 2. This video was then synchronised with the eye-tracking video. The synchronised output provided a combined insight into where a participant was positioned and what they were looking.

Computerised three-dimensional models were then made of the study streets and edges in Trimble SketchUp 2015 using data gained from Edina Digimap, onsite measurements and photographs. Sketchup 2015 was then again used, in combination with the plugin Vertex, to draw vector gaze lines from where a participant was located in the street to where their gaze was being focused with the aid of the synchronised participant position / gaze location videos. When each participant's three-dimensional gaze mappings were completed they were overlaid. This provided a highly detailed insight into how and where gaze was projected on to urban street edges spanning all the study participants. For ease and legibility this was exported as a .DWG in plan and elevation (left side and right side) then imported into Adobe Illustrator.

The production of the mappings provided the lead researcher with a nuanced insight into the participant's visual engagement with urban street edges. The mappings themselves were also used within subsequent analyses. This was in qualitative terms, through the visual interpretation of the graphics, as well as quantitatively, with further data being extracted from the three-dimensional models. To the knowledge of the lead researcher the three-dimensional mapping of gaze data has not been undertaken before. It therefore provides a new, innovate and accessible insight into human experience of urban street edges. Significantly such an insight is from a perspective that has previously been challenging to accurately detail and visually communicate.

Graphs and Photographs

Beyond the innovative visualisation and mapping approaches developed, more conventional techniques were also employed to aid in the articulation of the empirical insights gained. Bar and scatter graphics with best-fit lines, produced using Excel in combination with Adobe Illustrator, were used to help articulate quantitative insights.

In order to capture information about the urban street edges engaged photographs were taken using a DSLR camera (Nikon d5000, 18-55mm DX lens). These covered, where possible, the entirety of edges and paid particular attention to the ground floor segment scale of the street edges. In some instances multiple photos were stitched together using Adobe Photoshop. These photographs were subsequently used as reference during analysis as well as within the production of data visualisations.

Data analysis – quantitative

Within the methodological framework (Chapter 4) was discussed the intention to used qualitative techniques in combination with quantitative analyses, within a mixed methods approach that followed a post-phenomenological framework of analysis. This was in order to provide the various visualisations produced with a level of empirical and statistical validity. The quantitative analyses were performed in the R statistical computing environment (version 3.0.2; R Core Team 2013). During the Results (Chapter 7) further methodological detail is added which explains the quantitative processes employed specific to each research question.

Research investigation – moving forwards

The procedures detailed within the current chapter were used to capture and comprehend how people visually engage with urban street edges whilst they inhabit differing streets and undertaken a range of variable activities. This provided the foundation for answering the research questions of the current investigation, which takes place within the results chapter that follows.

Chapter 7

Results

The current chapter presents and examines results from the eye-tracking investigation. This is whilst answering the research questions forwarded (Chapter 5) within the context of the ideas developed and forwarded within conceptual edge framework (CEF – Chapter 3). The structure of the results mirrors the parts used to introduce the research questions. Each part has its own brief methods section, which looks to specify the analytical approaches undertaken beyond the general methods that were discussed within the research investigation (Chapter 6). Following this, there are detailed results in relation the question posed and a brief findings discussion. Importantly, this establishes empirical and experientially focused foundations that can be subsequently used within the exploration of theoretical (knowledge and practice) and real-world application undertaken during Chapter 8.

Part 1: Urban street edges as socio-spatial assemblages

Hypothesis – Visual engagement with urban street edge assemblages will be influenced in combination by both the variable edges of differing street settings (spatial factors) as well as the activity of street inhabitants (social factors).

Part 1.1 (Visualisation) – How does who we are, where we are or what we are doing influence what we look at when walking down the urban street?

Method

The coded timelines and Street DNA visualisation approach developed within the current investigation was used (Chapter 6, Part 3). The DNA visualisations were organised over three page-spreads by i) the 24 participants who took part within the investigation – the *who*; ii) the 12 streets they territorially inhabited – the *where*; iii) the 6 everyday activities they carried out – the *what*. The resultant visualisation groupings were then visually interpreted and examined through comparing the composition, distribution and frequency of colour across and within them. This provided a graphically established interpretation into how social and spatial factors influenced phenomenological visual engagement with the urban street edges.

Results

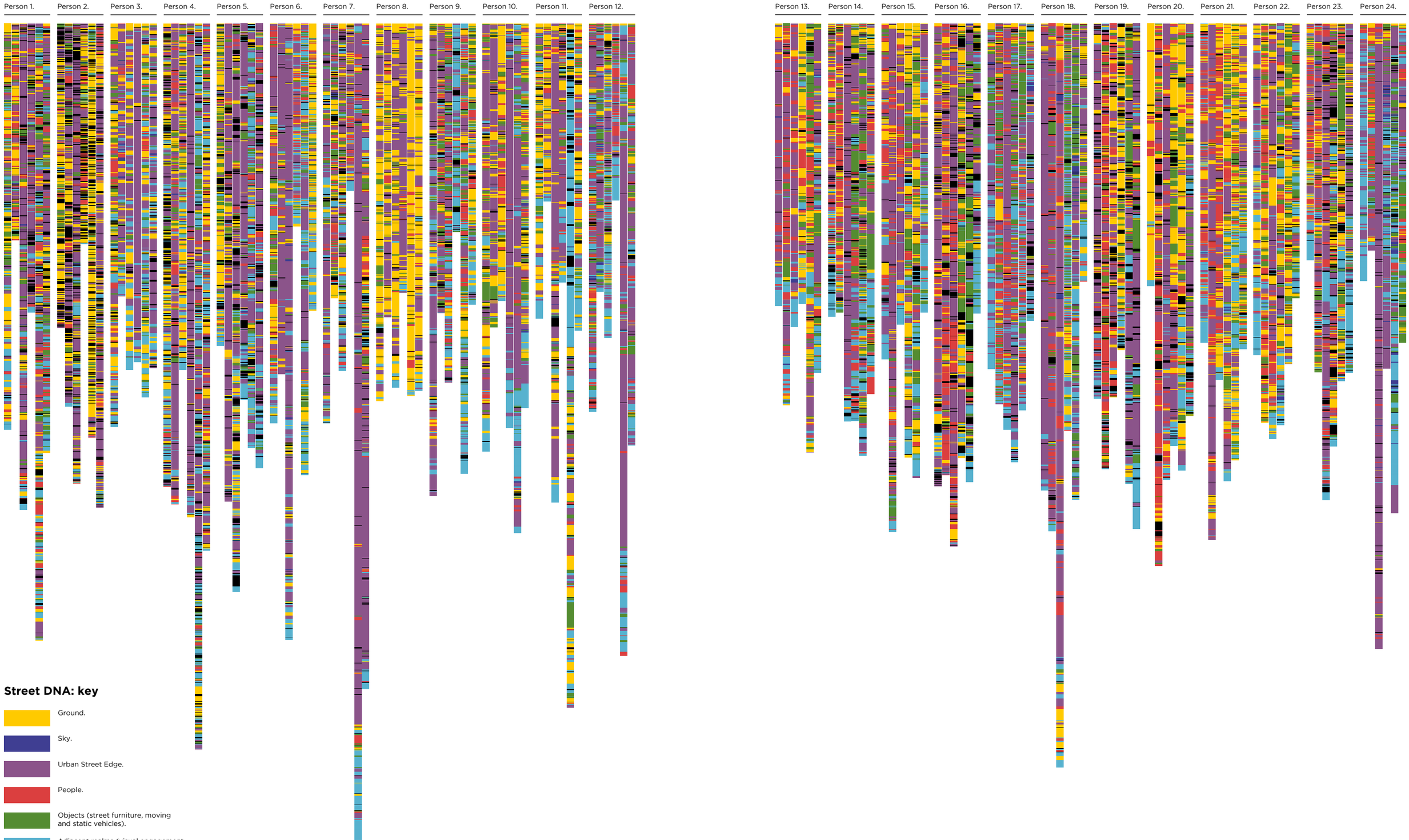
Over the following page spreads are presented –

Spread 1 – Street DNA: *who* we are.
Figure 32.1 – People 1-12 and Figure 32.2 – People 13-24

Spread 2 – Street DNA: *where* we are.
Figure 33.1 – Streets 1-6 and Figure 33.2 – Streets 7-12

Spread 3 – Street DNA: *what* we are doing.
Figure 34.1 – Tasks Necessary and Figure 34.2 – Tasks Optional

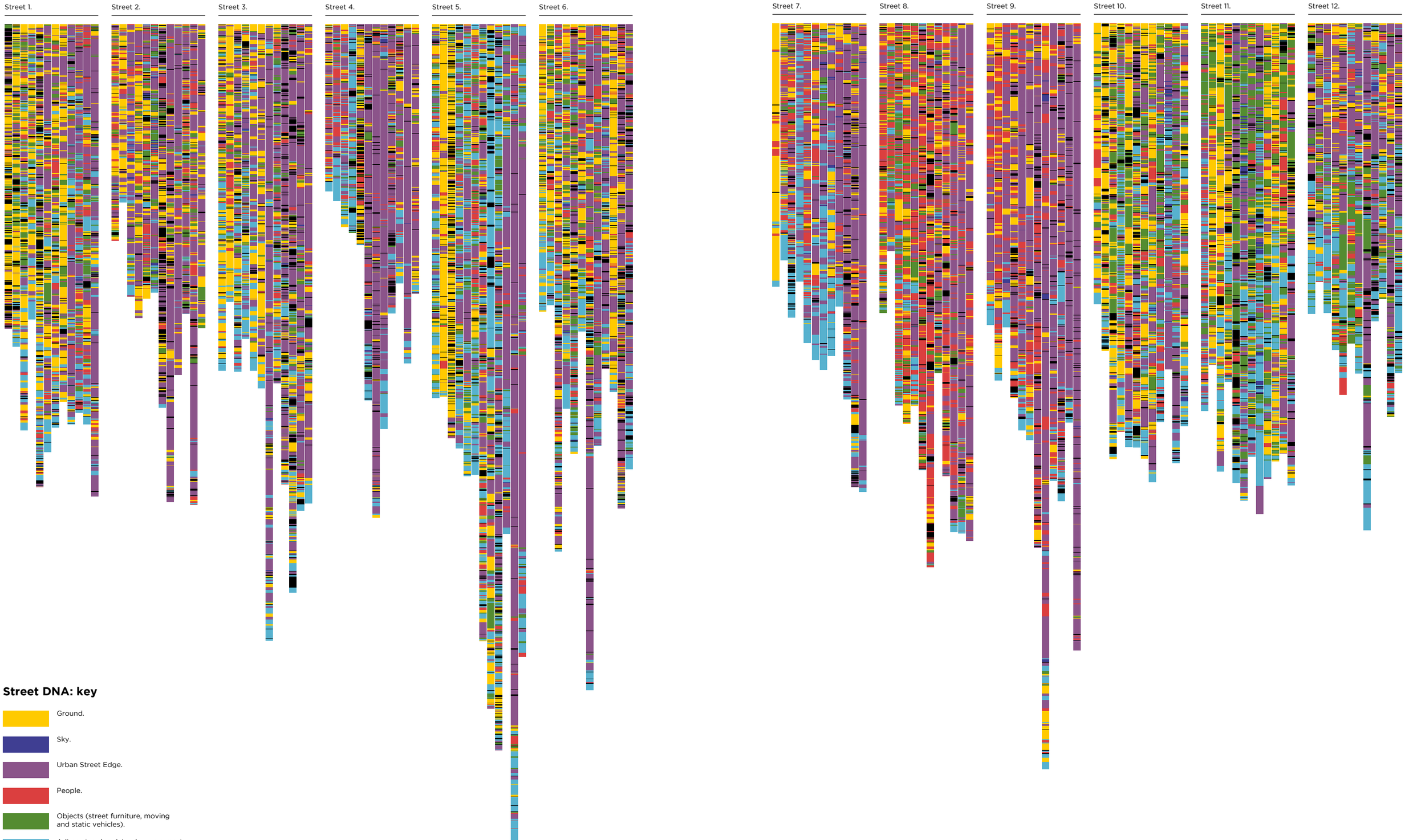
Street DNA: *who* we are.



Street DNA: key

- Ground.
- Sky.
- Urban Street Edge.
- People.
- Objects (street furniture, moving and static vehicles).
- Adjacent realms (visual engagement outside the inhabited street).
- Data loss.

Street DNA: *where* we are.

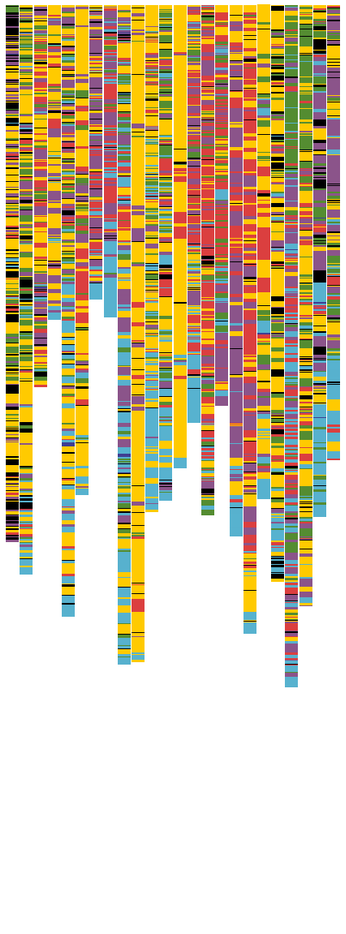


Street DNA: key

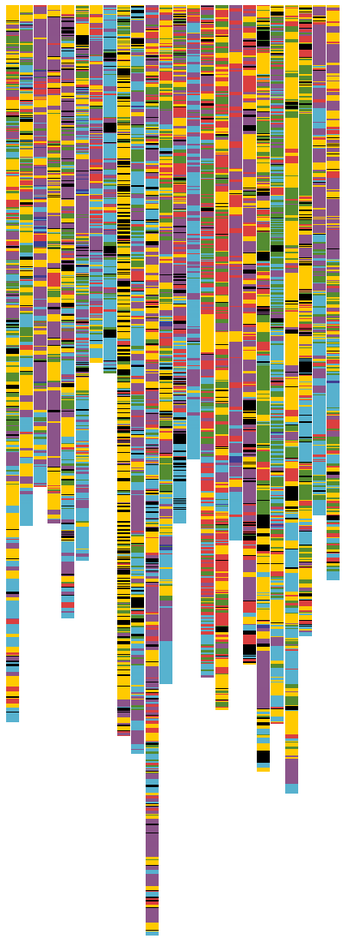
- Ground.
- Sky.
- Urban Street Edge.
- People.
- Objects (street furniture, moving and static vehicles).
- Adjacent realms (visual engagement outside the inhabited street).
- Data loss.

Street DNA: *what* we are doing.

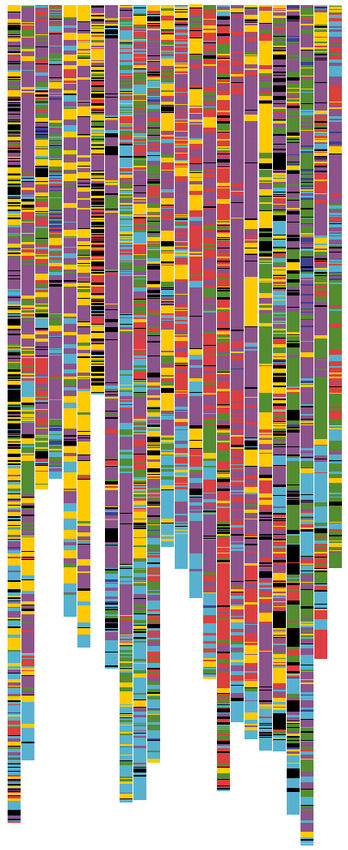
Rush to work - You are close to being late for work. Hurry to make sure you don't miss the meeting you had planned.



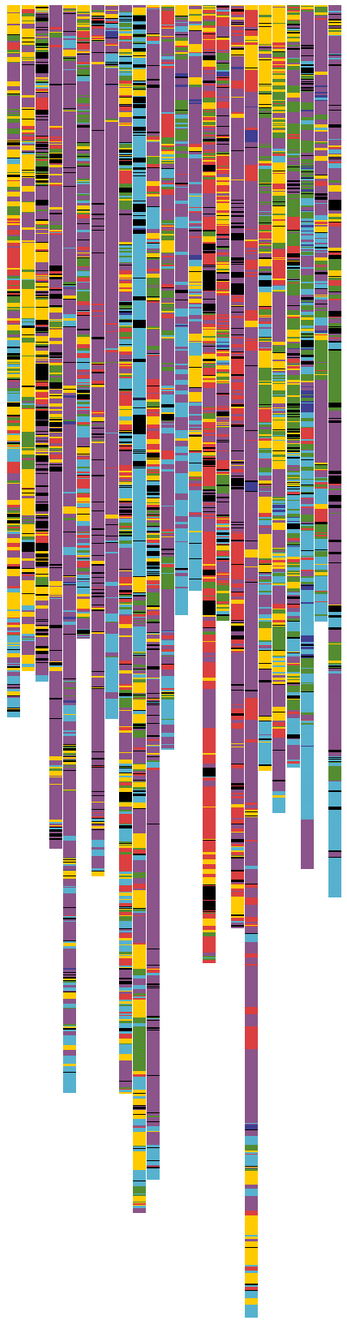
Drop off - A friend has asked to borrow something and you have agreed to drop it off with them. They said they would be waiting for you on the street corner.



Wander to the bus - You have finished all you need to do in the city centre and are on the way to catch the bus. You don't know when it will leave but you are not in any hurry as you know they depart regularly.

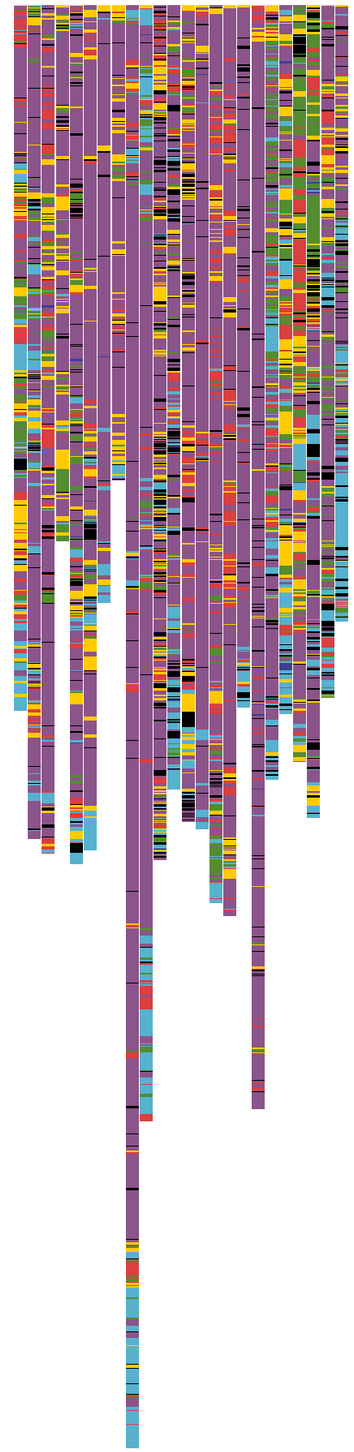


Break-time stroll - You are dawdling on your hour break and have decided to take a stroll to get some fresh air.



Coffee with a friend - You are on your way to meet a friend, who is always late, for coffee and cannot remember if you said to meet in a certain place.

Window-shopping - You have kindly been given some money for your birthday and are out window-shopping to find something to spend it on.



Street DNA: key

- Ground.
- Sky.
- Urban Street Edge.
- People.
- Objects (street furniture, moving and static vehicles).
- Adjacent realms (visual engagement outside the inhabited street).
- Data loss.

Findings discussion

The Street DNAs provide an overview of all the gaze data that was captured during the current investigation. They therefore contextualise how visual engagement with the urban street edges (shown in purple) fitted into wider visual engagement with the totality of the streets and their assemblage of components.

Prior to an examination of the influence of social tasks and spatial factors it is beneficial to establish how participant individuality might have impacted street edge visual engagement. The dispersal of purple across Spread 1 – *who* we are – highlights subtly that some study participants visually engaged with street edges more than others. Persons 8, 19, 20 and 21 gazed less upon street edges and more at the ground (yellow); Persons 6, 7, 17 and 18 looked marginally more at street edges rather than other street components. A definitive comprehension of how visual engagement with urban street edges varied depending on peoples' differences is, however, challenging to interpret through viewing these Street DNA. This is because of the rich complexity of the gaze data and how a combination of wider socio-spatial factors might have had a greater impact upon gaze distribution rather than participant individuality. Whilst this is the case, it is noticeable that overall the composition of no two people groupings are same. We all differ to some extent in terms of how we distribute our visual engagement within the urban street. Such an insight starts to provide the beginnings of an opportunity to read into what Tuan (1979) forwarded as *peoples' idiosyncrasies* influencing how they engage the world. Here, the DNAs capture and articulate individualised street engagement, from a direct perspective that might have otherwise been difficult to communicate especially verbally. They also highlight the way that analyses need to be considerate of peoples' individuality, as it may impact what they look at within streets and thus how they visually engage urban street edges in response to socio-spatial factors.

Within Spread 2 – *where* we are – correlations in the distribution of purple across and within the street groupings are a little more noticeable and easier to comprehend. Some groups have consistently greater amounts of purple within them – Streets 4 and 9; some have less – Streets 10 and 11; some are consistent in terms of having a common distribution of multiple colours across their DNA grouping – Streets 6, 10, 11 and 12; others are more variable across their grouping – Streets 1, 2, 3 and 5. Overall, what is again noticeable is that no two groupings are the same, even though some are similar. Such a reading infers at an initial level that people visually engage with streets and their edges differently depending on the environment around them. Significantly, within the context of the current investigation, some streets might have had more engaging edges than others, for example in the case of Streets 4 and 9. There is still, however, variation seen within groupings – Streets 1, 2, 3 and 5. The individuality of people and the nuances of the task they are engaged with might, therefore, have influenced engagement with these environments more than the street settings and their edges.

Spread 3 – *what* we are doing – highlights the greatest level of observable trends within and across the DNA groupings. There is a strong emphasis upon the distribution of purple running from less on the left to more on the right, more yellow (ground engagement) on the left than right and also DNA length increases from left to right. This is most probably due to optional tasks, on the right-hand page and notably window-shopping, encouraging greater levels of visual edge engagement than necessary tasks, show on the left-hand page. Also, optional tasks have less time restriction associated with them and thus the DNAs are longer in length (representing time). These DNA groupings back-up ideas explored by Gehl (2010), empirically mapping how the tasks people engage with influence urban experience. This is, however, from a nuanced first-hand perspective, adding new direct experiential insight to his observational understandings. There are however, still subtle variations within each task grouping. This suggests that within some situations spatial considerations and participant individuality might have had a greater impact than the task at hand on street edge visual engagement.

Through visually interpreting and contrasting the spreads of grouped Street DNAs, it is noticeable that insight into how urban streets and their edges are gazed upon is not gained until social and spatial factors are considered. An understanding of edge engagement that does consider people, where they are and what they are doing is therefore limited. Each has the potential to impact the extent to which urban street edges are visually engaged. Significantly, this starts to highlight that an interconnected socio-spatial consideration is needed, evidencing the notion that these realms are engaged as socio-spatial assemblages. This is a key foundation of the CEF. A comprehensive and empirical understanding of such engagement is however challenging to establish through solely these visualisations. Whilst this is the case, they provide an engaging and expansive overview that does not compress or distil the richness and variable complexity of urban street and street edge visual engagement. Part 1.2 aims to build upon this and add evidence towards a strengthened experientially manifested socio-spatial understanding.

Part 1.2 – Are there differences in the amount of visual engagement with urban street edges between i) street inhabitants undertaking different social tasks; and ii) different urban streets?

Method

The effect of task and street upon the percentage of visual engagement on the urban street edges was determined by fitting linear mixed-effects models to the data in R ('lme4' package, Bates et al., 2014). The fixed effects were 'Task' (optional or necessary) and 'Street' (street number 1-12). 'Participant' (participant number 1-24) was entered as a random effect, which allowed different intercepts for each participant (i.e. a differing baseline level of engagement for each participant) and differences in their response to street and task. This random effect was also included to account for random inter-participant variation in gaze behaviour and for differences in how they interact with street edges depending upon socio-spatial factors. P-values were simulated by comparing this model to a grand mean model using a parametric bootstrapping

method ('pbkrtest' package; Halekoh and Højsgaard, 2014) with 10,000 simulated generations. The goodness of fit for all mixed effect models was assessed using the 'R.squaredGLMM' function ('MuMin' package; Bartoń, 2018) and marginal R2 values (those associated with the fixed effects only) were high (Task: R2 = 0.49, Street: R2 = 0.52).

Results

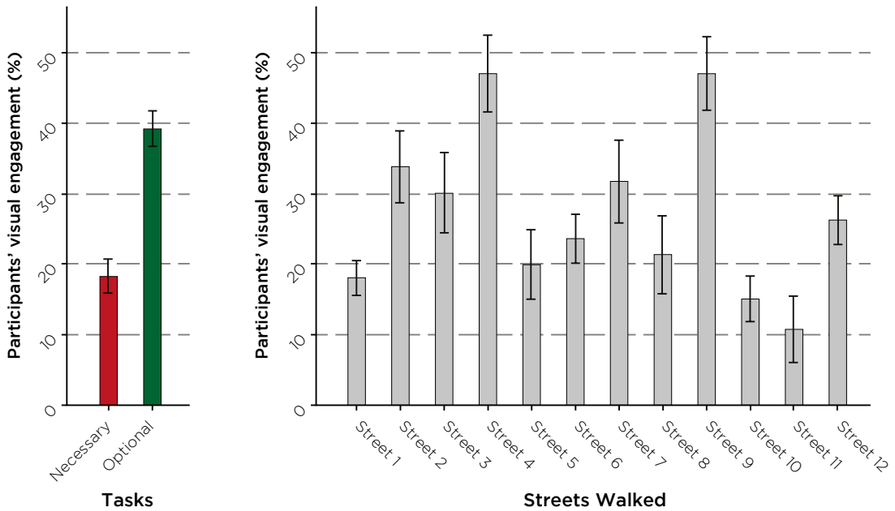


Figure 35.1 and 35.2 – The influence of task and street on the percentage of participants' visual engagement with urban street edges. Error bars represent 1 standard error.

The type of task being undertaken (optional vs. necessary) had a highly significant influence upon the time participants spent visually engaging with urban street edges, (Likelihood ratio test (LRT) = 35.24, $p < 0.001$), with participants engaging for 20.9% longer when on an optional task than when on a necessary task (39.2% vs. 18.3%; see Figure 35.1). The social processes, embedded within the two everyday task groups, were therefore important in determining urban street edge visual engagement.

The street inhabited, with variations in their street edges, had a highly significant effect upon the time participants spent visually engaging with street edges (LRT = 63.96, $p < 0.001$), with the percentage of time varying by 36.3% (10.8% vs. 47.1%) across the different streets (Figure 35.2). The material and spatial dimensions of the urban street settings being walked and their street edges were therefore important in determining visual engagement with the street edges.

Findings discussion

The amount of time that participants spent visually engaging with urban street edges was significantly influenced by the social task they undertook (Figure 35.1), with optional tasks promoting greater levels of visual engagement with street edges than necessary tasks. This result is consistent with findings from previous eye-tracking studies that found differing tasks significantly influence visual attention distribution (Rothkopf et al., 2007; Holmqvist et al.; 2011; Duchowski, 2017). However, whilst previous investigations tend to consider the effect of task when observing images and video (Yarbus, 1967; Rothkopf et al., 2007) or during indoor mobile situations (Land et al., 1999), the current investigation provides greater insight into the influence of differing tasks within dynamic outdoor contexts.

Understanding the experiential impact of different everyday social tasks upon visual engagement with urban environments has previously been challenging to capture and quantify. The current investigation achieves this and in doing so adds insight to the work of Gehl (2010), who has argued that everyday actions should be considered when seeking to comprehend how people behave and experience urban settings. The current investigation used Gehl's (2010) activity groupings and thus aligns directly with this work spanning a consideration of optional / necessary activities. The findings also add to insights gained by Metha (2008; 2013), during which the essential need for attention towards what people do within streets is encouraged in order to understand how they operate socially. The insights obtained similarly complement Pafka's (2018) examination of streetlife micro-rhythms and functional mixes broadly categorised by live, work and visit, supplementing this work with greater direct insight from a street inhabitant's perspective.

The differing streets the study participants inhabited, which all had spatially and materially different edges, significantly influenced the amount of time they spent visually engaging the urban street edges (Figure 35.2). Capturing the influence of spatial and material differences on street edge visual engagement provides quantification to existing theory that proposes the experiential significance of varying street edge characteristics (Bobic, 2004; Gehl et al., 2006; Gehl, 2010; Glaser et al., 2012). Part 2 of this current chapter builds upon this insight whilst examining spatial considerations in greater detail.

Overall, individually both everyday social tasks and spatial characteristics impact the amount of time with which people visually engage with urban street edges. The empirical and direct insights gained during the current investigation, therefore provides opportunity to further consider these realms are experientially socio-spatial. Such an insight builds on the ideas of Thwaites et al. (2013); Dovey & Wood (2015); and Simpson (2018) who have previously described urban edges as socio-spatially manifested. Significantly, these findings add systematic evidence to concepts and ideas developed in the conceptual edge framework. Within this was detailed how engagement with urban street edge assemblages is influenced by both the variable edges of differing street settings as well as the social activity of the street inhabitant.

Part 1.3 – Are the edges of streets that are visually engaged to a greater extent whilst undertaking optional tasks also visually engaged to a greater extent whilst undertaking necessary tasks?

Method

To answer this question, the correlation between average percentage of visual engagement on street edges under optional and necessary tasks was established using Pearson's product-moment correlation in R.

Results

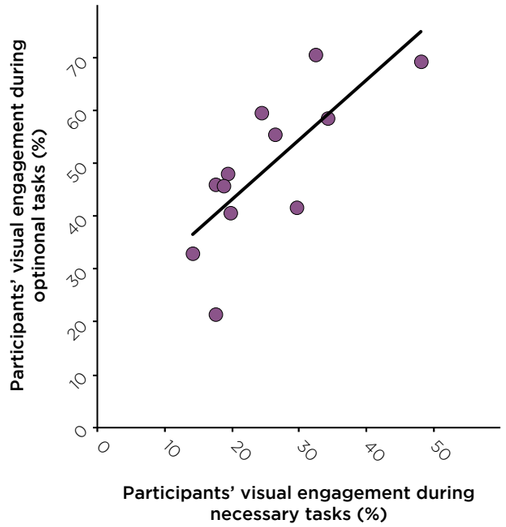


Figure 36 – The correlation between the percentage of participants' visual engagement with urban street edges during optional and necessary tasks (r = 0.69). Each point is the average data for one street.

The output showed that there is a significant positive correlation between the percentage of visual engagement with street edges under optional and necessary tasks (r = 0.69, t = 3.04, d.f. = 10, p = 0.012).

Findings Discussion

Street edges that are visually engaged to a greater extent whilst undertaking optional tasks were also visually engaged to a greater extent whilst undertaking necessary tasks (Figure 36). This finding is important as it highlights how the edges of some streets were visually engaged more than others across the differing tasks that study participants carried out. Significantly, it also begins to emphasise the experiential impact of certain physical edges characteristics whilst remaining reflective of the differing things people do within streets. In turn, such a finding justifies the pursuit of ways in which street edges could be manipulated for the experiential benefit of street inhabitants. This is the overarching aim of this overall investigation.

Part 1 – Findings Summary

Insights gained through the graphical visualisation of gaze data and quantitative analysis of the same data highlight how peoples' everyday social actions as well as spatial and material factors in combination impact the extent to which people visually engage with urban street edges. These findings verify the Part 1 hypotheses and add weight to an experiential consideration of urban street edges are socio-spatial assemblages. However, the findings also show that certain street edges are visually engaged to a greater extent regardless of the social tasks being undertaken by street inhabitants. Part 2 builds upon this insight whilst focusing to a greater extent on spatial and material edge characteristics and how they impact visual engagement with urban street edges.

Part 2: Urban street edges as nested multi-scalar and multi-directional assemblages with experientially significant segments

Hypothesis – Visual engagement will be focused upon the ground floor of urban street edges – its segments – regardless of social task. It will also vary along the length of a street edge, especially in response its ground floor segments, highlighting variable points of experiential intensity and thus shifts in the edges directional / locational emphasis.

Part 2.1 (Visualisation) – Where is visual engagement distributed on urban street edges?

Method

An explanation of how the three-dimensional data mappings were produced was undertaken within the research investigation section (Chapter 6, Part 3). This technique was used to explore six of the twelve study streets. Gaze data for all the twelve streets were not mapped due to time constraints, with the mappings taking a significant amount of time to produce. A street selection was made through using the findings from Part 1.2 of the current chapter. The streets were ranked based upon the average percentage of participant's visual engagement with their street edges, taken from the linear mixed-effects modelling. Two streets from the top of this ranking, two from the bottom and two from the middle were selected and investigated through the mapping processes developed, see Figure 37 for selection. This was done in order to gain an understanding of a broad range of streets that were visually engaged by the study participants.

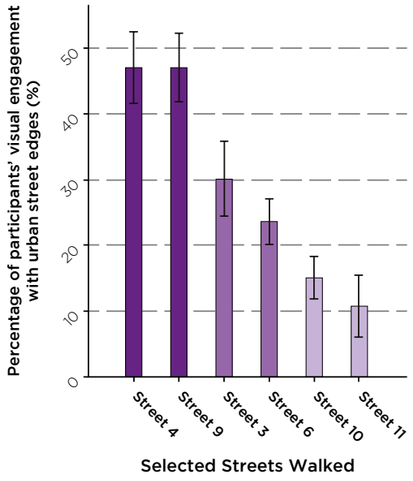


Figure 37 – Streets and edges selected for three-dimensional gaze mapping

Each of the streets was visualised in two ways, both of which are formatted in plan and elevation (both left-hand side and right-hand side edges of the streets). The first mappings take in to consideration the social tasks undertaken by the participants, again grouped by optional (in green) and necessary (in red). These are then combined in a second mapping that visualises overall visual engagement with the urban street edges. During this, the mappings are converted into a heat-mapping, using a gradient overlay in Adobe Photoshop. Heat-mapping of eye-tracking data is a comment analytical technique and provides qualitative insight into where gaze was focused upon a stimulus (Holmqvist et al., 2011).

Results

The three-dimensional gaze mappings are presented on the following page spreads. Firstly, the streets which were not sided (pedestrian streets) are presented, then the sided streets were the edges were separated by pedestrian and vehicular thoroughfares. The mappings are not scaled.

Spread 1 – Street 9 (not sided)
Figure 38.1 – Street 9 three-dimensional gaze mapping by task group
Figure 38.2 – Street 9 three-dimensional gaze mapping combined heatmap

Spread 2 – Street 11 (not sided)
Figure 39.1 – Street 11 three-dimensional gaze mapping by task group
Figure 39.2 – Street 11 three-dimensional gaze mapping combined heatmap

Spread 3 – Street 3 (sided)
Figure 40.1 – Street 3 three-dimensional gaze mapping by task group

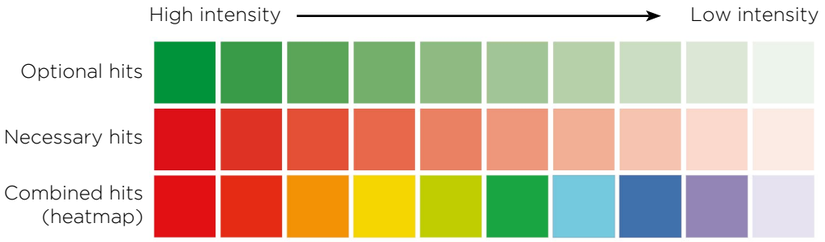
Figure 40.2 – Street 3 three-dimensional gaze mapping combined heatmap

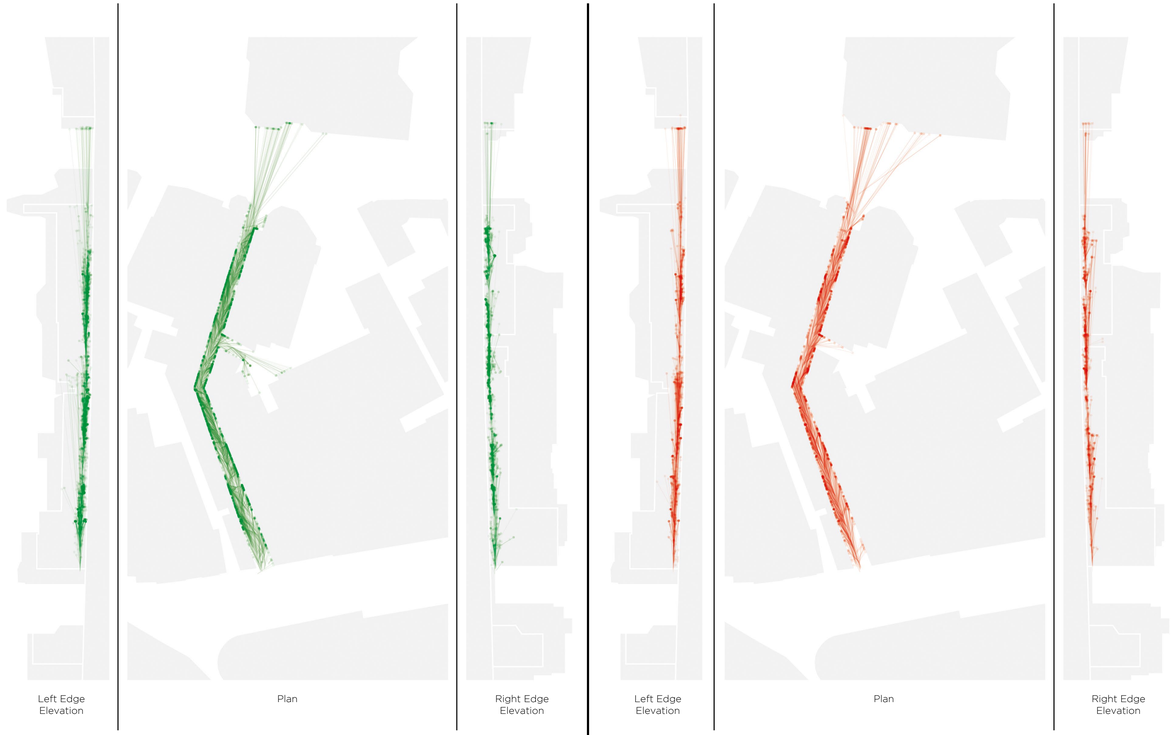
Spread 4 – Street 4 (sided)
Figure 41.1 – Street 4 three-dimensional gaze mapping by task group
Figure 41.2 – Street 4 three-dimensional gaze mapping combined heatmap

Spread 5 – Street 6 (sided)
Figure 42.1 – Street 6 three-dimensional gaze mapping by task group
Figure 42.2 – Street 6 three-dimensional gaze mapping combined heatmap

Spread 6 – Street 10 (sided)
Figure 43.1 – Street 10 three-dimensional gaze mapping by task group
Figure 43.2 – Street 10 three-dimensional gaze mapping combined heatmap

Key





Optional Task

Necessary Tasks

Figure 38.1 - Street 9 three-dimensional gaze mapping by task group (not sided)

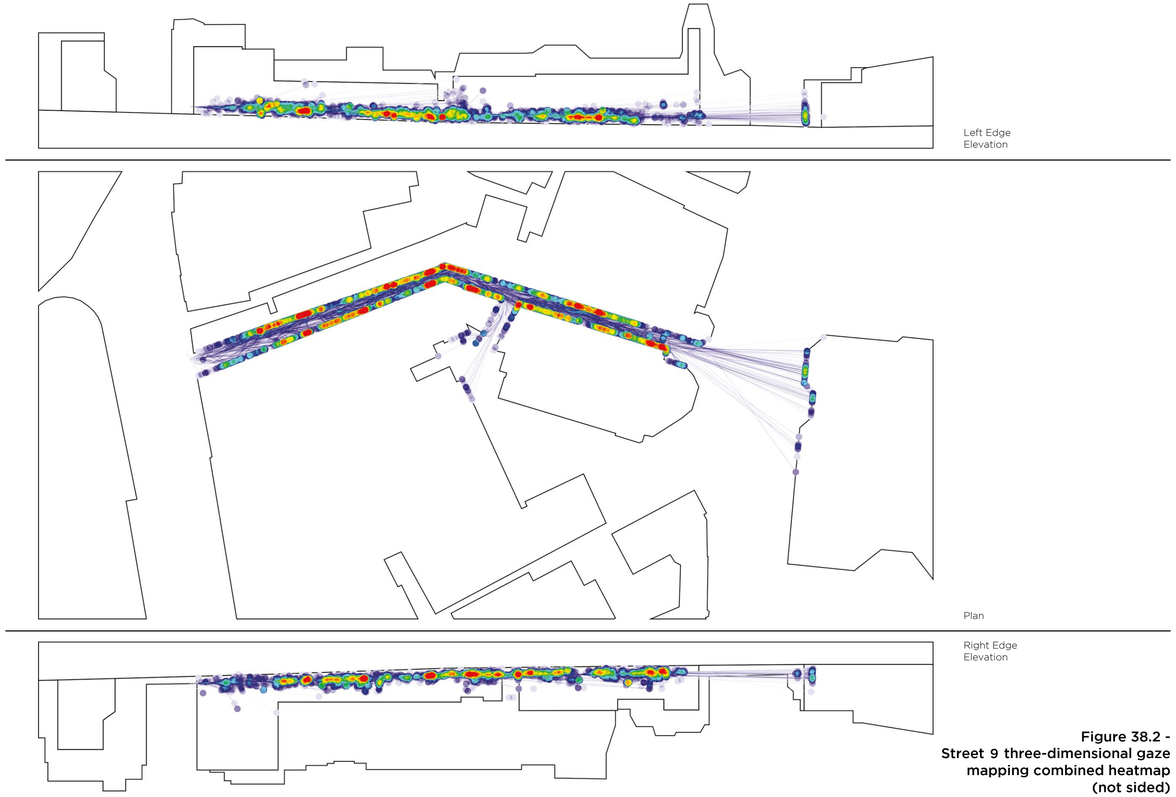
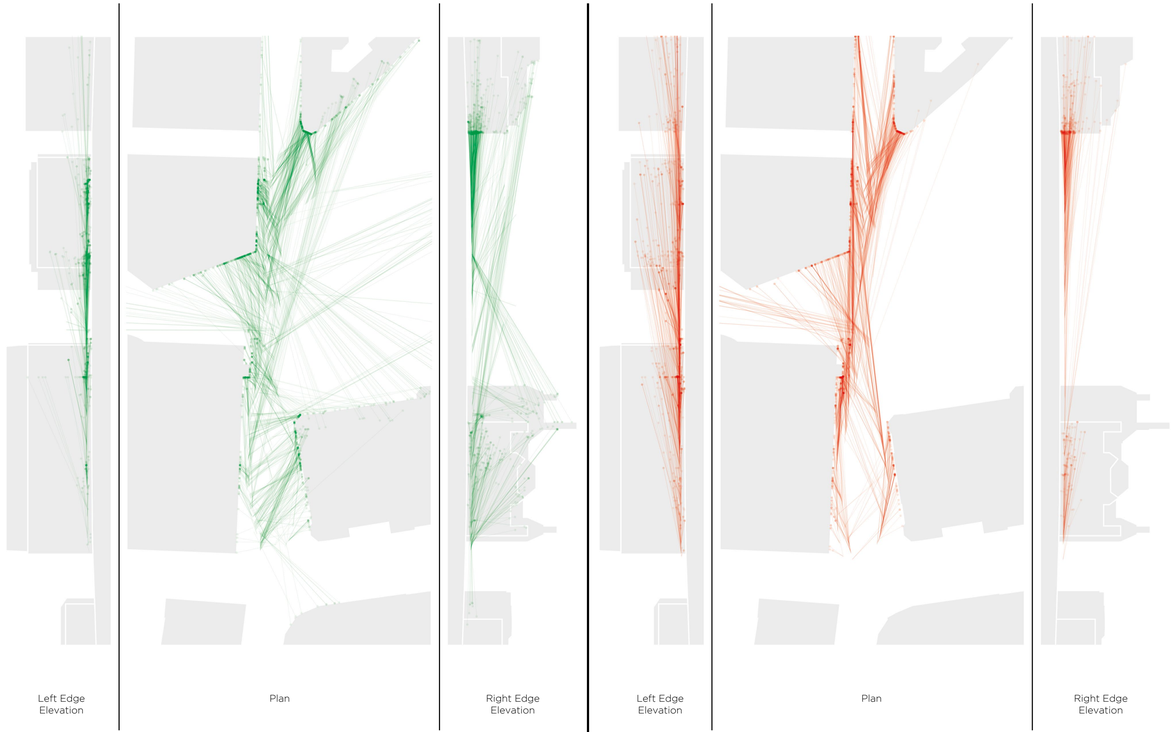


Figure 38.2 - Street 9 three-dimensional gaze mapping combined heatmap (not sided)



Optional Task

Necessary Tasks

Figure 39.1 - Street 11 three-dimensional gaze mapping by task group (not sided)

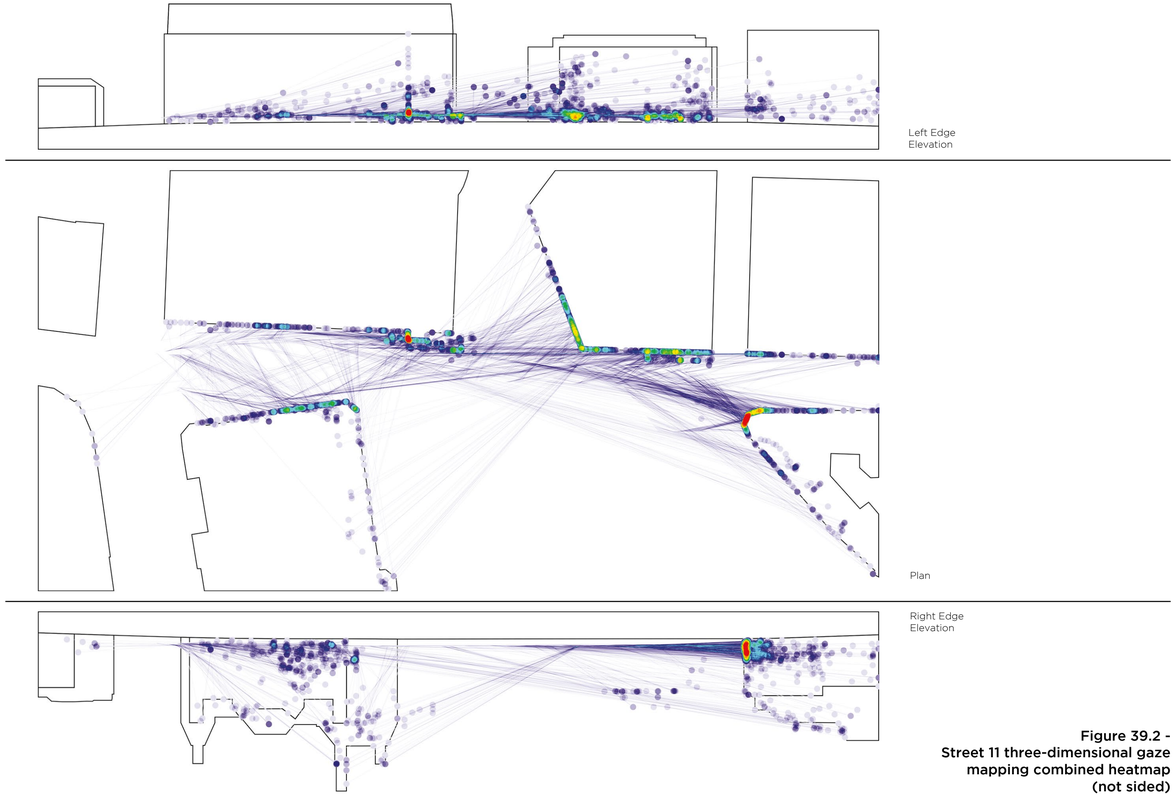


Figure 39.2 - Street 11 three-dimensional gaze mapping combined heatmap (not sided)

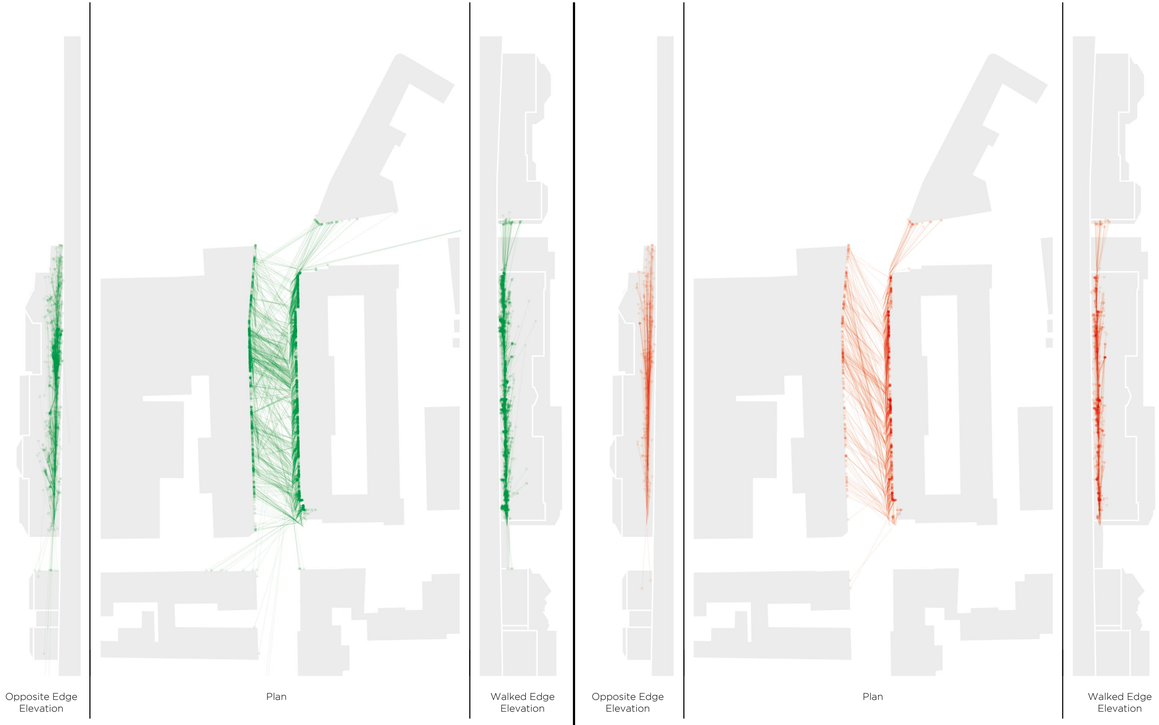


Figure 40.1 - Street 4 three-dimensional gaze mapping by task group (sided)

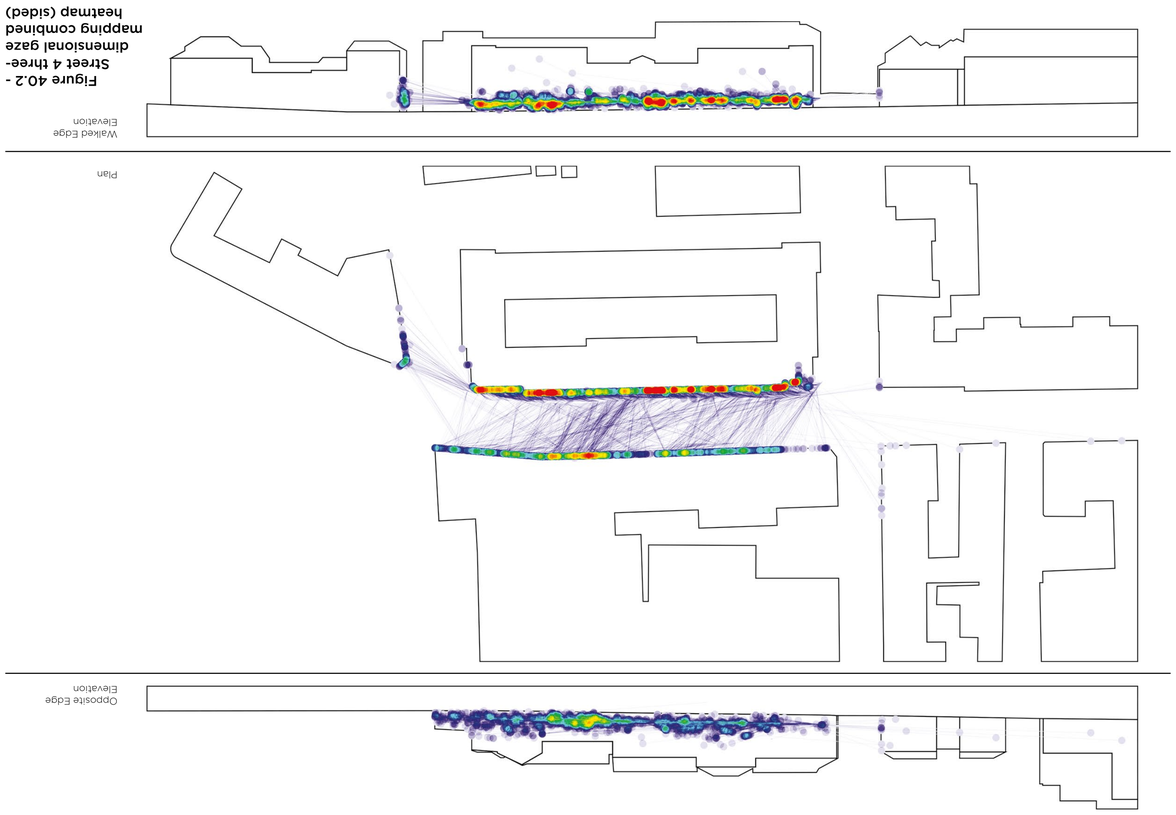
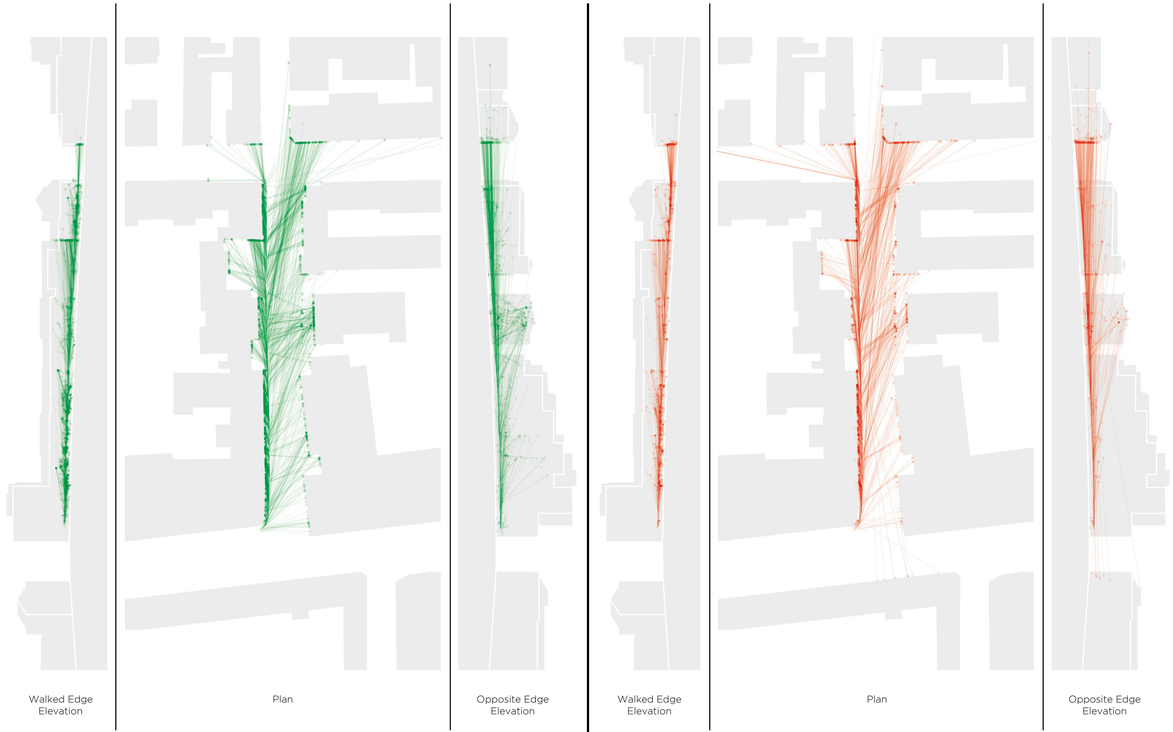


Figure 40.2 - Street 4 three-dimensional gaze mapping combined heatmap (sided)



Optional Task

Necessary Tasks

Figure 41.1 - Street 3 three-dimensional gaze mapping by task group (sided)

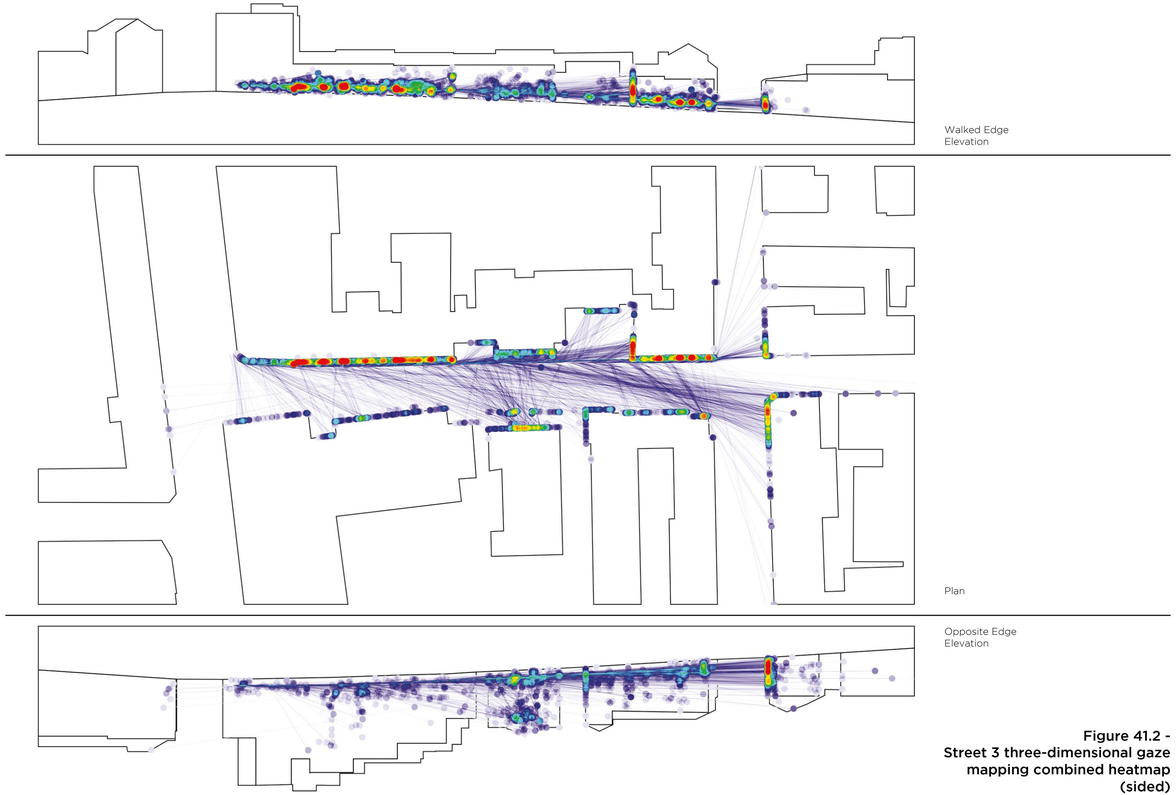
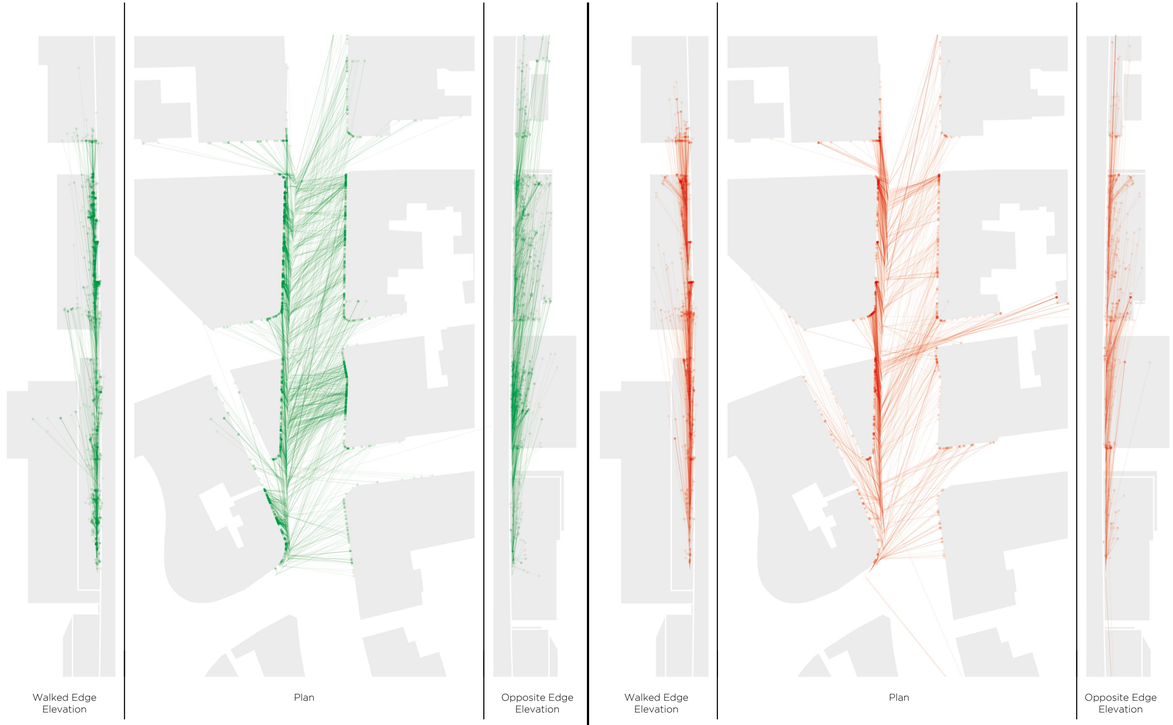


Figure 41.2 - Street 3 three-dimensional gaze mapping combined heatmap (sided)



Optional Task

Necessary Tasks

Figure 42.1 - Street 6 three-dimensional gaze mapping by task group (sided)

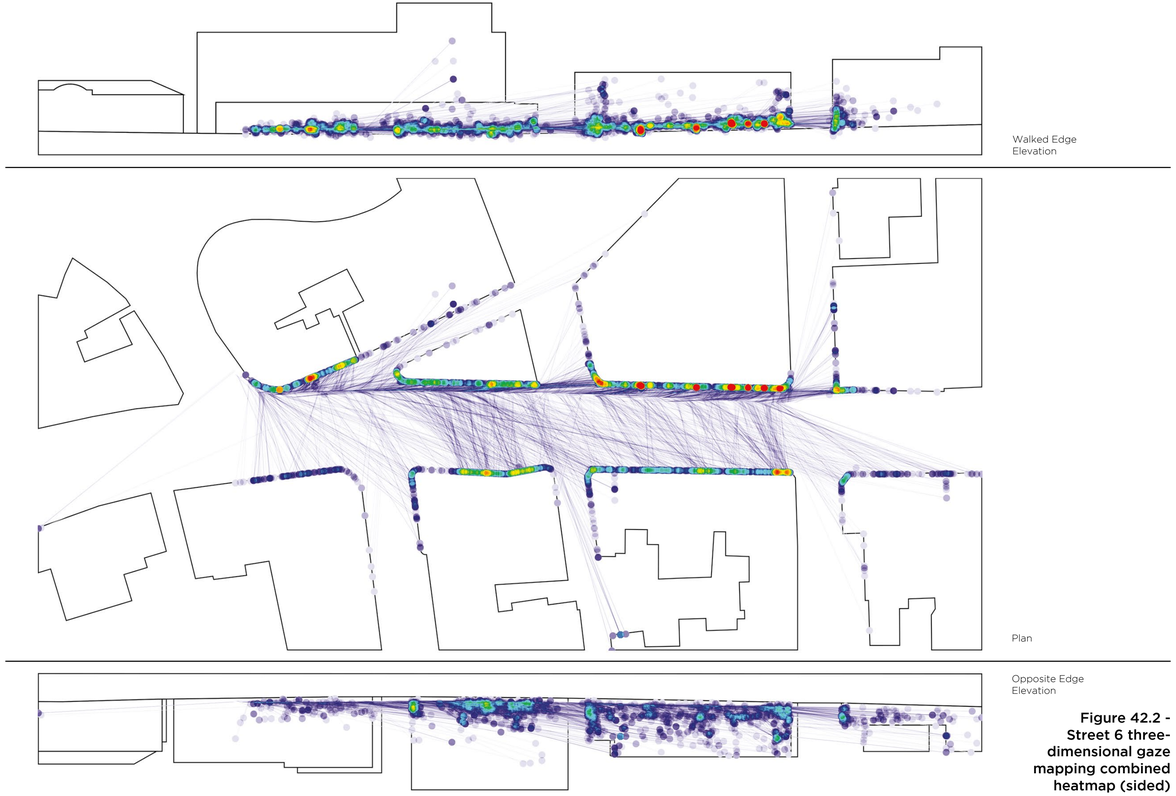
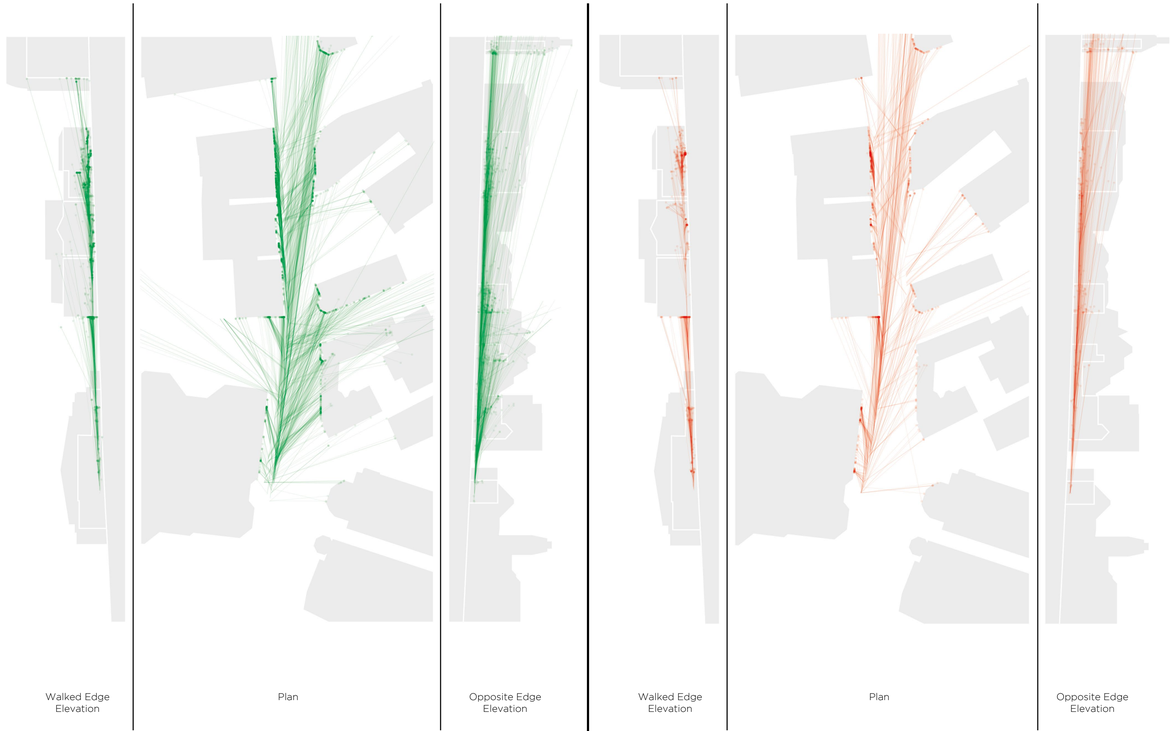


Figure 42.2 - Street 6 three-dimensional gaze mapping combined heatmap (sided)



Optional Task

Necessary Tasks

Figure 43.1 - Street 10 three-dimensional gaze mapping by task group (sided)

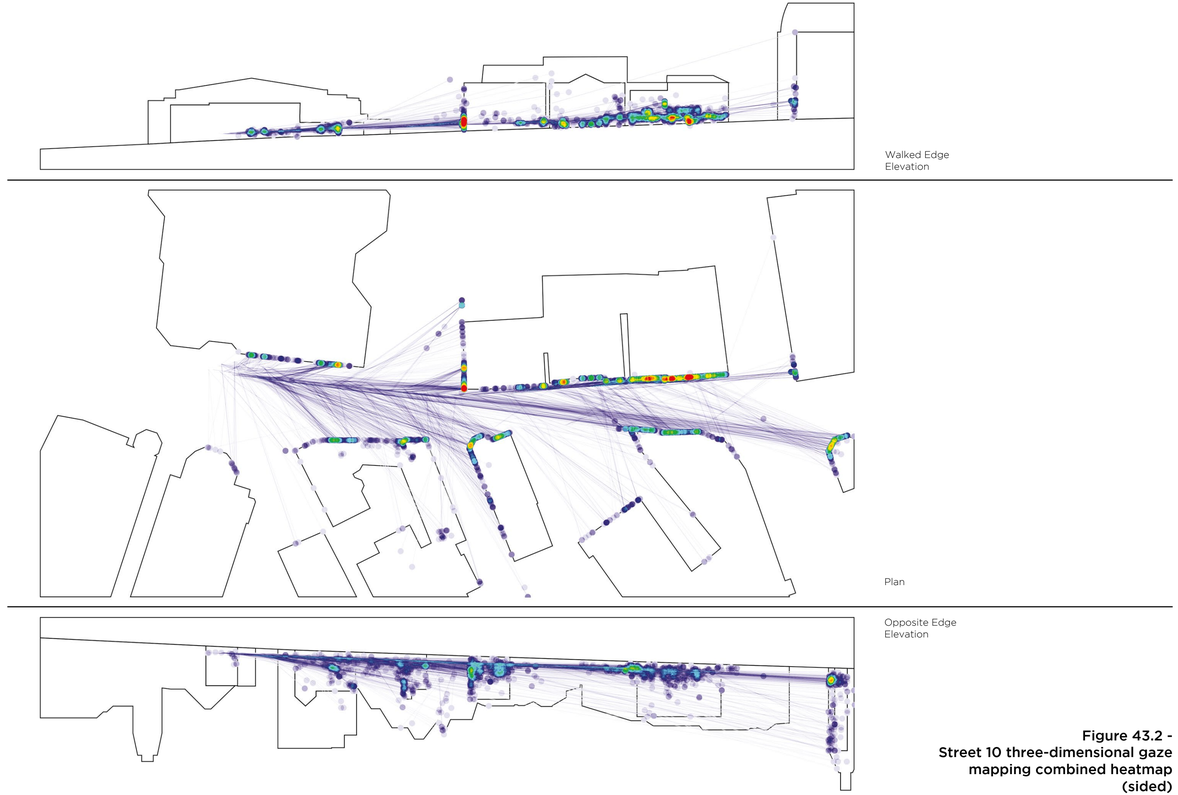


Figure 43.2 - Street 10 three-dimensional gaze mapping combined heatmap (sided)

Findings discussion

The three-dimensional gaze mappings highlight how participant visual engagement was focused most intensely on the lower portions of the urban street edges – their ground floors. This is detailed across both the mappings separated by task groups (optional and necessary) and combined heatmaps. Through this, the visuals begin to suggest the experiential significance of the plinth scale, along with the segments nested within these spaces. In doing so, these representations evidence the ideas of Gehl et al. (2006) and Glaser et al. (2012) who highlight the experiential significance of edge ground floors. Building upon this, the insights attained add considerable weight to the argument that urban street edges cannot be considered experientially as singular entities. There is the requirement for a more nuanced, scalar reading of their manifestation, as detailed previously within an edge context by Bobic (2004); Porta & Romice (2010); Glaser et al. (2012) and Feliciotti et al. (2016). These thinkers, in their own ways, provided the foundations for the multi-scalar assemblage ideas forwarded within the CEF and the hypothesis at start of the current section. The insights gained add new insight to multi-scalar street edge ideas. This is based upon the experiential understanding that visual engagement, when inhabiting a street, is not evenly distributed across the whole of its street edge, but it is focused upon certain scales nested with it – plinths and segments.

The mappings also provide insight into the directionality and variable intensity of participants' visual engagement urban street edges. This in turn offers opportunity to examine their experiential multi-directionality. The visualisations show how the gaze of street inhabitants (study participants) projected from where they were walking, or sometimes standing stationary, at an array of angles and across a range of distances. Often, rather than just projecting forwards in conjunction with the dominant linear spatial structure of these spaces, gaze was instead pulled and manipulated sideways. This is whilst engaging with different portions of the street edges at differing angles and for different durations of time (number of visual hits on the street edges).

Equipped with this insight, is the opportunity to examine in detail how visual engagement varies along a street edge's extent. A comprehension of this can be gained through viewing the combined heatmaps, which highlight points of experiential intensity (yellow, orange and red) and less visual engagement (blues and greens) along all of the street edges. Significantly, these variations are most noticeable when participants visually engaged with edge ground floors; the realms structured by the edge's plinths and importantly segments. Such experiential fluctuations begin to show how street edges comprise a mixture of ground floor spaces with potential experiential significance, manifesting locational *hereness*, as well as points of directional *thereness* (Cullen, 1971; Thwaites et al., 2013). This provides understanding into the way street edges are not often experientially manifested as singular linear forms. But, have a complex multi-directionality established through fluctuations in experiential intensity and as a result shifts in directional / locational emphasis (Thwaites et al., 2013). Obviously, this is only an initial insight. It is challenging to examine, at this abstracted level, how visual engagement is influenced by street edges in such a way

that evidences thinking about them as experientially multi-directional, especially without fully considering the physical characteristics of the edges engaged. However, the three-dimensional gaze mappings have provided significant insight into experientially manifested multi-directional edge thinking.

In addition to the points raised so far is the way that the three-dimensional mappings show how visual engagement with urban street edges varies between edges on different sides of a street. The visuals start to show how a predominant amount of gaze if focused upon the side of the street being walked, compared with the opposite side of the street. This is notably when the street is sided and segregated, for example by a vehicular thoroughfare. To the knowledge of the lead researcher this is a characteristic of street and edge engagement that has not been fully observed or documented before. It could, therefore, have profound impacts on how we understand streets and their edges to be experientially manifested. It could ultimately bring in to question the way in which the space between the edges, which is often the pedestrian and vehicular thoroughfare, is structured. This is based upon the understanding that certain street configurations might be restricting opportunities for beneficial street and edge experiences.

Across all the points raised is the opportunity to being to highlight the phenomenological significance of urban street edge ground floors and particularly their segments. The mappings show how a disproportionate amount of visual attention is focused upon the ground floor of street edges. Also, considerable experiential variation occurs along the length of edge ground floors, where segments are nested. Significantly, as forwarded within the CEF, such an insight potentially shifts the experiential emphasis away from buildings or plots as a whole, towards a focus upon their nested multi-scalar parts, notably the human-scaled segments and plinths that comprise edge ground floors. Part 2.3 will build upon this notion. Beyond this, the mappings themselves provide an intricate insight into street edge engagement that until now has been challenging to articulate in detail. However, the insights gained, notably in terms of multi-scalar and multi-directionality thinking, currently lack the required evidence to fully evaluate the ideas forwarded.

Part 2.2 – Are there differences in the amount of visual engagement on urban street edge quadrants (lower and upper floors on different sides of the street) between i) street inhabitants undertaking different social tasks; and ii) different urban streets?

Method

The three-dimensional mapped data from Part 2.1 was broken down by visual engagement with the upper and lower portions of the street edges. This based upon the presence of plinth scale or area where a plinth might be defined on some of the edges where no plinth scale existed, thus the area of the edges defining the *city at eye level* (Gehl, 2010; Glaser et al., 2012). The data was then split by the different sides of the streets – walked and opposite. The streets that were not sided, Streets 9 and 11, were considered separately and split by their left-hand and right-

hand sides. The participant's gaze that engaged with the edges was then categorised based upon these quadrants and the percentage of gaze to fall upon these areas calculated.

Statistical processes were also employed through fitting a linear mixed-effect model to the data. This was to investigate the effect of spatial (street) and social (task) dimensions upon the participant's visual engagement with the defined quadrants of the edges. The effect of task and street was determined by fitting linear mixed-effects models to the data ('lme4' package, Bates et al., 2014). The fixed effects were 'Task' (optional or necessary) and 'Street' (streets 3, 4, 6, 10; then 9 and 11). 'Participant' (participant number 1-24) was entered as a random effect, which allowed different intercepts for each participant (i.e. a differing baseline level of engagement for each participant). P-values were simulated through comparing this model to a grand mean model using a parametric bootstrapping method ("pbkrtest" package, Halekoh and Højsgaard 2014) with 10,000 simulated generations. The significance level was set at 0.05.

Results

Sided Streets (3, 4, 6, 10)

	Lower Floors		Upper Floors	
Street	**Walked Side**	**Opposite Side**	**Walked Side**	**Opposite Side**
3	70.5%	14.1%	8.2%	7.2%
4	69.1%	28.1%	0.8%	2.0%
6	65.6%	21.2%	5.2%	8.0%
10	62.9%	23.7%	5.1%	8.3%
Average	**67.0%**	**21.8%**	**4.8%**	**6.4%**
Combined	**88.8%**		**11.2%**	

Figure 44.1 – The distribution of visual engagement with urban street edge quadrants on sided streets

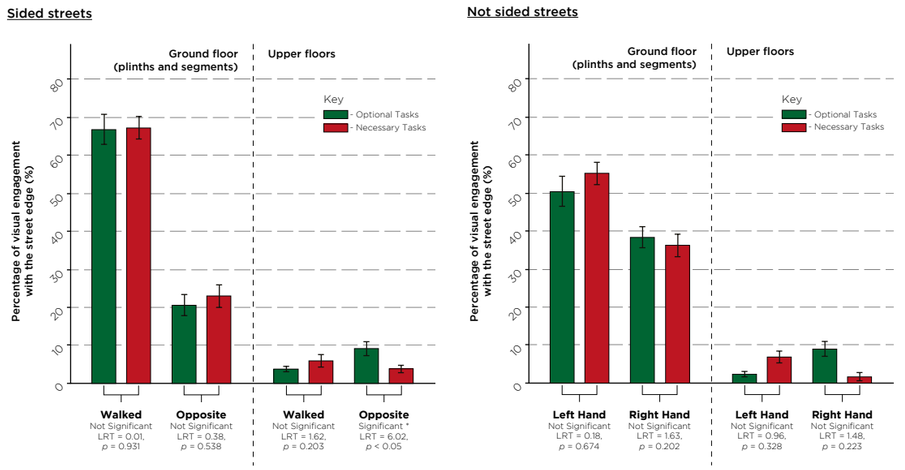
Sided Streets (9, 11)

	Lower Floors		Upper Floors	
Street	**Left Side**	**Right Side**	**Left Side**	**Right Side**
9	51.0%	45.5%	2.2%	1.2%
11	54.6%	29.1%	7.0%	9.4%
Average	**52.8%**	**37.3%**	**4.6%**	**5.3%**
Combined	**90.1%**		**9.9%**	

Figure 44.2 – The distribution of visual engagement with urban street edge quadrants on not sided streets

Figures 44.1 and 44.2 highlight a significant emphasis towards visual engagement with the ground floors of street edges. This is common across all the streets and is backed up the totals within the descriptive statistics, where 88.8% of gaze engaged with the ground floors of the edges when the streets had a walked side and 90.1% when there was no walked side.

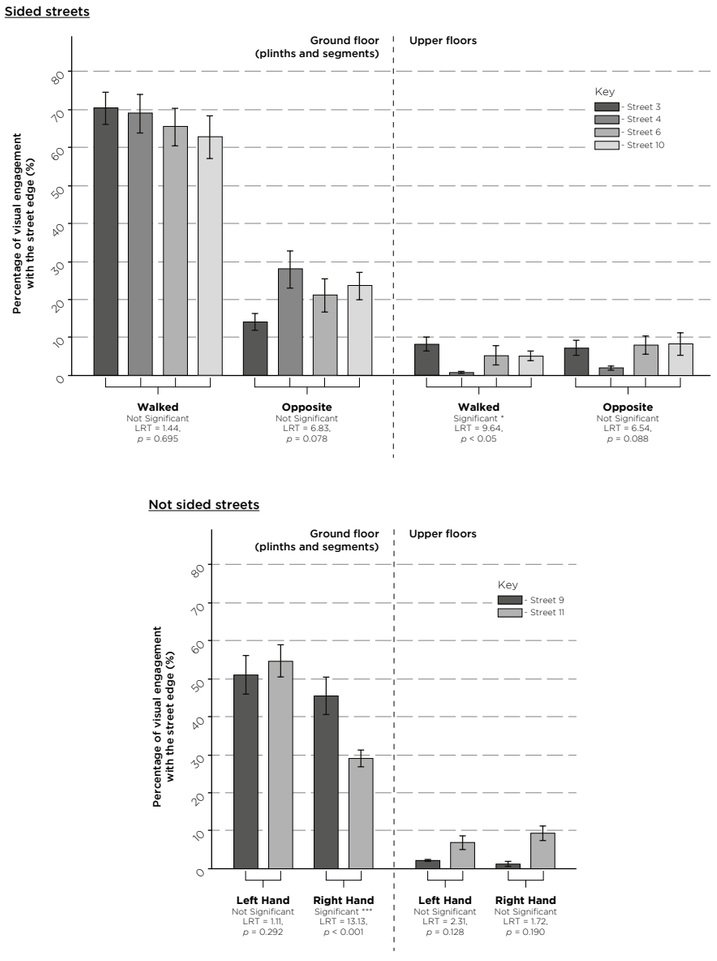
When there was a walked side considerably more gaze engaged with the edge on the side walked - 71.8%. When not sided the edges were visually engaged with more similarly, in terms of the percentage of gaze upon them – the left side with 54.2% and right side 45.8%.



Figures 45.1 and 45.2 – The influence of task on the percentage of participants' visual engagement with urban street edge quadrants. Error bars represent 1 standard error.

When walking a sided street (edges on walked and opposite sides separated by a vehicular thoroughfare) task had very limited influence upon the total amount of time that the street inhabitants (study participants) gazed upon the different edge quadrants. The only significant variation was when visually engaging with the edge area above the ground floor on the opposite side of the street (LRT = 6.02, $p < 0.05$). Here, participants engaged for 5.0% longer whilst on an optional task than when on a necessary task (8.9% vs. 3.9%). None of the other quadrants highlighted significantly different variation caused by the differing task groups, see Figure 45.1.

When walking a street that does not have defined sides (not sided, therefore, only left and right edges separated by an open pedestrian thoroughfare) task had no significant effect on the amount of time participants spent gazing within the different edge quadrants, see Figure 45.2.



Figures 46.1 and 46.2 – The influence of street on the percentage of participants' visual engagement with urban street edge quadrants. Error bars represent 1 standard error.

When walking a sided street the spatial setting inhabited had very limited influence upon the total amount of time that the participants visually engaged with the different edge quadrants. The only significant variation was the amount of gaze upon the area above the ground floor on the side of the street being walked (LRT = 9.64, $p < 0.05$), with percentage of time varying by 7.3% (0.8% vs. 8.2%), see Figure 46.1.

When walking a not sided street the street setting inhabited had a significant effect on the amount of time participants spent visually engaging with the ground floor on the right-hand side (LRT = 13.13, $p < 0.001$). Here, the percentage of time varied by 22.0% (29.0 vs. 51.0%). The street setting inhabited did not influence the percentage of time that the other street quadrants were gazed upon, see Figure 46.2.

Findings discussion

The results highlight how significantly more visual engagement was distributed upon the ground floor and thus the plinth and segment scales of the street edges. This is regardless of the task being carried out (optional or necessary) and the street being inhabited, even if it is sided (walked and opposite) or not (left side and right side). This finding begins to add robust empirical evidence to the insights gained during the three-dimensional mapping process and ultimately to the hypothesis that the ground floors of urban street edges, comprising plinths and segments. are experientially significant.

Rather than urban street edge visual engagement happening with the edge as a whole or even a building (or plot) as a distinct entity, visual edge experience is instead predominantly focused upon the phenomenologically influential plinths of buildings and the segments with them. As a result, street edges can be forwarded, with a degree of empirical conviction, as experientially defined by a series of plinths and segments occupying edge ground floors. Such thinking backs up claims made by Gehl (2010) and Glaser et al. (2012), providing their *city at eye level* ideas with empirical insight. Ultimately, these findings also further shift the emphasis away from urban street edges being considered as experientially singular entities, towards a nested multi-scalar consideration with aspects (scales) that establish an edge's morphological structure as well as realms (scales) that hold particular phenomenological significance at a human-scale – its plinths and segments nested with them.

The findings from Part 2.2 also emphasise how edge ground floors on the side of the street being walked, when on a sided street, are visually engaged significantly more than the ground floor on the opposite side of the street. In relation to this, the ground floor of street edges that were not sided are visually engaged more similarly, with a slight emphasis to the left-hand side. As explored previously, through the three-dimensional gaze mapping, this is a phenomenon of urban visual experience not shown or fully examined before. This finding could, therefore, have a number of implications for urban street and edge understandings. Firstly, it could impact the way a street is conceptually considered in relation it its edges. Here, the edges that define and characterise streets physically as well as experientially might require consideration as separate, but still as realms that contribute to the street as a whole. For example, Bobic (2004) conceptualises the street as *a place between the edges*; however, with this finding in mind it is potentially beneficial to think about the street as *a place between two experientially different edges*. The findings from the current investigation back this up by starting to highlight how the street edge and its plinths / segments that are locationally nearer to the street inhabitant (on the side being walked) are experientially engaged to a far greater extent, and thus potentially experientially defined the street overall, more than the edge on the opposite side.

This conceptualisation refocuses street edge experience towards a consideration of the influence of *proximity* (Hall, 1966; Gehl, 2010). Here, people engage with the street edge near to

them potentially because it is not only closer, and thus convenient, but also because the details manifested within it can be engaged in greater detail without distractions breaking the experience, for example cars and objects in the way. Through this is thus the need for a stronger understanding of the experiential influence of what sits between street edges. Obviously wide roadways with fast moving cars break experience and engagement across them, something observed by Jacobs (1961), Appleyard (1981) and more recently Gehl (2010). However, streets with just two vehicular lanes, pedestrian paths and sometimes parking at around a width of around 13-18 meters, for example Streets 3, 4, 6 and 10 of the current study, have now been shown to influence engagement with the edges on the opposite side of the street. Such an insight could have a significant impact upon how we consider urban streets especially in response to planning and urban design decision-making. Further work, building upon the insights gained from this current investigation, is however required to understand the nuances of such influences.

Part 2.3 – Where is visual engagement distributed across urban street edge ground floors in response to their segments?

Method

Data was extracted from the three-dimensional street mappings shown in Part 2.1, specifically, all gaze data where participants visually engaged with the ground floors of the urban street edges. The data for the edges of the same street remained grouped together, however, it was considered separately. This built upon the understandings that visual attention is distributed disproportionally upon different sides of the same streets (Part 2.2). The data for each edge ground floor was then portioned in relation to its segments. The segments were defined based upon notions established within the CEF, Part 3. Firstly, territorial ownership of ground floor edge realms was used to determine the differing segments. Following this, differentiation through material characteristics was used to aid in distinguishing them. This was used within situations where a single owner might have territorialised a substantial part of an edge's ground floor, however, visually different parts of it still existed. Here, physical features split this territorialised realm down into a number of distinct segments. Lastly, orientation was used to define some of the segments, although this did not occur often. This is due to some parts of the edges facing contrasting directions and thus experientially projecting in differing directions. Throughout there was also the consideration of the plots, and thus plinths, in which the segments were nested.

Once the segments were defined, an insight into the amount of visual engagement with each segment could be gained (number of visual attention hits). The mean number of visual attention hits upon each segment within each task group (optional and necessary) was subsequently calculated as well as a combined mean value across both task groups determined. Fitting linear mixed-effects models to the data for the separate edges ('lme4' package, Bates et al., 2014) provided opportunity to assess if variations in visual attention distribution across the differing segments was significant. 'Segment' (The differing segments within each edge) was the main

fixed effect with 'task' (optional and necessary) added as an additional fixed effect. 'Participant' (participant number) was entered as a random effect, which allowed different intercepts for each participant (i.e. a differing baseline level of engagement for each participant). P-values were simulated through comparing this model to a grand mean model using a parametric bootstrapping method ("pbkrtest" package, Halekoh and Højsgaard 2014) with 10,000 simulated generations. The significance level was set at 0.05.

Graphical representations were also created. Here, the segment hits data was arranged in relation to its segment positioning within each edge. With this, variations in experiential intensity running along each series of segments could be visualised (experiential extent lines using the mean number of hits across both task group). Subsequent visualisations were also produced displaying and comparing separate segment extent lines as well as overlaid visual based upon the walked side and opposite side for the sided streets (Streets 3, 4, 6 and 10) and left and right sides for the not sided streets (Street 9 and 11). The plot structure of each edge was also considered throughout and included within the visualisations.

Results

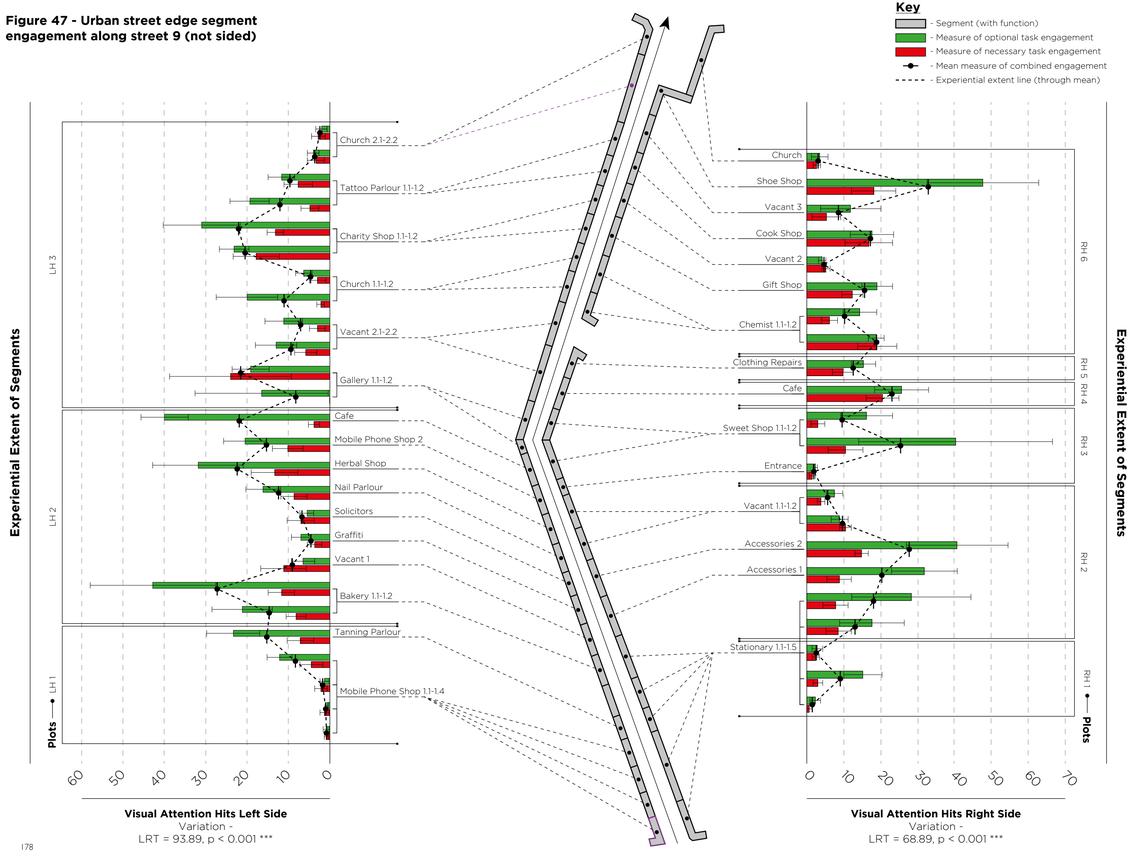
Over the following pages are presented -

Segment visual attention mapping

Experiential extent lines

Visual attention distribution across all of the segments within each urban street edge was highly significant. The statistical results highlighting this are presented alongside the data visualisations (Figures 47-52). Figures 53 and 54 subsequently show overlaid experiential extent lines and Figure 55 presents ranked extent lines by the most visually engaged edge to the least.

Figure 47 - Urban street edge segment engagement along street 9 (not sided)



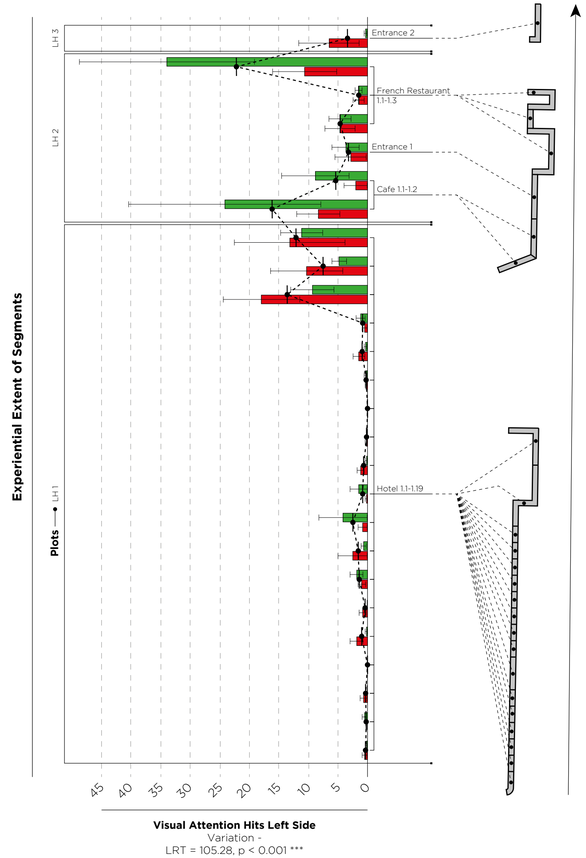


Figure 48 - Urban street edge segment engagement along street 11 (not sided)

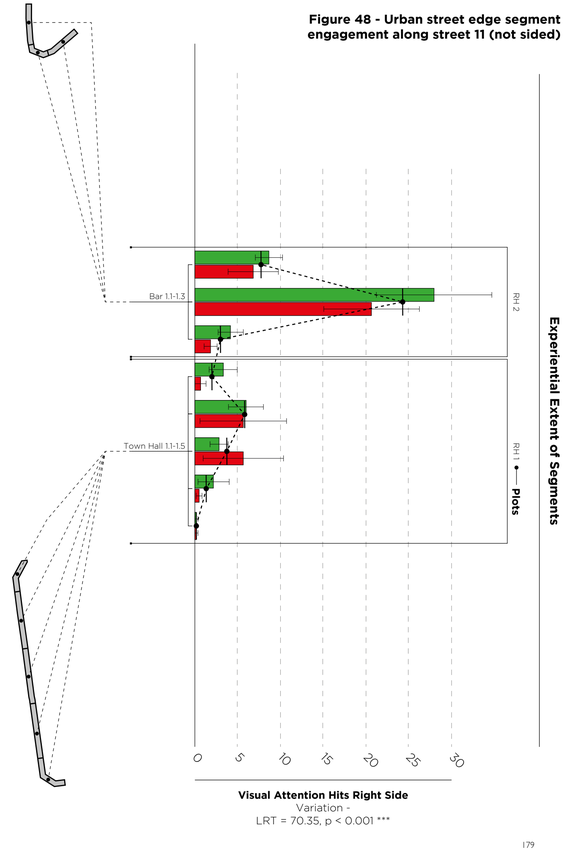


Figure 49 - Urban street edge segment engagement along street 3 (sided)

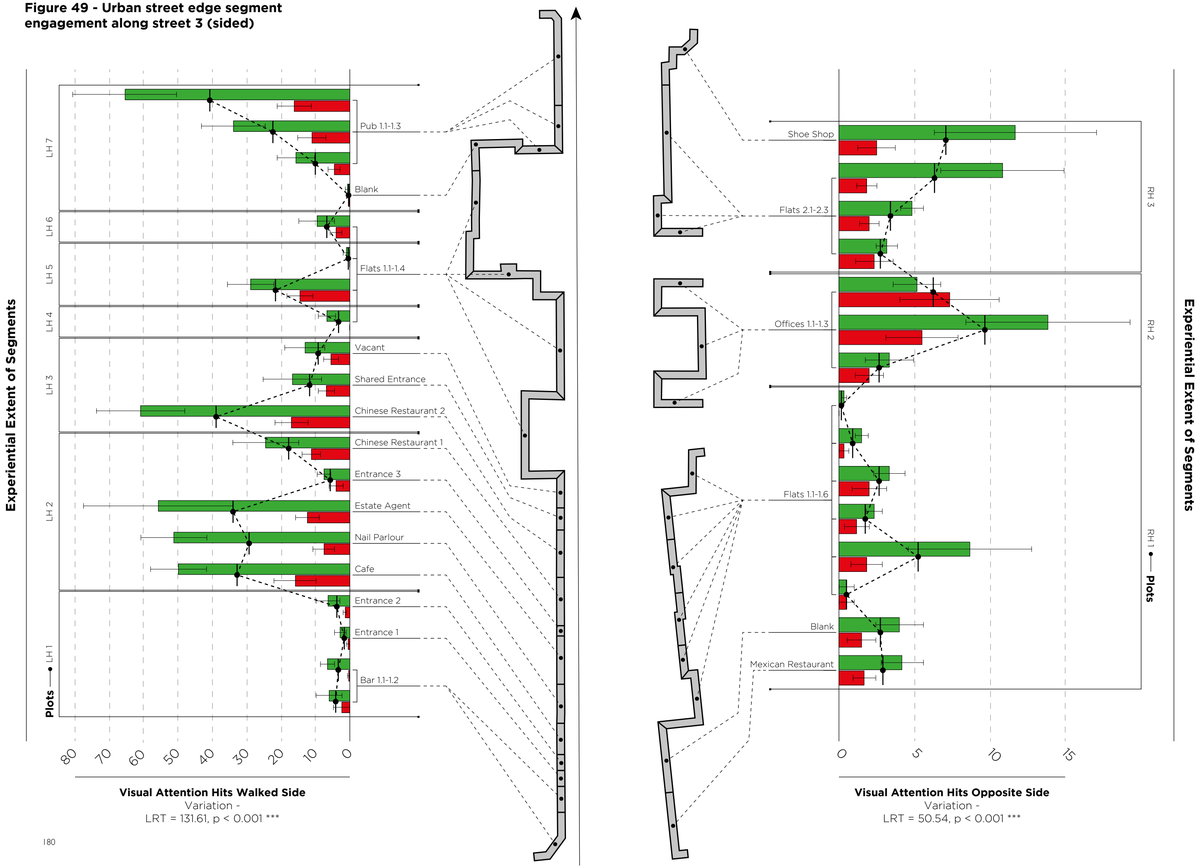


Figure 50 - Urban street edge segment engagement along street 4 (sided)

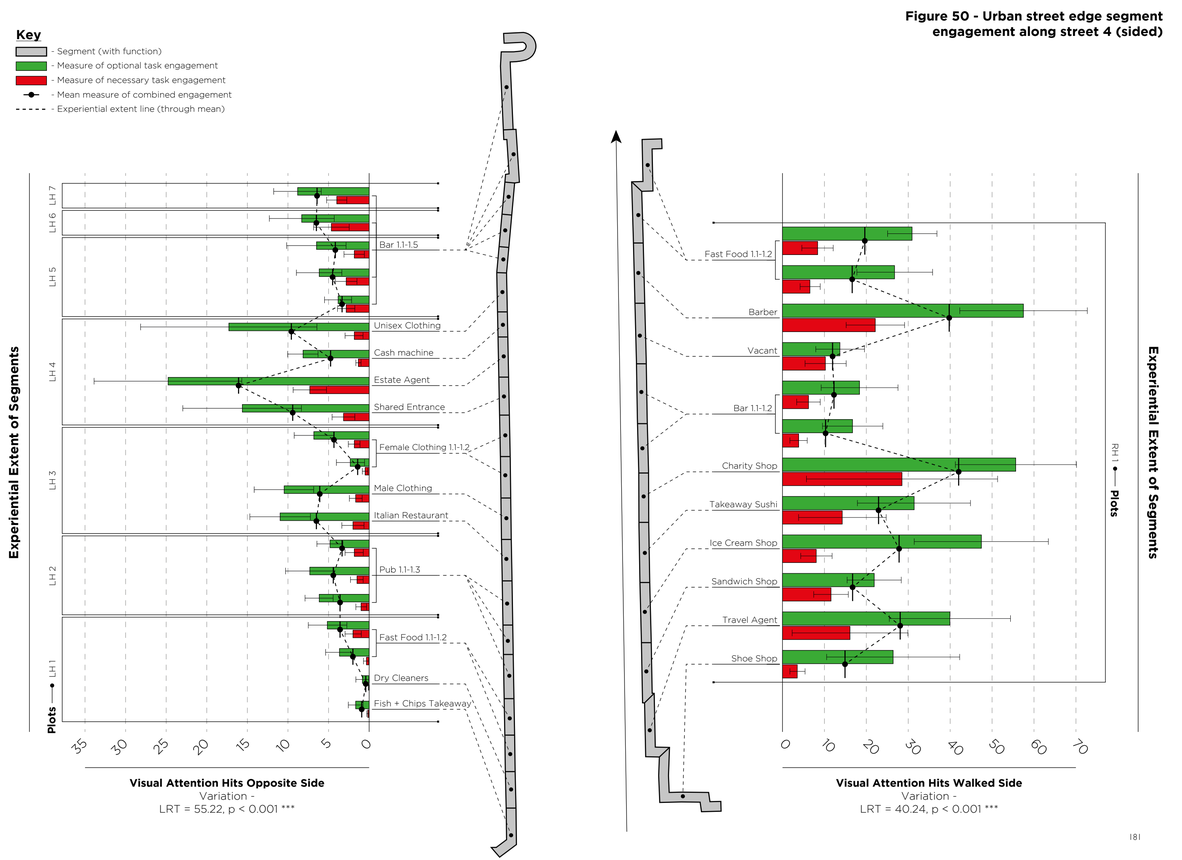
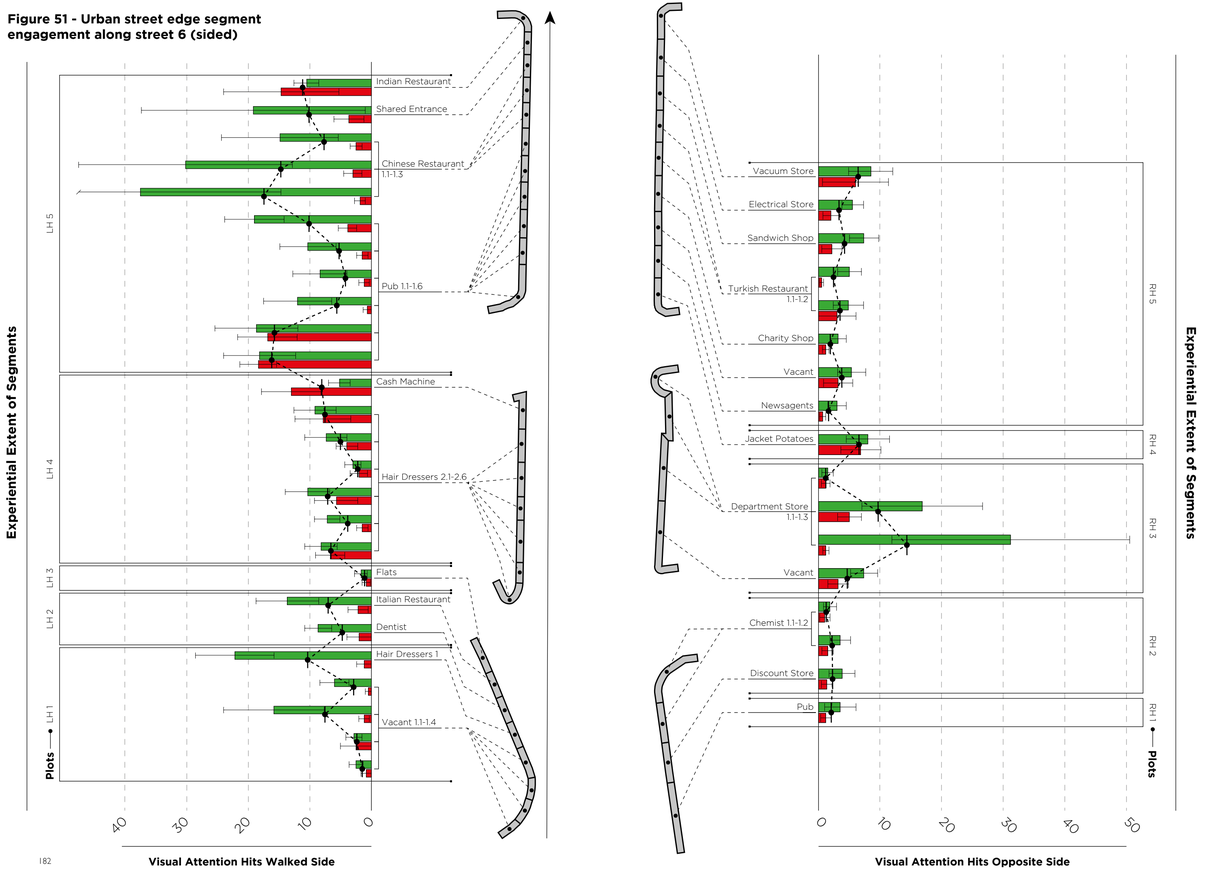


Figure 51 - Urban street edge segment engagement along street 6 (sided)



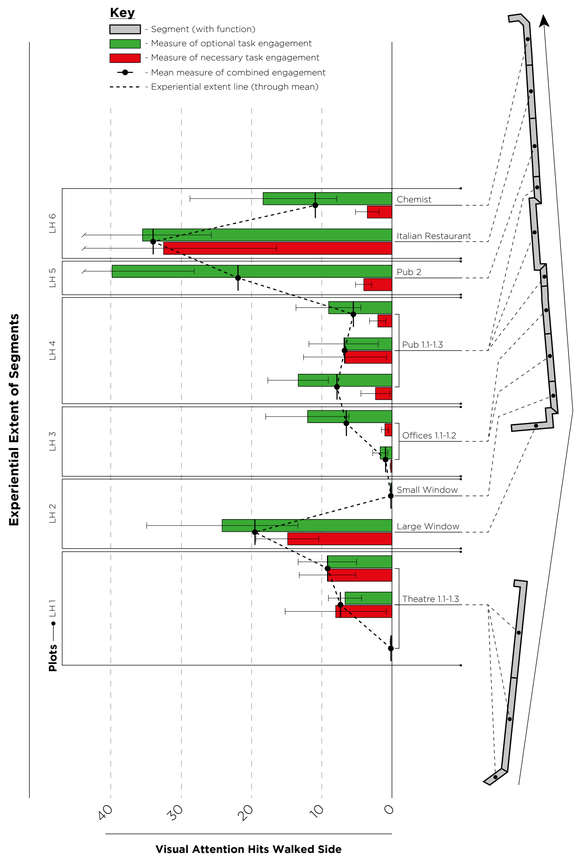


Figure 52 - Urban street edge segment engagement along street 10 (sided)

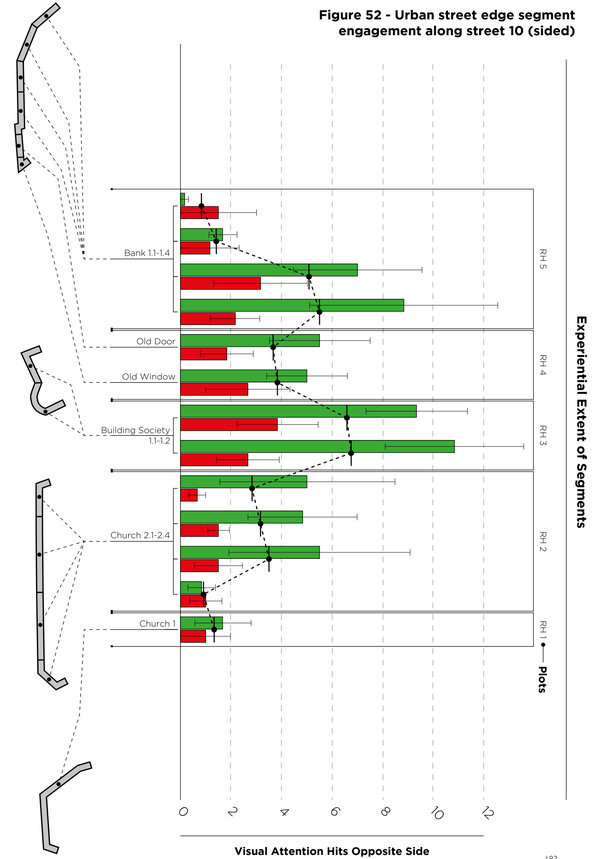


Figure 53 – Experiential extent overlays on sided streets

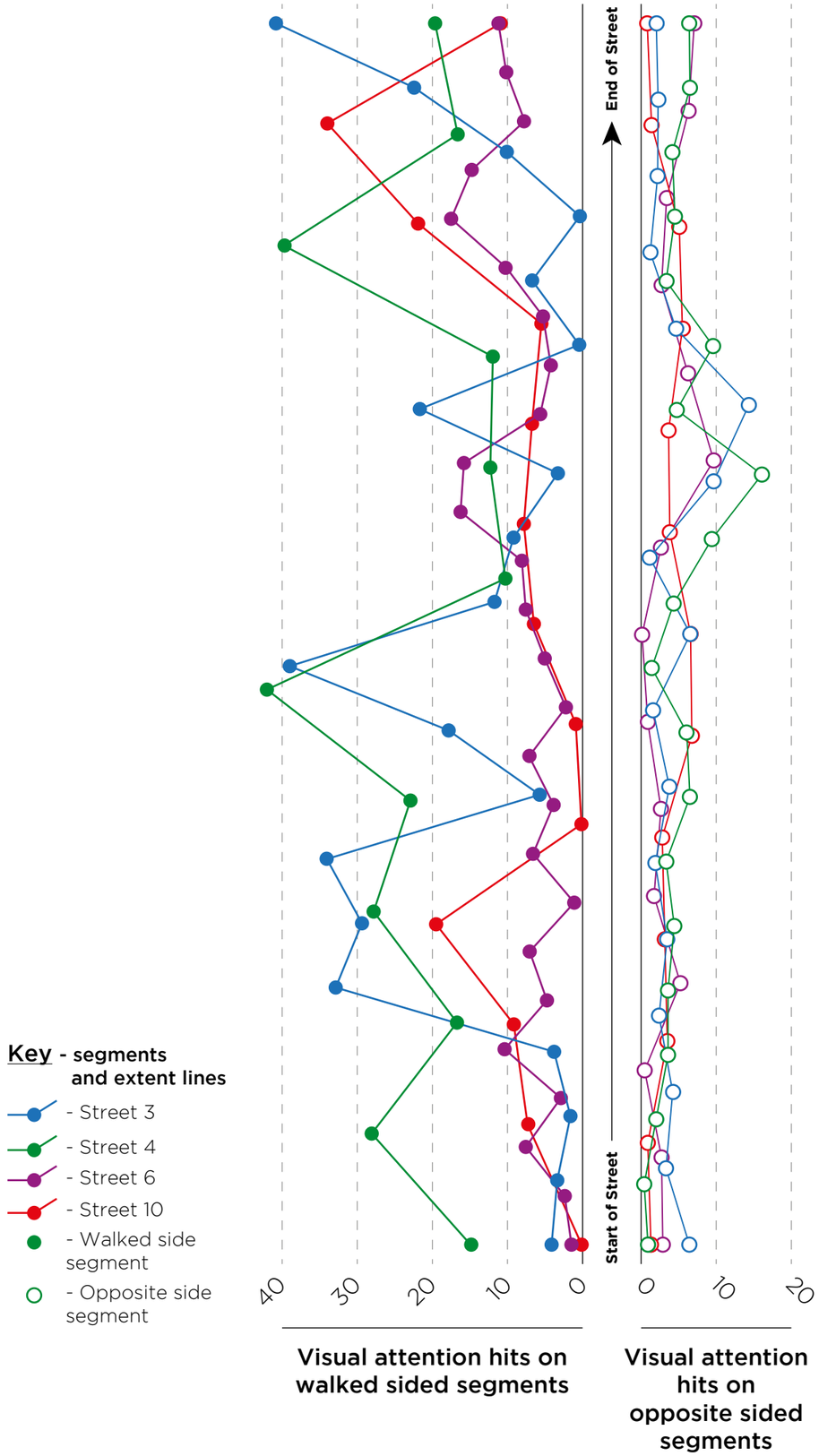


Figure 54 – Experiential extent overlays on not sided streets

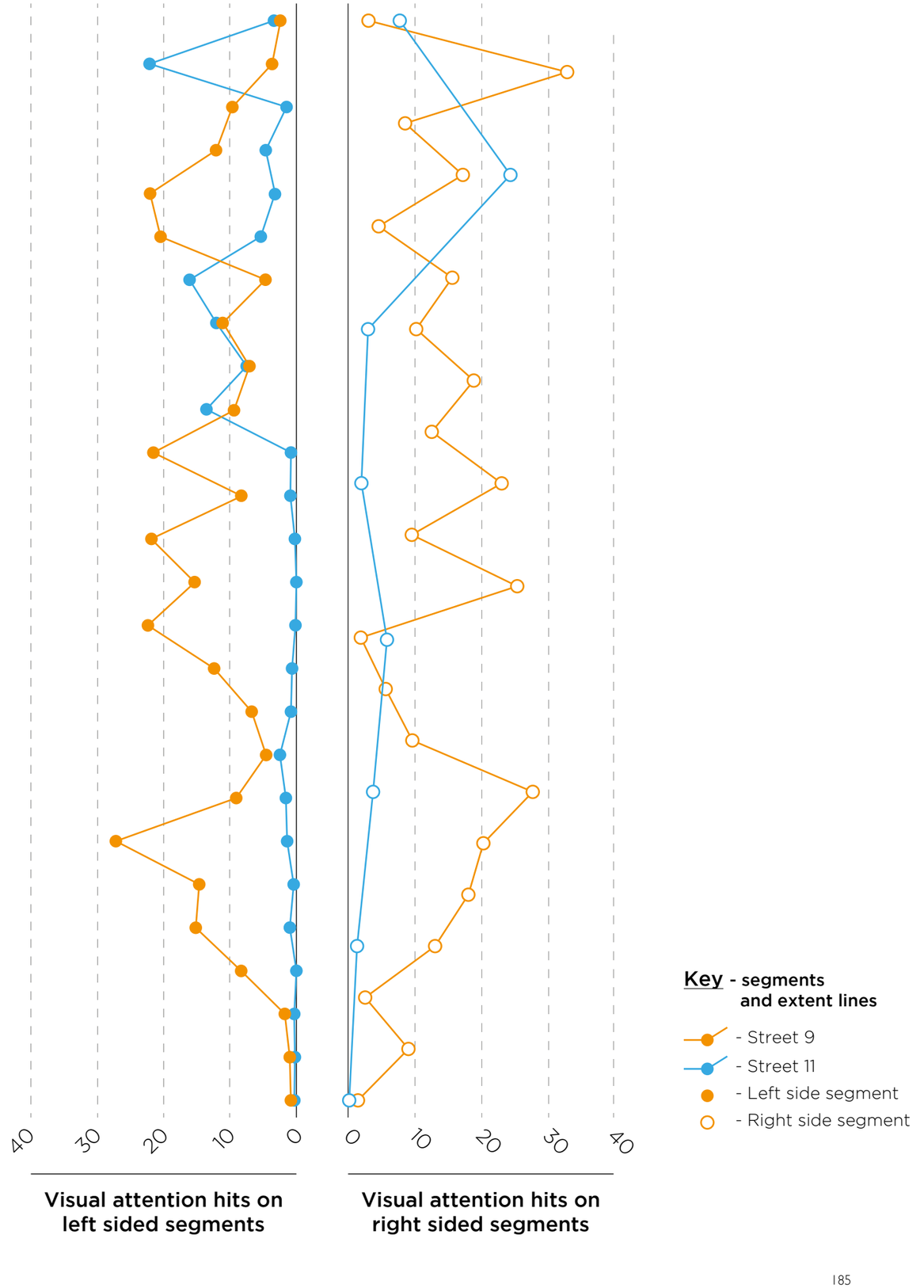
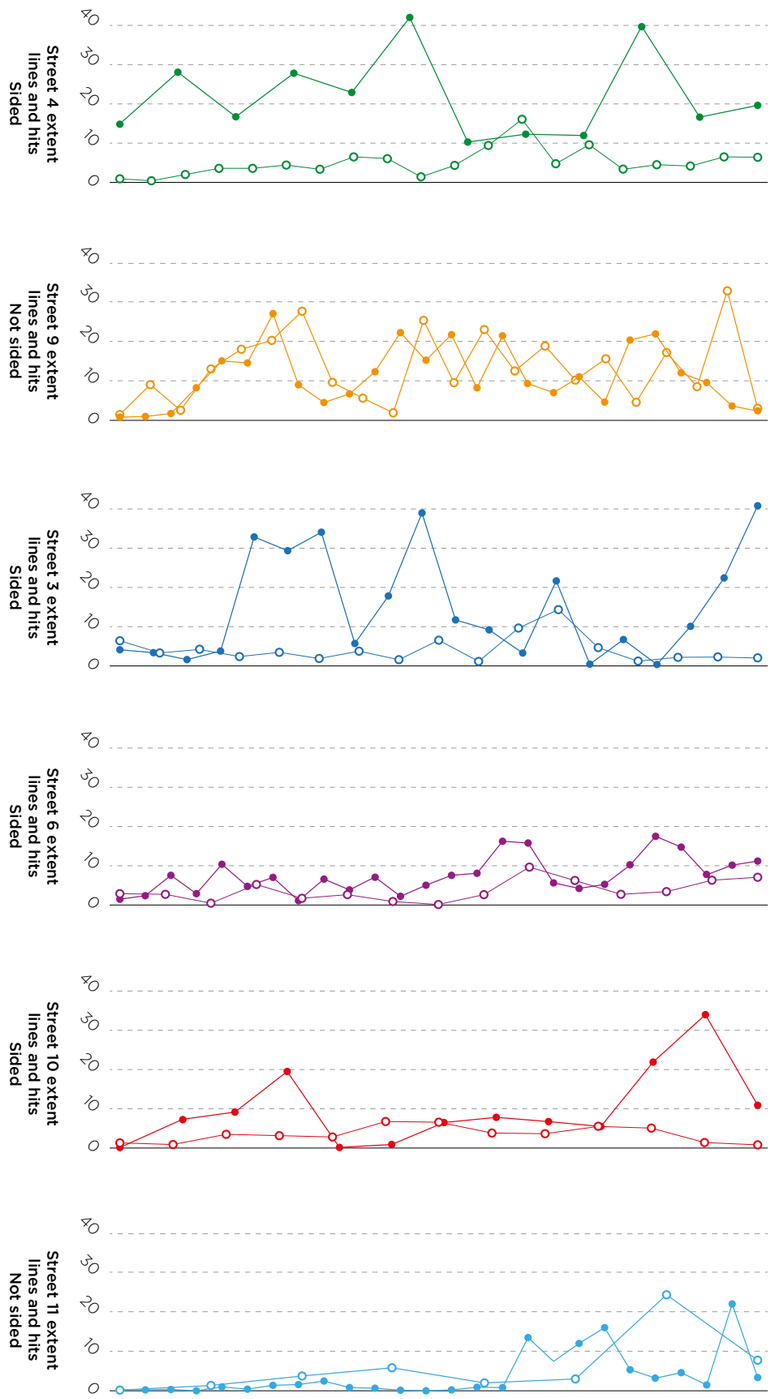


Figure 55 – Experiential extent lines by street

Most engaged edges by street



Least engaged edges by street

Findings discussion

Figures 47-52 rationalise and quantify the experiential fluctuations that were initially presented within the three-dimensional heatmaps (Part 2.1). This is whilst highlighting how visual engagement varied significantly along the segments of each street edge. Visually, variations in such engagement, in response to the differing segments and edges, are most easily assessed when viewing the combined extent overlays (Figures 53-54). Here, fluctuation in the amount of visual engagement across the edge segments are standardised (scale) and more easily contrasted. Noticeable within these is how visual attention across segments varied greatest on the walked side of sided streets (Streets 3, 4, 6 and 10). This is in contrast to edges on the not walked side. Along these opposite edges the amount of variation in segment visual engagement was far less pronounced; with only the occasional experientially salient segment that captured visual attention for a noticeably greater duration of time. This can be seen through points upon the green and blue lines (Streets 3 and 4) where mean segment engagement went above 10 hits. On the not sided streets (Streets 9 and 11), variation in segment engagement along their left and right sides was more consistent and balanced across both sides, although the high levels of variation still occurred across the differing segments, see Figure 54.

Figure 55 visualises a significant finding gained whilst understanding how visual attention is distributed across the segments examined. This figure orders the segment experiential extent lines, shown within Figures 53 and 54, by the mean amount of total visual engagement with the edges, with the most visually engaged edges at the top and least at the bottom. Figure 37 highlights this ranked ordering. Noticeable within Figure 55 is how as the street edges are visually engaged less overall (moving down the page) their segments are also visually engaged on average less. This is along with variations in the experiential extent of their ground floor segments become less variable on a segment-by-segment basis whilst being flatter for prolonged periods. To some degree, this experiential phenomenon might seem obvious, especially when ground floors are the most visually engaged aspect of street edges (Part 2.2). Thus, as a consequence, street edge ground floors that are visually engaged more by people will have segments that are engaged to a greater extent. However, these visualisations highlight how such engagement is manifested in relation to individual and collectives of segments, adding a level of detail that has previously been challenging to capture and comprehend empirically.

As a result, the inclusion of street edge segments within a multi-scalar edge consideration begins to be justified. This is through highlighting the way street edge engagement can vary considerably on a segment-by-segment basis, in combination with the way that a series of segments can collectively influence how a street edge is engaged overall. Significant within this understanding is how a single segment, which is visually engaged considerably more than others around it, cannot impact significantly if a wider street edge is more experientially engaging. An insight into this can be seen through the salient points on the red (Street 10) and light blue (Street 11) lines of Figure 55. These highlight segments that were visually engaged more so than many others

examined across all the street edges. However, the edges these segments are manifested within were not engaged as much overall (mean average, see Figure 37) as the other street edges within the investigation. A collective of experientially engaging, or even segments that attract an average amount of visual attention (10-20 gaze hits, for example), can on the other hand impact significantly visual engagement being focused more upon its street edge. This can be seen along the green (Street 4) and yellow (Street 9) lines which were the most engaged street edges as well as the dark blue line (Street 3). The scale of a single street edge segment is thus potentially too small to impact if a wider street edge is experientially engaging. This brings forward a conversation relating to edge *coherence* (Thwaites et al., 2013); and how socio-spatial realms come together in *serial collectives* (Karrholm, 2012) and *collective interfaces* (Bobic, 2004) that can influence edge engagement as a whole. It also places importance upon the way segments never sit as distinct and individual realms, but nest together, within plots and plinths, in a manner that can collectively impact how urban street edges are experientially engaged.

In terms of urban street edge multi-directionality, these visualisations add further insight into how the experiential extent of street edges can fluctuate in terms of locationally significant *hereness* and more linear and directionally-focused *thereness* at a segment scale (Cullen, 1971; Thwaites et al., 2013). This again builds upon the three-dimensional gaze mappings within Part 2.1, highlighting how some segments have the potential to capture and hold visual experience more than others and therefore potentially become established as experientially significant locations / places within an edge. The visuals also highlight how the coming together of segments influences the wider multi-directionality of a total edge; its overall directional / locational multi-directional emphasis (Thwaites et al., 2013). Here, some edges potentially have a far greater number of locationally significant segments within them, such as Streets 3 (dark blue), 4 (green) and 9 (yellow) within Figure 55, compared with other edges, for example those on Streets 6 (purple), 10 (red) and 11 (light blue). Again, notions of *coherence* (Thwaites et al., 2013) are significant here. However, without comprehending the physical characteristics of the segments, and thus edge ground floors visually engaged, it remains challenging to fully comprehend the multi-directional experiential impact of these segments. An insight into this seeks to be furthered within Part 3.

Significant alongside the justification that collectives of segments can influence street edge engagement, and an edge's experiential multi-directionality, is also the insight that plots are potentially a scale of the edge's multi-scalar assemblage that is independent from the level of phenomenological interaction that engages with it. Evidence for this, building upon the way in which visual engagement is predominantly focused upon edge ground floors, can be seen within the individual segment visual attention mappings (Figures 47-52). These highlight how plots are structured in relation to the segments visually engaged. Significantly they show how considerable variation can occur across segments housed within the same built plot. For example, on the walked side of Street 4 where all the segments sit within a single built plot; the three plots on the left side of Street 9 that house all the segments of this edge and the last plot on the walked side of Street 6. Within these examples, and many other situations, it is not so much the built plots that play a predominant role in whether a series of street edge segments attract visual attention or not and thus if a wider street edge is potentially engaging or not. It is the collective of segments that are established within their infrastructure that impacts visual attention being focused upon these street edge. This is not to say, however, that plots do not influence street edge engagement as they provide segments with a morphological structure and plinth scale to nest within (Porta & Romice, 2010; Feliciotti et al., 2016). They also enclose the street, impacting how much of the street is open to the sky, which will inevitable influence how these spaces are perceived (Porta & Renne, 2005; Thwaites et al., 2013). Overall however, the extent to which they are visually engaged in comparison to street edge segments is minimal.

Overall, the points highlighted allow opportunity to infer that there is an entwined relationship between how much an urban street edge is visually engaged and its collective make-up of ground floor segments. The evidence suggests that experientially segments, and how they come together, are highly significant in dictating whether a street edge, spanning plots, plinths and segments, is experientially engaging for street inhabitants or not. This is along with insight into how a street edge's directional or location emphasis is experientially manifested, with points of distinct experiential intensity as people visually engaging with these segmented realms for variable durations of time. Within this is experiential insight into the way, street edges have opportunity to contribute towards streets being more distinct *places* / series of experientially significant *places*, rather than just a directionally focused *links* (Jones et al., 2007b; Jones & Boujenko, 2009). Evidence has thus been attained that validates the notions detailed within the current section's hypothesis – visual engagement will *vary along the length of an edge, especially in response its ground floor segments, highlighting variable points of experiential intensity and therefore shifts in its directional / locational emphasis.*

Inherently this is just an initial understanding and more investigation needs to be undertaken. But clearly these findings add new empirical evidence, from an embodied perspective, to claims made by Gehl (2010) and Glaser et al. (2012) who both regard ground floor realms as the most influential component urban street experience. The notion that ground floor edges are socially important has also been forwarded for many years within the work of Lynch (1960); Jacobs (1961); Cullen (1971); Alexander (1979); Habraken (1998) and many others. Through visualising and analysing segment visual engagement, and highlighting their experiential importance, new insight has been added to key built environment ideas explored over the past 50 years.

Part 2.4 – Are urban street edge segments that are visually engaged to a greater extent whilst undertaking optional tasks also engaged to a greater extent whilst under necessary tasks?

Method

To answer this question, the correlation between the average number of visual hits on all street edge segments under optional and necessary tasks was established using Pearson's product-moment correlation in R. The data was first log transformed to improve normality.

Results

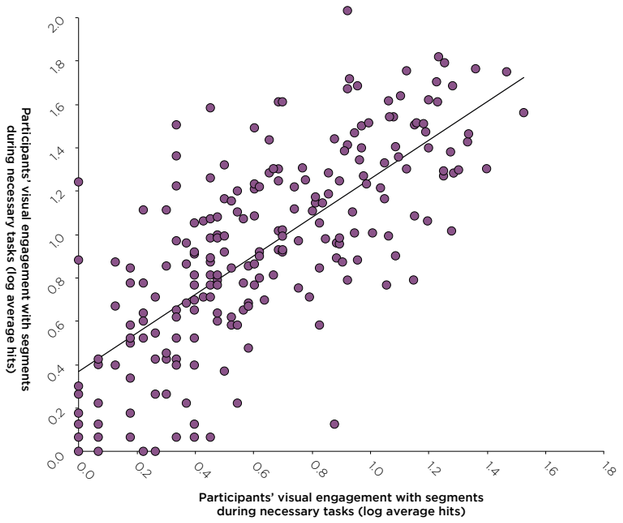


Figure 56 – The correlation between the average number of visual hits on urban street edge segments during optional and necessary tasks (r = 0.73). Each point is the average data for one street.

The output showed that there is a significant positive correlation between the average number of visual hits on street edge segments under optional and necessary tasks (r = 0.73, t = 15.87, d.f. = 216, p < 0.001).

Findings Discussion

The results highlight how urban street edge segments that the study participants visually engaged to a greater extent whilst undertaking optional tasks were also visually engaged to a greater extent whilst undertaking necessary tasks. Already established is the way that everyday social activities significantly impact street edge engagement (Part 1.2) and that segments of the same edge are visually engaged to differing amounts (Part 2.3); the finding from the current section adds the next level of detail. This whilst also starting to place heightened experiential

importance upon the physical characteristics of segments along with their spatial and material manifestation. Significantly, this suggests that certain segment qualities can transcend the actions of street inhabitants whilst capturing people's visual engagement across the potential multiplicity of street activities whether optional or necessary. For example, a distinctive and appealing shop window often grabs the attention of people rushing to work as well as people on a breaktime stroll. This insight subsequently justifies the examination of what segment characteristics are able to experientially engage the street inhabitant, which have been conceptually forwarded as affordances (CEF Part 3) and will be examined in the following results section.

Part 2 – Findings Summary

The insights gained through three-dimensionally mapping gaze distribution, then interpreting such visuals and extracting data from them for subsequent analysis has provided insight into the way in which people visually engage with urban street edges. Throughout it is noticeable that people look predominantly at edge ground floors where urban street edge segments are housed. The evidence accumulated highlights how these realms are experientially significant and collectives of them can impact the extent to which urban street edges are gazed upon. This is whilst also influencing an edge's experiential locational / directional emphasis. In doing so, the empirical insights gained verify ideas forwarded within the Part 2 hypothesis. The findings have also started to suggest the experiential significance of a segment's physical manifestation. Part 3 explores this further whilst examining affordances, which are territorially established within these ground floor edges realms.

Part 3: The experiential influence of affordances territorially manifested within segments

Hypothesis – Visual engagement will be focused most intensely on segments that portray individually and collectively the territorially established affordances of distinctiveness, transitional quality, sensory complexity and a level of temporality.

Part 3.1 (Visualisation) – How does visual engagement with urban street edge segments vary in response to their physical and material manifestation?

Method

Photographs were taken to capture the physical and material make-up of the street edges engaged and particularly their segments using a DSLR camera (Nikon d5000, 18-55mm DX lens). The photos were then arranged by street and corresponding side and then ranked in order from the most visually engaged to the least engaged (mean amount of visual hits upon the segment across both tasks). A process of visually examining the qualities of the segments, in accordance with their ranked ordering, was subsequently undertaken. This was done whilst using

the questions focused towards specific segment affordances to guide the visual examination of the segments (Parts 3.2-3.6).

Results

The following page-spreads contain the ranked segment photographs. Across all the pages the top left segment photo is always the highest ranked in terms of visual attention hits, running down to the lowest ranked on the bottom right of each page, not spread.

Figure 57.1 - Street 9 left side (not sided street)
Figure 57.2 - Street 9 right side (not sided street)

Figure 58.1 - Street 11 left side (not sided street)
Figure 58.2 - Street 11 right side (not sided street)
Figure 59.1 - Street 3 walked side (sided street)
Figure 59.2 - Street 3 opposite side (sided street)

Figure 60.1 - Street 4 opposite side (sided street)
Figure 60.2 - Street 4 walked side (sided street)

Figure 61.1 - Street 6 walked side (sided street)
Figure 61.2 - Street 6 opposite side (sided street)

Figure 62.1 - Street 10 walked side (sided street)
Figure 62.2 - Street 10 opposite side (sided street)

Key

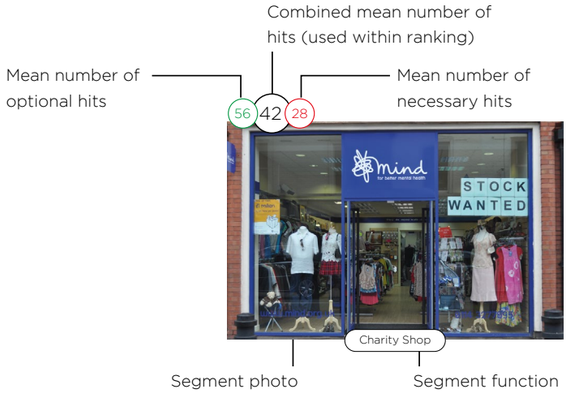


Figure 57.1 - Street 9
left side (not sided street)

Figure 57.2 - Street 9
right side (not sided street)

Figure 58.1 - Street 11
left side (not sided street)

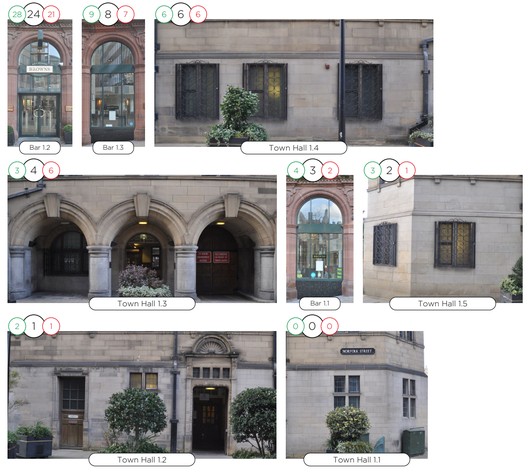


Figure 58.2 - Street 11
right side (not sided street)

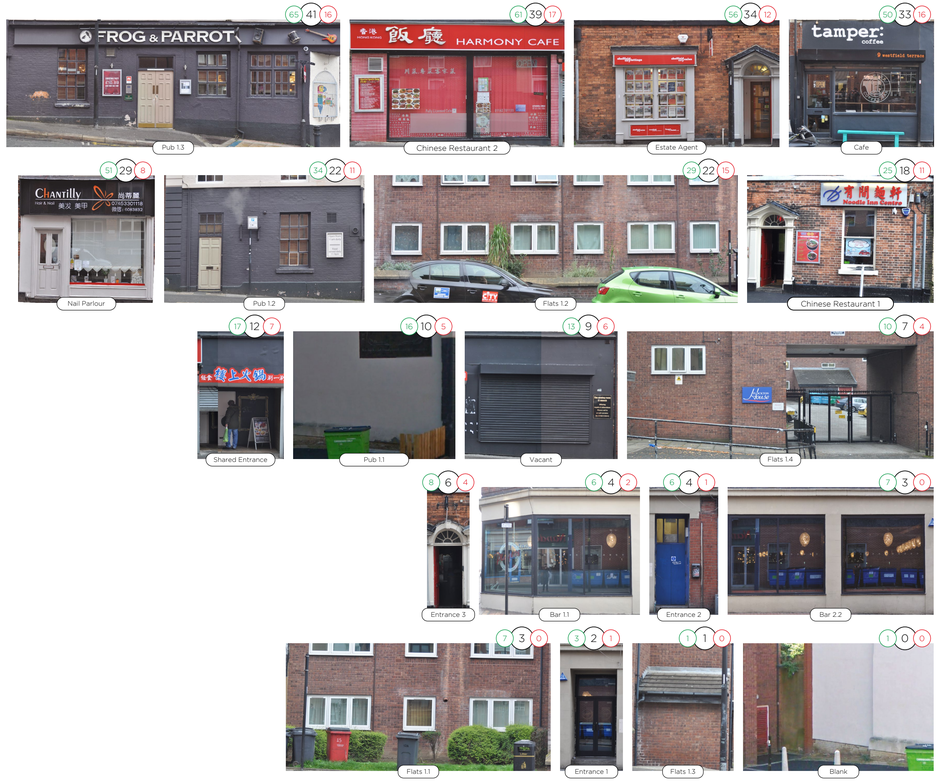


Figure 59.1 - Street 3
walked side (sided street)

Figure 59.2 - Street 3
opposite side (sided street)

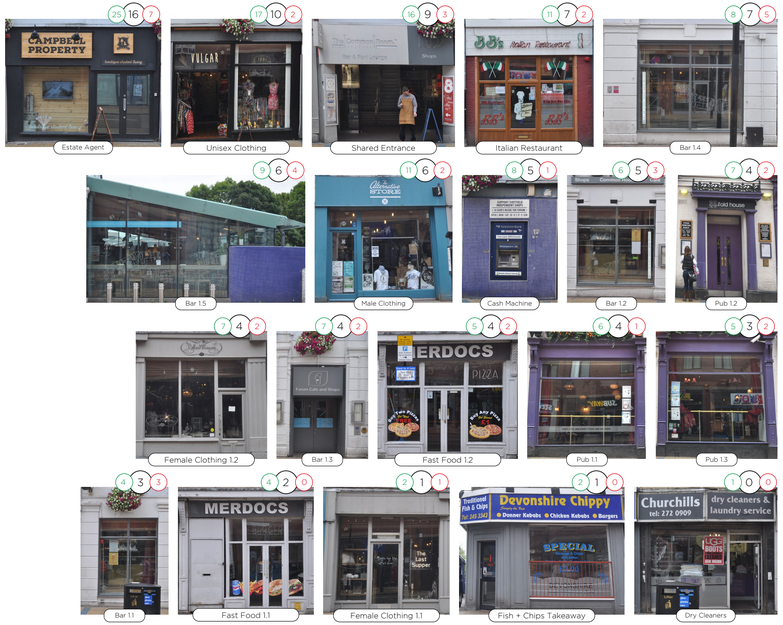


Figure 60.1 - Street 4
opposite side (sided street)

Figure 60.2 - Street 4
walked side (sided street)

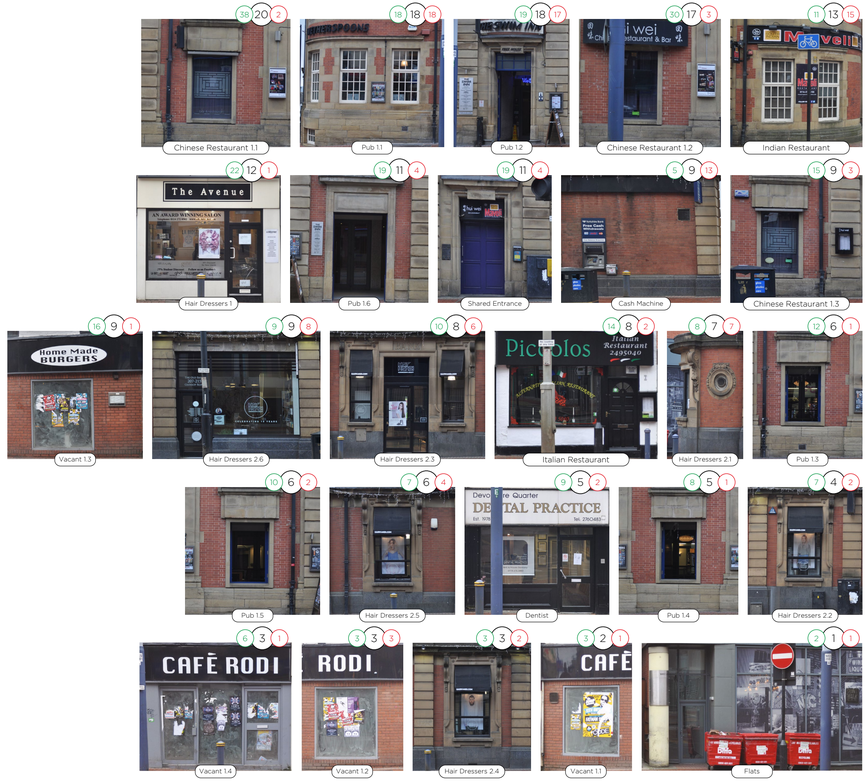


Figure 61.1 - Street 6
walked side (sided street)

Figure 61.2 - Street 6
opposite side (sided street)

Figure 62.1 - Street 10
walked side (sided street)

Figure 62.2 - Street 10
opposite side (sided street)

Findings discussion

Prior to examining the ranked segment photographs in relation to specific affordances established within them (Parts 3.2-3.6), it is clear that certain overarching trends are visible in terms of broad segment characteristics. Notable, across all the streets and sides, is how segments that were engaged more so often had an easily definable function and thus materiality that reflects this. As a result, they were generally more visually interesting and rich in response to multi-sensory qualities. This is most apparent across both sides of the streets that were not sided (Streets 9 and 11) as well as the walked sides of the sided streets (Streets 3, 4 and 10). Of the edges on the opposite side of these sided streets this trend is a less pronounced, further highlighting the potential influence that the space between the edges might have – the make-up of the pedestrian and vehicular thoroughfare, see Results Part 2.1 for further insight. An anomaly to this trend can also be seen along the walked side of Street 6, see Figure 61.1. Here, the consistency of the segments, in terms of colour and texture as well as function, potentially meant that the segments were engaged more similarly; none of them experientially standing out from their surrounding segments (see Figure 51). Of the segments that do have a defined function, and materiality that reflects this upon the walked side of Street 6, their orientation to the directionality of the street might have been influential in terms of how they were engaged. This can be seen through the hair dressers 1.1, Italian restaurant and dentist, all of which have a defined function and potentially engaging physical manifestation (Figure 61.1). However, the way in which they taper away from the predominant direction of movement may have meant that they were not as easily engaged compared to the other segments of the street, see Figure 55 for this orientation. Further investigation could seek to examine the impact of such edge orientation upon visual engagement with these realms.

The manifestation of segment qualities was conceptually forwarded during the current investigation as territorially established through personalisation and appropriation (CEF, Part 3). In instances where such actions prioritised the communication of information and promotion of engagement this was called *positive segment territorialisation*. Noticeable across the ranked photos is the way that the most engaged segments adhered to this positive manipulation whilst projecting their qualities to street inhabitants. In contrast, the segments of each edge that were engaged to a lesser extent were often less easily definable in response to function and were materially harsh and blank, manifested through *negative segment territorialisation*. Whilst it is challenging to assess the specific territorial actions that people (segment owners) had undertaken, as well as the nuanced desires behind such processes whilst manipulating segments, clearly there is a trend across the segments in relation to territorialisation that can be categorised in response to positive or negative intentions. Again, this is specifically from the perspective of the street inhabitant. The ranked photos add evidence to such notions and the following questions look into the resulting manifestation of these actions in detail. This is whilst examining distinct segment affordances.

Part 3.2 – How does visual engagement with urban street edge segments vary in response to their distinctiveness, manifested through high-level and low-level saliency?

Method

The ranked photographs from Part 3.1 were used whilst examining the relationship between segment distinctiveness (high-level and low-level salient aspects) and the amount of visual engagement with the street edge segments.

Findings Discussion

Highlighted previously is how the most visually engaged segments regularly had functions that were easily definable and materiality that projected such functionality to street inhabitants (Part 3.1). This insight relates directly to the experiential affordance of distinctiveness and notably high-level saliency. Here, features such as the people, tables, chairs, signage, text within a segment, features and objects on show and being displayed drive visual interaction with a segment, see Figure 22. These high-level elements not only provide target objects aiding in a given task, for example at an extreme level an engaging shop window aids and aligns with window-shopping. But, at a more nuanced level, they provide something to look at and visually engage regardless of the task at hand. This supports and adds detail to the previous insight that certain segments are able to visually engage people more than others across the multiplicity of street task, whether optional or necessary (Results Part 2.4).

Such an understanding, in response to high-level distinctiveness, also provides insight into why blank as well as vacant segments, which are often uniform and sterile across their frontage, were regularly visually interacted to a lesser extent. This is noticeable across all Figures 57-62. These segments often portrayed fewer definable high-level drivers of attention, especially in contrast to their surrounding segments. As a result, they provided people with very little to visually engage when inhabiting the street and going about their everyday actions. This insight empirical evidences claims made by Gehl et al., (2006) and their street edge typology that considers blank / passive edges as experientially restrictive. Similarly, it backs up and adds new insight to the ideas of Bobic (2004); Glaser et al. (2012); Montgomery (2013) and Ellard (2015) who have detailed the negative impact of blank edges.

The photos also highlight how the material make-up and physical constituent parts of segments (low-level salient factors), rather than just definable objects that comprise them (high-level aspects), were influential in terms of visual engagement. These characteristics spanning colour, texture, orientation, movement and intensity of elements within a segment, contributed significantly to a segment's overall distinctiveness and were influential in capturing visual attention, see Figure 22. In response to this, a segment that was engaged more than others around it was

generally found to be more colourful and portrayed noticeable contrasts in colour. This was either in relation to its physically or the objects housed within it. Here, it would be anticipated that colour grabbed the participants eyes and attracted attention, as previously explored through wider eye-tracking investigations (Itti, 2005; Rothkopf et al., 2007; Cerf et al., 2008; Borji, 2012). An insight into this is most prevalent within the segments on the left side of Street 9 (Figure 57.1), the walked side of Street 3 (Figure 59.1) and both sides of Street 4 (Figures 60.1 and 60.2). Again, however, the opposite sides of the streets walked and consistency in the materiality of segments within an edge (walked side of Street 6, Figure 61.1) noticeably influenced this trend, as discussed before.

Segments that contain moving low-level aspects, most notably the presence of forever-shifting people, were also often engaged to a greater extent. This movement might have caught people's attention and drawn their eyes to a segment, compared with segments that were continually static and contained no moving aspects. Significantly, the affordance of this is heavily influenced by the transparency of a segment, to be explored in detail within the next question. The occurrence of people in itself is a high-level driver of attention / engagement and something that Gehl (2010) has examined, whilst highlighting that the presence of people attracts people.

The orientation of elements within a segment was another low-level influence upon visual engagement with these realms. Here, a number of segments that were visually engaged to a greater extent had distinctive elements such as signs and objects like benches, walls and planted areas (high-level factors) projecting from the dominant linear orientation (low-level factor) of the edges. For example, the signage of herbal store on the left side of street 9 (Figure 57.1); seating areas of the café 1.1 and French restaurant on the left side of street 11 (Figure 58.1); the planting of the flats 1.2 on the walked side of Street 3 as well as the benches outside of the café on the same side (Figure 59.1) and outside of the barbers on the walked side of Street 4 (Figure 60.2). When the street inhabitants were walking along the streets these elements caught attention, potentially due to the fact that rather than being to the side of them these features were in front of them as they approached a segment. This makes them distinctive aspects of a segments that can be viewed easily, protruding from the edge's linearity and the influence of perspective on such flatness. This also meant that they were objects that on occasion required consideration in order to avoid collisions. In response to ideas developed by Franck & Stevens (2007) and Thwaites et al. (2013), these qualities experientially *stretched the edge* creating an ambiguity and *looseness* about where a segment spatially started and ended. However, further work is required to examine these factors in detail.

Overall, in terms of the distinctiveness of segments, the insights gained through the real-world mobile eye-tracking study have empirically highlighted how both low-level and high-level salient drivers of attention have the potential to influence visual engagement with urban street edge segments. This is a progressive idea conceptually developed within the CEF and evidenced through the data collected during this current investigation. A distinct segment can thus often be

thought of as one that regularly contains definable high-level instances of this affordance, notably signage, posters and distinctive elements on display (objects and features). It also regularly contains distinct low-level factors relating to colour, texture, intensity, movement and orientation. However, many of these qualities, as presented within the CEF, are often impacted by the lateral transitional quality of a segment as well as wider segment affordances, which will be explored within the following questions.

Part 3.3 – How does visual engagement with urban street edge segments vary in response to their lateral transitional quality, manifested through transparency and permeability?

Method

The ranked photographs from Part 3.1 were used whilst examining the relationship between the lateral transitional quality of segments (transparency and permeability) and the amount of visual engagement with the street edge segments.

Findings Discussion

Segments that portrayed notable levels of transparency and permeability, manifested physically within doors, windows and openings into the segments, were generally engaged to a greater extent than those that did not. This can be seen across all Figures 57-62. Based upon the empirical insights attained, it is evidenced that the lateral transitional quality of a segment influences the amount of visual attention that engages it.

Transparency allows vision to project into a segment and thus engage with distinctiveness elements housed within it, both in terms of high-level and low-level salient factors introduced earlier, as well as visual sensory complexity to be explored later. The most engaged segments of each edge were thus often glazed in some way, which the ranked photos highlight throughout. Segments that were not transparent, or had transparency that was blocked off by objects within the segments, were engaged less than those that were visually open. This is noticeable across many of the hotel segments (1.1-1.16) on the left side of Street 11 where transparency is blocked out often by curtains (Figure 58.1); likewise the stationary shop segments 1.1-1.3 of the right side of Street 9 (Figure 57.2); as well as many of the windows on both sides of Street 3 (Figures 59.1 and 59.2) and Street 10 (Figure 62.1 and 62.2). Such an insight adds new empirical evidence to ideas forwarded by Jacobs (1993); Porta & Renne (2005); Gehl et al., (2006); Gehl (2010); Glaiser et al. (2012) and Mantho (2014) who all advocate the experiential significance of transparent urban edges.

Permeability allows wider sensory engagement, beyond visual stimulation, to transition across the edge's indoor / outdoor realm division. Again, this allowed distinctiveness and sensory complexity to be projected to the people occupying the street. The most engaging segments of-

ten had doors that were open allowing not only experiential but also spatial access through removing the division across the street edge. Though this, the multi-directionality of the edge and street is subsequently influenced. This is due to edge engagement being focused away from the dominant linearity of street and edge, towards greater lateral focus across and locational significance within the street edge. This was notable when street inhabitants (study participants) engaged with the bakery and café on the left side of Street 9 and the shoe shop on the right side of the same street (Figure 57.1); as well as the sushi takeaway on the walked side of Street 4 (Figure 60.2) and pub 1.2 on the walked side of Street 6 (Figure 61.1). All of these segments continually portrayed the affordance of permeability through doorways that were open throughout the day. This contrasts with the least interacted segments – blank walls and vacant segments – that were often shut off with no potential for lateral engagement across the street edge. Here, the experiential directionality of the edge and street is focused towards linearity (*thereness*) with limited lateral and often as a result limited locational significance (*hereness*) (Cullen, 1971). The lack of permeability ultimately suppresses the opportunity for a rich, experientially multi-directional street edge (Thwaites et al., 2013).

Notable across the ranked photos is how the lateral quality of a segment is inherently entwined with the affordances of distinctiveness and sensory complexity, which has been alluded to throughout. As a result, these affordances cannot often exist without the presence of transparency or permeability. For example, many of the hotel segments along the left side of Street 11 (hotel 1.1-1.19, Figure 58.1) might have contained distinctive elements and sensory complexity within them that could have engaged the study participants. However, the often blocked-off transparency of these segments meant that they were not highly engaged. Likewise, the presence of lateral transitional quality is often not significantly engaged if distinctiveness and sensory complexity do also not exist. For example, the doorways, openings and transparent elements and segments on the walked side of Street 3 were some of the least engaged segments of this edge (Figure 59.1), potentially due to the lack of distinctiveness and sensory complexity within. Significant, therefore, do not exist in isolation but require each other to activate them – Maier et al.'s (2009) *artefact-artefact affordances*. These ideas are central to the affordance ideas developed within the CEF and ultimately to the way a segment can either positively engage street inhabitants or negatively disengage them.

Overall, in response to the lateral transitional quality of segments, the empirical insights gained through the real-world mobile eye-tracking study have highlighted how both transparency and permeability have the potential to influence visual engagement with urban street edge segments.

Part 3.4 – How does visual engagement with urban street edge segments vary in response to their transitional quality of experiential extent along a street edge?

Method

The ranked photographs from Part 3.1, in combination with the visualisations produced within Part 2.3, were used whilst examining the relationship between the amount of visual hits upon the street edge segments and variations in the transitional quality of experiential extent along a street edge. In addition, Figure 63 was created as an example in order to show such a relationship in greater detail. This allows for an exploration of how the experiential extent along a series of segments shifts and changes in terms of such transitional quality along an edge. Within the figure, three instances are shown along the walked side of Streets 3, 4 and 10, where notable shifts in experiential extent occurred for prolonged periods along an edge's length (visible within the extent mappings).

Findings Discussion

Figure 63 – Transitional quality along segments

Visualised within Figure 63 is how prolonged periods where an edge's ground floor was engaged

to a lesser amount (low amount of visual engagement hits along their experiential extent) coincided with a series of segments that did not portray the wider affordances that are expected to make a segment experientially engaging – distinctiveness, lateral transitional quality and sensory complexity. The Street 3 example highlights situations were even though lateral transitional quality is present across all the segments, distinctiveness and sensory complexity is lacking in the first four segments. As a consequence, these segments were not engaged as much and the experiential extent line remains low between 0-5 mean visual hits on each segment. This shifts when more distinctive and sensually rich segments along the edge's ground floor are engaged and the extent line of the edge reflects this. The same is visible along the Street 4 example, with the middle three segments lacking in the key affordances anticipated to make them engaging, as well as the first three segments of the Street 10 example.

This insight provides evidence to argue that variation in segment engagement, along the transitional extent of a series of segments, rises and falls in accordance with the occurrence of the affordances detailed within the current investigation. As a result, this experientially impacts an edge's directional / locational emphasis within a multi-directional edge consideration, see discussion with Part 2.3. Significantly, such an insight establishes and furthers the way that segments need to be considered on a segment-by-segment basis, with the potential for highly and less engaging segments to be sitting next each other, all of which is influenced by the affordances manifested within them. The extent lines produced within Figures 53-55 provide insight into this, with none of the edges engaged by the study participants containing segments that were able to engage them consistently along their whole length. The reason for this is potentially because not all the segments within each edge contained qualities / affordances able to engage street inhabitants, see Figures 57-62.

Linked to this discussion is the way that the ranked photos also highlight a number of segments that would have been expected to capture greater amounts of visual engagement than they did. This is especially when contrasted with segments on other streets and in response to the affordances forwarded as experientially significant. For example, it would have been predicted that the shoe shop on the walked side of Street 4 (Figure 60.2) would have been engaged to a greater amount than the flats 1.2 on the walked side of Street 3 (Figure 59.1). Likewise, segments such as the cook shop and gift shop on the right side of Street 9 (Figure 57.2) were surprisingly engaged to the same amount as the chain food facilities of the sandwich shop and fast food outlet on the walked side of Street 4 (Figure 60.2). These variations, and potential abnormalities from what would have been anticipated, are potentially in response to the way that a segment cannot be extracted from the edge and thus experiential extent within which it sits. Here, the shoe shop on walked side Street 4 (Figure 60.2) is positioned within an edge that comprises a number of segments around it that are highly engaging. As a result, visual engagement is potentially drawn away from it, as it sits alongside more engaging segments. In contrast, the flats 1.2 segment, upon the walked side of Street 3 (Figure 59.1), sits within a set of generally less engaging segments; visual engagement is thus not drawn away from it as much by aspects of its surrounding edge. In terms of the gift shop and cook shop on the left side street 9 (Figure 57.2), visual engagement is more evenly split across both edges of this street with in not being sided. There is thus more potential for visual attention to be spread over both edges of the street and as a consequence this might have impacted visual engagement with these segments.

Overall, in terms of the transitional quality along a series of segments, the insights gained through the real-world mobile eye-tracking study suggest that the experiential extent of an urban street edge's ground floor is influenced by the presence of affordances manifested within its segments as well as the collective composition of the segments themselves. Within this, engaging segments, with locational significance, can sit next to ones that attract less visual engagement and manifest street edges with forward-focused directional emphasis. The extent mappings and segment photographs highlight this and when combined such an influence is noticeable, as shown within the example of Figure 63. Beyond this, the findings highlight how segments cannot easily be considered away from the experiential extent within which they are embedded. Here, surrounding segments can influence the amount of visual engagement with a segment due to how engaging or disengaging they are – the broader transitional extent within which a segment sit is thus significant.

Part 3.5 – How does visual engagement with urban street edge segments vary in response to their sensory complexity?

Method

The ranked photographs from Part 3.1 were used whilst examining the relationship between the level of sensory complexity and the amount of visual engagement with the street edge segments.

Findings Discussion

Throughout the previous discussion there has been an initial introduction to the experiential significance of sensory complexity, especially how it works in accordance with and is influenced by the other affordances manifested within urban street edge segments. Viewing the ranked segment photos highlights how the most visually interacted segments were those that were often the most visually multifaceted in terms of sensory complexity. They regularly comprise a range of high-level and low-level drivers of attention manifesting their distinctiveness, as detailed within Part 3.2. They were also frequently transparency, allowing the visual complexity of the qualities and characteristics inside them (indoors) to be engaged from the street (outdoors), see Part 3.3. The edges of Street 6 (Figure 61.1) were again a slight anomaly to this.

Linked to the way transparency allowed the visual complexity of a segment to be engaged is the way permeability influenced wider sensory engagement with the segments, again see Part

3.3. Many of the most visually engaged segments had doorways that were regularly open. This allowed the audio of the activities house within them to emanate into the street. This can be seen through examples such as the shoe shop on the right side of Street 9 (Figure 57.2), the music from which could be heard in the street; the chatter of people from the café on the left side of this street (Figure 57.1) also filled the adjacent outdoor space. Other examples where audio provided wider sensory complexity were on the walked side of Street 6 through the pub 1.2 segment (Figure 61.1), which provided the main entrance to the pub and the noise of people inside could be heard; as well as the sushi takeaway on the walked side of Street 4 (Figure 60.2) with the sound of people inside. The level of permeability on occasion also allowed the sensory complexity of smells to radiate from some segments. This was, however, not overly common and only noticeable from the bakery on the left side of Street 9 (Figure 57.1); the café on the walked side of Street 3 (Figure 59.1); and the smell of smoke close to the pub entrance already discussed on Street 6 (Figure 61.1). Whilst providing an initial insight, more detailed work is required to examine these multi-sensory influences in detail.

However, it is noticeable that overall very few of the segments examined encouraged sensory complexity beyond the visual dimension in order to stimulate street inhabitants in a multi-sensory and cross-modal manner, backing up arguments made by Degen (2008). Other than the segments already discussed limited audio or smells emanated from the study segments. Wider sensory factors such as touch and taste were more challenging to explore in-line with the approaches employed and thus data collected within the current investigation. They were also sensory processes that were potentially not used at a great level during the tasks given the street inhabitants. The current study has focused upon using vision and its relationship to wider sensory engagement, notably sound and smells as discussed above. However, further investigation would be interesting to understand the influence that these wider senses play in urban street edge and notably segment engagement.

Of the segments that were engaged to a lesser extent it is noticeable that not only did they provide no opportunity for audio and olfactory stimulation but also visual qualities were often lacking. This is noticeable within all the ranked photos by street edge with the least engaged segments often being blank walls; shut off windows and doors; and vacant segments which lack sensory complexity as a whole and especially visually.

These findings provide evidence which highlights how the most engaged segments were generally more visually complex and stimulating. This was on occasion complemented with wider sensory complexity through the sounds and smells of the activities housed within a segment, yet overall this was relatively limited. The discussion had also detailed how sensory complexity is inherently linked with the wider segment affordances shown to be significant, notably, lateral qualities that allow visual (transparency) and wider sensory stimulation (permeability) to experientially transition across the urban street edge.

Part 3.6 – How does visual engagement with urban street edge segments vary in response to the temporality of their affordances?

Method

The ranked photographs from Part 3.1 were used whilst examining the relationship between segment temporality and the amount of visual engagement with the street edge segments. It should be noted, however, that the influence of temporality is challenging to fully explore through just the ranked segment photos. This is due to them capturing only a single snapshot of the segments at a given point in time. Through using the photos in conjunction with prior knowledge of the segments, along with an understanding of how the segments shifted and changed, greater insight was provided into the temporality / visual engagement relationship.

Findings Discussion

The temporality of interest, as detailed within the CEF, is not so much related to the often-regular rhythms of the street edge and notably the closing and opening of segments in-line with the daily flows and rhythms of the wider city. At a basic level, it is anticipated that engagement with a segment will vary based upon if it is open or not (Bobic, 2004). Instead, this current investigation, as detailed within the CEF, is focused upon examining temporality in response to the adaptability of segments and their affordances, along with their shifts and changes over time and how this impacts how these realms are experientially engaged.

Notable across all the ranked photos (Figures 57-62) is how some of the most visually engaged segments were those that adapted over time, notably in two differing ways echoing ideas forwarded within the CEF. Firstly, a whole segment that changed function, often through new ownership, provided something different along with new affordances, within a street edge for people to engage (territorial temporality). Secondly, a segment that changed its physical and material affordances regularly, for example within the re-making of a shop window, was engaged to a greater extent (affordance temporality).

The change in a segment's function meant that a newly territorialised, or re-territorialised part of a street edge afforded new experiences. A couple of segments that were interacted by the study participants (street inhabitants) had recently changed ownership before they took part within the investigation. The estate agent on the opposite side of Street 4 is an example of this (Figure 60.1). Potentially, as a result, this is why it was the most engaged segment of this edge, even though it is probably not the most engaging segment within the edge based upon an understanding of wider segment affordances discussed. Likewise, the vacant segment on the opposite side of Street 6 (Figure 61.2) was engaged more than a number of other segments. This is potentially due to it recently closing, having been a wedding dress shop with a distinctive shop window. This is an interesting insight whilst suggesting the nuanced significance that tem-

porality might hold at this territorialised segment scale. What would have been anticipated to be a disengaging segment instead attracted visual engagement, potentially because it was a very recent change to a street edge. Overall, these examples provide an insight into how temporality, in terms of territorial shifts, can potentially influence whether a segment is engaged or not. Here, a segment that is new or has changed ownership within an edge has the potential to grab attention, due to the fact that it was different last time the street was inhabited. However, more work is required to establish such ideas with limited segments changing during the timeframe of the current investigation.

Similar to the influence of territorial temporality at a segment scale is the effect that affordance temporality had on segment engagement. This is related to short-term and often minimal-effort changes to the interconnected affordances of interest, particularly distinctiveness and sensory complexity. The transitional quality of segments is linked more to the daily rhythms of the city with segments being shut and opened over time (Bobic, 2004).

Segments that regularly portrayed temporal shifts in their distinctiveness were some of the most engaged within the current study. This is potentially why charity shops, which regularly changed their shop windows based upon what they were trying to sell, were visually engaged more than many other segments. For example, the charity shops on the left side of Street 9 (Figure 57.1); and on the walked sides of Street 4 (Figure 60.2). This is similar to other shops that regularly changed their displays, notably the department store 1.2 on the opposite side of Street 6 (Figure 61.2); the unisex clothing shop of the opposite side of Street 4 (Figure 60.1) as well as the shoe shop, cook shop and gift shop on the right side of Street 9 (Figure 57.2). Another notable temporal shift can be seen in the gallery 1.2 on the left side of Street 9 (Figure 57.2), which was also highly engaged and changed the artwork on show regularly. These changes in turn influenced the sensory complexity of the segments.

Beyond material changes in segment affordances, temporality through the presence of people occupying a segment potentially also grabbed vision. This is why cafés and food outlets as well as places where people were able to sit and stay may have been engaged to a greater extent than segment that don't allow people to territorially occupy them. This insight evidences the work of Gehl (2010) as discussed earlier whilst examining the influence of people as a high-level driver of attention. In terms of temporality, such an impact can be seen through the barbers on the walked side of Street 4 (Figure 60.2), which continually contained new and changing faces and the food outlets on the same street. The same can be said for the cafés on the left side of Street 11 (Figure 58.1) and walked side of Street 3 (Figure 59.1), which contained considerably more people than the other segments around them.

Overall, a segment engaged to a greater extent often shifts and changes more regularly than a segment that is static and unvarying in terms of its affordances. Insights from this current investigation adds evidence to these ideas whilst also highlighting how the interconnected affordances that influence segment engagement can often be temporal.

Part 3 – Findings Summary

The findings gained from the current section, focusing upon the uses of ranked segment photos on an edge-by-edge basis, add evidence to the notion that certain individual and combined affordances impact visual engagement with urban street edge segments. In doing so, the findings establish evidence towards the Part 3 hypothesis – *visual engagement will be focused most intensely on segments that portray individually and collectively the territorially established affordances of distinctiveness, transitional quality, sensory complexity and a level of temporality.*

Results - moving forwards

The study results, spanning Parts 1-3, have established a new robust and direct knowledge of how urban street edges are experienced from the perspective of street inhabitants. This has been achieved through the use of vision captured via mobile eye-tracking. The data collected has subsequently been analysed in a number of ways, many of which have been developed during the current investigation. As a result, the understandings attained have provided insight into the ideas developed within the CEF (Chapter 3) and the resultant hypotheses (Chapter 5). These insights will now be used whilst reflecting upon the problems and issues detailed within Chapter 2, in an attempt to address the knowledge and practice aims forwarded. From this, the intention is then to consider how the evidence-based ideas can be used to influence real-world issues impacting contemporary urban street edges.

Chapter 8

Discussion and application

The following chapter seeks to apply research findings gained during the current investigation to problems and issues raised within Chapter 2. Already, during the results (Chapter 7), a number of brief discussions examined insights captured through the mobile eye-tracking investigation. These discussions detailed specific points in relation to study hypotheses and research questions, which stem from ideas forwarded within the conceptual edge framework (CEF – Chapter 3). However, the exploration did not develop in any significant depth how the findings can be used to address issues raised at a theoretical level – how we think about (knowledge implications) and act when seeking to change (practice implications) urban street edges. As a result, there was limited application of the study findings in response to the knowledge and practice aims and objectives previously forwarded (Chapter 2). Such an exploration will take place within Part 1 of the current chapter. Beyond this, the investigation results were not fully examined in relation to the real-world urban street edge issues previously raised – homogenisation and scale, the harsh division of realms as well as decline. The real-world application of the findings, therefore, also requires attention. This will take place within Part 2 whilst building upon ideas forwarded within Part 1. Importantly, the discussion spanning these two parts subsequently provides a foundation from which to address the overarching question that the current investigation seeks to answer – *how might we be able to make more experientially engaging urban street edges?* This takes place within the Conclusion (Chapter. 9). Prior to this, however, Part 3 of the current chapter briefly details methodological considerations associated with the use of mobile eye-tracking as a data collection technique as well as the limitations of the current investigation.

Part 1: Considerations when thinking about (knowledge) and seeking to change (practice) urban street edges

The problems and issues discussion examined, building upon evidence within existing discourse, the way in which certain professional design decision-making practices and approaches have negatively impacted how experientially engaging contemporary street edges are for street inhabitants (Chapter 2). From this, practice objectives were detailed, which sought to understand and comment upon the impact of matters associated with who professionally deals with urban street edge change (practice objective 1); the relationship between top-down and bottom-up street edge design decision-making (practice objective 2) and the focus upon architectural objects as the primary factor by which street edges are considered (practice objective 3). The subsequent practice aim distilled these ideas into the need for a reconsideration of how design decision-making approaches urban street edge change.

The current investigation also examined how knowledge issues have compounded such practice-based matters – *designers simply lack sufficient knowledge about human environmental experience* (Goldhagen, 2017, p. 32-33). Building upon this, knowledge objectives were devised. These sought to direct attention specifically towards street edges, as there is currently only a partial focus upon street edges (knowledge objective 1) and provide an empirical account of street edge experience from the first-hand, direct perspective of street inhabitants (knowledge objective 2). These objectives culminated in an overall knowledge aim. This focused upon the need to capture a rigorous and empirical account of how urban street edges are experienced spanning social and spatial considerations.

The two knowledge objectives have started to be addressed through the mobile eye-tracking investigation undertaken (Chapter 6). This systematically captured and articulated how people visually engage urban street edges. In doing so, it has provided new empirical and direct understanding of how street inhabitants experience these realms at the interface of socio-spatial considerations (Chapter 7). Building upon these insights, the following will now forward progressive evidence-based ideas regarding to how urban street edges should potentially be thought about in the future; further addressing the knowledge objectives and aims. These are established upon ideas presented within the development of the CEF (Chapter 3) and the empirical testing of the resultant hypotheses through the mobile eye-tracking investigation. Significantly, each of the ideas presented also has a number of implications for practice when approaching street edge change. In doing so, the discussion also seeks to address the practice aim and objectives.

Experientially urban street edges are spatial realms that require activation through everyday social actions

The social actions of people territorially inhabiting the street, manifested within their everyday tasks and activities, significantly influence the extent to which they visually engage with street edges. Optional activity promotes greater visual engagement with street edges than necessary activities (Results Parts 1.1, 1.2). However, street edges overall, as well as experientially significant street edge segments, which are visually engaged to a greater extent whilst undertaking optional tasks are also visually engaged to a greater extent whilst undertaking necessary tasks (Results Parts 1.3, 2.4).

These socially focused yet socio-spatial accepting empirical insights highlight the need for reflection upon the way human actions in some way mediate engagement with the spatial manifestation of street edges. Some everyday tasks promote edge visual engagement, others less so. Within such a consideration, an emphasis is placed upon the living and experiencing phenomenological human and their everyday actions. Through these, the spatial assemblage of the street edge is engaged with potential for fluctuations in experiential intensity. Based upon this, it could be argued that experientially the spatial significance of urban street edges and their constituent parts never truly gain prominence without an understanding of their social manifestation and the way peoples' actions engage these realms. As a result, street edges do not become animated without people and their everyday activities, desires and needs; an experientially manifested SOCIO-spatial consideration aligning with assemblage foundations of Deleuze & Guattari (1987) and DeLanda (2006).

Such socially grounded and responsive ideas break directly from the Cartesian mind-set that

observes a disconnection between body / mind; subject / object (Lincoln & Guba, 1985). It justifies at some level a strengthened phenomenological consideration (Merleau-Ponty, 1962); or at least post-phenomenological mind-set when thinking about street edges (Ihde, 2008; 2009). These realms are not entities or objects that can be thought of as *out there* and observed from a detached position. But, are assemblages that require variable everyday human actions to establish their experiential manifestation (Dovey, 2010). Philosophically, this thinking subsequently overcomes issues associated with assemblage thinking, raised by Brenner et al. (2011) and Storper & Scott (2016), by focusing upon differing human actions as the process through which the spatial qualities of the environment are engaged and gain potential significance. This is whilst not suppressing the importance of the edge's spatial manifestation towards an integrated SOCIO-spatial edge consideration, which is reflective of multiple concurrent realities / levels of potential engagement with the urban street edge (Ihde, 2008; 2009).

When thinking about street edges the social actions of those engaging these realms should, therefore, not be dis-regarded or their importance suppressed (Gehl, 2010; Mehta, 2013). They are *everyday social realms* (de Certeau, 1984; Lefebvre, 1991). As a result, street edges are not abstract, disconnected architectural objects, or a series of objects, but are instead a complex inhabited and engaged assemblage of social and spatial (Dovey, 2010; Thwaites et al., 2013). This echoes the pioneering work of Jacobs (1961). She advocated the need for people to be the primary consideration within a spatial world – if we do not understand where people are, why they are there and what they are doing a comprehensive understanding of how urban environments function socially cannot be gained. Overall, the ideas forwarded, backed by the evidence gained through mobile eye-tracking, add to our existing understanding of how urban street edges are experientially engaged; addressing points forwarded within the knowledge aim.

Implications of SOCIO-spatial consideration for practice when seeking to change street edges

The problems discussion (Chapter 2) highlighted how contemporary design thinking, which often stems from a modernist and architectural focused mind-set, has regularly sought to elevate the design of urban settings to a heroic display of formal dexterity during the production of architectural objects as distinct *urban jewels* (Harris & Burke, 1997; Porta & Romice, 2010). At an extreme level, architecture and urban design becomes *a goal unto itself* with limited true social consideration (Habraken, 2005; Porta & Romice, 2010). People and how they engage design intervention within an everyday context are not often of particular interest but the avant-garde pursuit of expressive *form* dominates (Habraken, 1998; Bobic, 2004; Cuthbert, 2007; Porta & Romice, 2010; Goldhagen 2017). The result can be design intervention that disengages and alienates people rather than promoting interaction on a realistic everyday basis (Harris & Burke, 1997; Bobic, 2004; Goldhagen 2017).

Empirical insights from the current investigation, and ideas developed within the previous section, start to provide new experiential evidence that questions the validity of this physicality focused and object-based mind-set and ultimately its foundations as decision-making approach within an urban street edge context. In doing so, points detailed within practice objective 3 begin to be addressed. It does this through establishing the impact of routine social actions upon edge engagement and the way they can influence significantly the extent to which people visually engage these realms – a more balanced socio-spatial outlook. As a consequence, design decision-making's primary focus should not be how interventions look on a drawing board or how they appear when viewed from a detached and enlightened position, abstracted from the complexities of variable everyday urban experience. But instead, concerns should be aligned to a greater extent with how people, who live in and around intended street edge changes, will potentially engage interventions whist they carry out differing routine tasks.

However, the question subsequently arises – *how can street edge design decision-making become more socially considerate and responsive to variable engagement that is impacted by peoples' everyday actions and mind-sets?* In order to achieve this, it is potentially worth approaching the issue from a slightly different perspective than is commonplace within built environment thinking. Street edges as well as the wider built environment could start to be considered in the same terms as some art historians and critics have used neuropsychology concepts to interpret artwork. This is notably within the development of ideas relating to the *beholder's share*.

For Kandel (2012), whilst building upon Reigl's early 20th century work, the beholder's share has been used to understand how people engage and react to visual artistic material. Significant within the concept is how artwork needs to be considered as unfinished until an individual experientially engages it. Within this, the person interpreting the work cognitively completes the artefact and until they view or interact with it the piece remains only partial. The viewer, therefore, collaborates at some level with the artist in transforming the often two-dimensional canvas of colour and texture to a personal three-dimensional cognitive interpretation of significance, meaning and emotion. This is potentially why different people often notice different things when viewing the same artwork. Aligned to this is the way people may see contrasting aspects of an artwork at different times, whilst in variable mind-sets and moods for example. Some days they might observe certain colours and shapes, on others differing aspects of a depiction.

In order to introduce the significance of the beholder in simple everyday terms, Kandel uses a painting by Gustav Klimt, *The Auditorium of the Old Castle Theatre* (1888), to highlight his point –

> *… rather than painting a view of the stage or the actors on it, Klimt painted specific, recognizable members of the audience as seen from the stage. These members were not attending to the play but to their own inner thoughts. The real drama of Vienna, Klimt's painting implies, did not take place on the stage, it took place in the private theatre of the audience's mind.*
>
> Kandel, 2012, p. 6

Using the notion of the beholder's share in terms of street edge ideas could provide a useful concept, especially when considering professional influenced change within it. The aim, however, is not to reduce the socio-spatial complexity of these multifaceted realms to the level of a static two-dimensional image or theatrical performance. But, provide a progressive concept from which to comprehend how design intervention should potentially be considered.

Such thinking would firstly provide opportunity for design decision-making to be more accepting in response to the range of actions that streets accommodate. These span optional and necessary tasks (Gehl, 2010; Mehta, 2013) or even sensations of *link* and *place* (Jones et al., 2007a; 2007b; 2008) and ultimately impact how urban street edges are engaged. This was shown during the current investigation through mobile eye-tracking. Building upon this, street edge intervention therefore has the opportunity to be engrained with an expectation that differing levels of interaction will occur with it concurrently as people go about their daily lives. Not everyone is going to interact with a new building to the same extent, especially those rushing to work for example. But, there is opportunity to explore what factors and characteristics might be experientially salient, even for a fleeting moment, across the range of social actions that streets inherently accommodate. This builds upon the understanding that certain street edges and aspects of their assemblage are visually engaged to a greater extent across optional and necessary tasks. This point will be picked up again later when detailing the experiential significance of segments and affordances manifested within them.

Adopting the mind-set of the beholder's share would also shift the emphasis away from designers producing *finished* interventions / architectural objects within the urban street edge. This works towards a more fluid and forever-changing comprehension of completion, with multiple various in engagement (spanning the everyday tasks of the street) creating multiple iterations of finished interventions over time. This notion aligns with Dovey's (2010) assemblage ideas, related to places being in a continual state of *becoming*, as well as Lefebvre's (1991) concept of representational space and Gibson's (1979) affordance theory. The designer is, therefore, not a person who creates things and society uses them but is a facilitator of interaction and engagement. The process is collaborative and as such everyday people are given value in relation to how they ultimately finish what a designer decision-maker starts.

Within the context of the current investigation, these ideas start to address aspects of the practice aim forwarded whilst attempting to explore how decision-making practice can begin to be aligned to a greater extent with realistic everyday social actions and processes. At the same time, such thinking begins to address concerns raised by Cuthbert (2007); Thwaites & Simkins (2007); Dovey (2010); and Thwaites et al. (2013). This is whilst shifting the emphasis away from physical and spatially focused considerations towards a more socially accepting and fluid mind-set. Here design intervention does not seek to create finished architectural objects but instead focus is upon human actions and how they can impact street edge engagement.

Street edges are not engaged as singular entities but are a nested multi-scalar assemblage comprising morphological infrastructure and experientially significant territorialised realms

The current investigation has highlighted empirically how visual engagement with urban street edges is not evenly distributed across their totality but clumps and dissipates around certain points (Results Part 2.1). Significantly more visual engagement is focused upon street edge ground floors – their plinths and territorialised segments (Results Part 2.2). It has also shown how a series of segments that are experientially engaging or disengaging influences considerably if the wider street edge is visually engaged or not – more experientially engaging segments ultimately create a more engaging edge (Results Part 2.3). Significant within this is how segments that are visually engaged to a greater extent whilst undertaking optional tasks are also visually engaged more so whilst undertaking necessary tasks – an engaging segment is generally an engaging segment regardless of what the person inhabiting the street is doing (Results Part 2.4). Alongside these insights was the finding that a street edge's plot scale is independent from visual engagement with its ground floor segments (Results Part 2.3).

These findings establish evidence that validates the notion that street edges require consideration not as singular entities but as nested assemblages comprising experientially variable scales. In doing so, new insight is added to the conceptual multi-scalar notions of Bobic (2004); Feliciotti et al. (2016), Porta & Romice (2010) and Glaser et al. (2012). Within this multi-scalar acceptance is embedded the experientially significant segment scale within edge ground floors. This adds empirical justification to ideas explored recently by Gehl (2010) and Glaser et al. (2012). They have forwarded the need for focus upon building ground floors that face the street – *the city at eye level*, and the significant role this realm plays upon wider built environment experience. Whilst this is the case, segments inherently require a morphological infrastructure within which to sit – street edge plots and plinths (Porta & Romice, 2010; Glaser et al., 2012). These scales were shown to have limited impact upon the extent to which experientially significant segments were visually engaged, defining them as more morphological important rather than experientially significant in terms of street edge engagement. They still require attention, however, providing structure and space within which segments can nest. They also give streets definition and a shape (Jacobs, 1993). Overall, these insights add considerable weight towards thinking about how street edges are engaged as multi-scalar assemblages and in doing so further address the knowledge aim posed.

Within the multi-scalar assemblage of the urban street edge the make-up and materiality of segments, as forwarded within the CEF (Chapter 3, Part 3), are influenced by territorial processes manifested within personalisation and appropriation. Here, an individual / group has power over how segments are established and their qualities whilst seeking to either engage (*positive segment territorialisation*) or disengage (*negative segment territorialisation*) street inhabitants. Study findings (Part 4.1) highlight how often the most engaged segments within each street edge were

those that positively engage street inhabitants through territorial appropriation focused towards the projection and communication of information. However, during the current investigation the focus of attention was not upon the specific actions of such territorialisation but the resultant creation of varying edge segments. This was detailed though the creation of affordances, the specifics of which are discussed later in response to segment and wider edge engagement.

Beyond the experiential significance of the affordances themselves, the findings reaffirm the need for understanding the presence and requirement of territorialisation, supporting the thinking of Karrholm (2012) and his discussions about the territorial richness of certain public realms. Within this, the territorial appropriation of segments can manifest the street edge as entity that is more than just physically *form* (Habraken, 1998). This is whilst also establishing experiential opportunities for the street inhabitant, as when – *people personalize their territories, they clarify individual and group territories, make the environment more attractive and complex, and set the stage for interaction* (Mehta, 2013, p. 61). Territorialisation thus provides a platform from which a multiplicity of opportunity can develop within the street edge – Karrholm's (2012) *territorial complexity* and *serial collectives*. A range of functions housed with an edge (series of segments) project the affordances developed through their territorialisation to street inhabitants, thus providing the potential for wide variety of opportunities with which to engage. Such ideas add further insight to the knowledge aim forwarded. This is whilst also having repercussions for how practice approaches street edges.

Implications of nested multi-scalar thinking and segment territorialisation for practice when seeking to change street edges

Understanding the experiential significance of multi-scalar and importantly territoriality accepting street edge thinking allows new potential to examine how professional design decision-making should influence these realms for the experiential benefit of street inhabitants. Building upon Habraken's built environment *controls* (1998) there is opportunity to consider the relationship between *form* (material and organisational structure of the built environment); *place* (territoriality and meaning, manifested within human impulses to identify and define territory); and *understanding* (human aspiration to relate to one another, through mutual structures and communal meanings), along with the experiential significance of their establishment. This is notably in relation to how these controls are manifested across and within the street edge's multi-scalar assemblage; whilst questioning – *where should professional top-down decision-making in the establishment of a street edge's form (creating an infrastructure to be inhabited as well as adapted) ultimately cease and the establishment of place and understanding within a street edge begin (processes which become manifested through bottom-up human territorialisation)?*

Such a question is highly significant, with the current investigation highlighting the way in which territorialising practices can impact how experientially engaging a street edge is. This is through the territorial appropriation and personalisation of ground floor segments and the affordances

manifested within them (Results Parts 2.3 and 3.1-3.6). Such territorialising actions resonate with Habraken's notion of *place*. Significantly, such processes are regularly bottom-up in nature, or at least balanced across top-down and bottom-up decision-making. However, such actions require adaptable edge spaces within which territorialisation can take place. There needs to be some level of adaptable *form* established through top-down professionalised decision-making. The issue within many contemporary street edge situations is that this is not regularly afforded; the suppression of *place*. As detailed within the problems and issues discussion (Chapter 2, Part 2), the result has been *form*-heavy street edges dictated more so by top-down professional decision-making rather than bottom-up territorial appropriation. Building upon this, and in response to experiential insights gained during the eye-tracking investigation, there is evidence backing a reconsideration of the relationship between top-down and bottom-up street edge decision-making influence, as detailing in the question just stated and also practice objective 2. During this there is also opportunity to review decision-making roles, both professional and non-professional (practice objective 1). This is most effectively considered in terms of how street edges are visually engaged in relation to their multi-scalar assemblage.

Plots and plinths are scales that do not noticeably influence visual engagement with street edges and their experientially significant territorialised segments (Results Part 2.3). They are however required for edges and adjacent streets to exist (Porta & Romice, 2010). From the perspective of the street inhabitant they can, therefore, be considered more as foundational infrastructure, which importantly requires a level of professional top-down input in order for street edges to be structurally stable. In to this infrastructure are nested the more experientially significant ground floor segments. The influence of bottom-up territorial processes are important here, establishing how engaging a segment and wider edge is when segments come together in a series. Overall, plots and plinths, therefore, contribute the *form* of the morphological edge with segments being the experiential drivers of an edge, territorially established through *place* as a control (Habraken, 1998). The relationship between the places along an edge could be conceptualised as the *understanding* of an edge, with connections across segments coming together in a series along its extent. All of this is experientially activated through the social processes of the street inhabitant (their *beholder's share*). They territorially occupying the street and establishing experiential significance within the edge, see Figure 64.

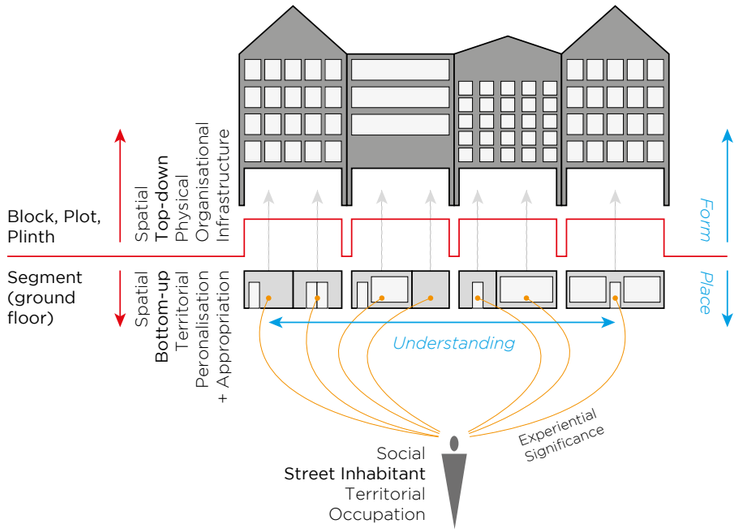


Figure 64 – *Form*, *place* and *understanding* across the multi-scalar urban street edge

Within such a model, expert decision-making is focused more towards establishing *form* in order to facilitate territorialisation and a relationship between territorialised realms (*place* and *understanding*). Significant here is a shift in mind-set where edge ground floors are not considered as architecture, with the same experiential significance as a whole building, aligning with Gehl (2010) and Glaser at al. (2013). But, they are territorialised and experientially important realms of their own, provided with infrastructure within which to work by the architecture. Building upon this is opportunity for a nuanced reflection upon the specific roles of those who can impact street edges across their multiple nested scales.

To provide a succinct overview, working within the context of Bobic (2004), strategic and wide-scale considerations for street edges often fall within the remit of regional and city planners. These professionals reflect upon streets and edges in terms of broad city infrastructure and networks, understanding how change within them might influence an edge's relationship to a city district or wider urban area. Down in physical scale are the professionals who play a role in the creation of the physical infrastructure of the edge and street – often architects and landscape architects, as introduced within the problems and issues (Chapter 2, Part 2). They make decisions in regards to the *form* of these urban realms, regularly on a site-by-site basis. In to this, on the ground floor of the buildings created, are the segment owners who are not built environment professionals. They have the ability to manipulate the material manifestation of these territorial *place*s housed within street edges, as discussed within this current investigation through the creation and manipulation of affordances. Lastly, the urban street inhabitant plays a key role in making the edge what it is through territorially occupying the street, engaging its edges and applying their *beholder's share*. This is whilst on occasion manipulating the street edge,

through moving chairs and opening doors for example. Deliberately within this model a key decision-maker has been left out. In relation to the built environment professions urban designers have been extracted for further investigation.

Urban design as a discipline has struggled for some time to establish a solid theoretical foundation as well as definitive decision-making role (Cuthbert, 2007; Marshall, 2012; 2016; Dovey & Pakfa, 2016; Foroughmand Araabi, 2017). Cuthbert (2010) puts this down to a fixation upon often physical and material considerations in relation to specific sites and projects. For him, this stems from the discipline's architectural underpinning established during its formation at Harvard University in the late 1950's. Such an approach is counter to what he sees as the need for greater focus upon interwoven social-spatial considerations, especially economics. During the construction of his argument he uses Sorkin (1991), and the below quote to drive home his argument –

> *Urban design has reached a dead end… While the task grows in urgency and complexity, the disciplinary mainstreaming of urban design has transformed it from a potentially broad and hopeful conceptual category into an increasingly rigid, restrictive and boring set of orthodoxies.*
>
> Sorkin, 1991, p. 155

There is opportunity, afforded by experientially manifested ideas developed during the current investigation as well as the ideas of others, for a reconsideration of urban design's role. This is specifically from a street edge and (post-)phenomenological perspective whilst considering the current disciplinary partitioning of expertise that influences these realms, which Cuthbert (2007); Marshall (2012) and Thwaites et al. (2013) have broadly examined. Currently, these ideas are in the form of a basic framework. However, with further development these ideas could provide a useful underpinning. This seeks to ground urban design within a solid theoretical foundation as well as position it with a distinct role in street edge as well as wider built environment considerations. The beginnings of this are set out below –

> Urban design has the potential to be socially focused and positioned to a greater extent as a discipline that mediates, communicates and links. Within this role, in terms of urban street edges, it looks to sit at the interface between top-down and bottom-up decision-making; where the infrastructure and *form* of street edges interweaves with territorialising actions establishing experientially significant *place* and *understanding*. It thus has the opportunity to be a field that acts as a go-between, spanning professional and non-professional decision-making. Within this, it mediates street edge influence and power, with the intended result being the opportunity to overcoming the *form*-heavy nature of existing street edges and built environment structures. Naturally it will therefore be a discipline that sits between scales, rather than being focused upon a specific scale of the street edge assemblage – linking plots and plinths with segments; segments with other segments within an edge as well as segments with users. As a result, urban design

ultimately becomes a field theoretically built upon Habraken's (1998) built environment controls, with the overarching focus towards finding a better balance across *form*, *place* and *understanding* within urban realm and particularly street edges.

It is obvious that this is only an initial framework. However, in direct response to the intentions of the current investigation, and specifically the practice aim and practice objectives 1 and 2, it provides a disciplinary field that has the capacity to deal more effectively with the complex qualities and issues associated with street edges, especially when seeking to change them. Significant here is how it is more socially focused rather than spatially driven; founded upon an understanding of the significant experiential benefit of territorialisation in urban street edges. Evidence for allowing such territorialisation was established during the current investigation through understanding how such actions can significantly impact urban street edge visual engagement.

Within the current section urban street edges have been forwarded as realms that span not only scalar considerations but also decision-making power and practices. To summarise the relationships across realms, disciplines and influence Table 3 has been formulated to provide an overview of the ideas discussed, whilst further highlighting the potential role of urban design in the future. Within this is also included a comment, based upon the eye-tracking insights from the current investigation, regarding how these professions might be able to contribute towards the creation of more experientially engaging street edges.

Profession / Discipline / Position	Scales	Role / Influence / Power	Built Environment Control	How to make a more engaging edge?
City / Regional Planning	City Organisation / Urban Networks	Top-Down Infastructure	/	Consider the significance of people's everyday experience
Architects / Landscape Architects	Block / Plot / Plinth	Top-Down Infastructure	*Form*	Implement *form* in to which territorialisation can take place, notably at segment scale
Urban Design	Mediator across scales	Go between Top-Down / Bottom-Up	Operationalising *Form / Place / Understanding*	Manage / mediate / communicate between and across professionals and non-professionals
Segment Owners / Managers	Segment	Bottom-Up Territorialisation	*Place / Understanding*	Seek to territorialise positively where appropriate, using affordances to project function and qualities to the street

Table 3 – Decision-making roles

Street and edge are often experientially entwined establishing a complex experiential multi-directionality spanning indoor and outdoor considerations

Two aspects of visual engagement with urban street edges, captured through mobile eye-tracking, provide opportunity to forward a holistic relationship that spans edge and street. In turn, this manifests both with a complex and entwined experiential multi-directionality. Firstly, across the 3d gaze mappings (Results Part 2.1) and segment visual attention mappings (Results Part 2.3) was highlighted how visual engagement with street edges along their extent intensifies and dissipates around certain points manifesting these realms with fluctuations in *directional / locational* significance (Thwaites et al., 2013) or experiential *hereness / thereness* (Cullen, 1971). Secondly, the finding that experientially significant segments are regularly at their most engaging when the division between indoor and outdoor realms becomes less well defined through the presence of permeability and transparency (Results Part 4.3). The first insight provides opportunity to question the perception that street edges, and the wider street, are experientially linear spaces that are solely directionally focused with forward dominance (*thereness*). This is whilst highlighting how visual engagement within the street if often manipulated by its adjacent edges and regularly at angles that break from its dominant spatial linearity, see gaze lines within 3d the mappings (Results Part 2.1). The experiential influence of transparency and permeability, manifesting a segment with lateral transitional quality, highlights how often there is potential for experience to be able to project across the division of realms, experientially merging adjacent indoor and outdoor spaces. This further adds to the way that the experiential multi-directionality spanning street and edge becomes manifested across, along and within street edges (Figures 16, 17 and 18 concluding with 19; Thwaites et al., 2013).

Inherently more work is required to examine these insights and ideas. However, an initial understanding, attained during the current investigation, provides new empirical and direct experiential insight from which to build. Firstly, the ideas developed provide further opportunity to begin to conceive streets as a series of spaces experientially impacted by the street edge adjacent to them rather than one single linear space. Here, street edges can fluctuate in experiential intensity based upon the composition of the edge's segments and how they come together within an edge. Such thinking aligns with street concepts focused upon the relationship between *link* and *place* (Jones et al., 2007a; 2007b; 2008), Thwaites et al.'s (2013) edge *locality*, *laterality* and *extent* thinking and Cullen's (1971) notions of *here* and *there*. The social implications of these ideas have been examined before (Thwaites et al., 2013). However, the current investigation adds a level of experiential detail spanning socio-spatial factors towards a strengthened multi-directional consideration of edge and street. The significance of this lies in how multi-directional street edge thinking might offer opportunity for more experientially engaging urban street edges. Detailed through Chapter 2 is how it has regularly been challenging to deliver experientially rich and appealing street edges for people to engage and use during their everyday lives. By breaking from the understanding that street edges are one-dimensional linear forms, towards multifaceted and fluctuating multi-directional experiential realms, a new foundation of thinking is established from

which to consider how these realms should be manifested in the future. The practice section that follows will build upon this notion and how it might be achieved.

Aligning with these ideas, there is also opportunity to question the established duality between indoor and outdoor street and edge realms that is often re-enforced by current professional disciplinary thinking (Cuthbert, 2007). This regularly defines indoors and outdoors in terms of whether a person has the sky or a ceiling above them; streets are thus categorised as outdoor realms and occupying built form (buildings) is indoors (Bobic, 2004). However, considering these settings as distinct spaces could potentially be restrictive when realistically human experience of these realms is often experientially entwined and within certain situations able to transition across and merge these adjacent spaces (Thwaites et al., 2013). This was examined during the current mobile eye-tracking investigation whilst highlighting the experiential significance of lateral qualities across street edges established through permeability and transparency. This realm connection has allowed Mantho (2014) to argue –

> … *certainly the relationship between the exterior space of the street and the interior space adjacent to it should be conceived as an essential relationship.*
>
> Mantho, 2014, p. 66

There is thus opportunity to forward a potentially more fluid and interconnected division of street and edge, which is more experientially manifested rather than morphologically defined; becoming *looser* (Franck & Stevens, 2007) than current disciplinary definitions allow. Obviously both street and edge have their own specific structural and wider urban needs. But, from the perspective of street inhabitants and their experiences there is the requirement to understand both edge and street not so much as linear spaces and forms but interconnected and merged experientially multi-directional realms. Such ideas again further our understanding of urban street edges, contributing insight to the knowledge aim forwarded and specific knowledge-focused objectives.

Implications of interconnected multi-directional street and edge relationship for practice when seeking to change street edges

A greater experientially manifested multi-directional and holistically entwined street and edge relationship has potential implications for street edge change. Firstly it could affect how design decision-making approaches intervention that impacts the lateral transitional quality of edges across adjacent indoor and outdoor spaces, established through the presence of transparency and permeability. Both of these affordances at a segment scale were found to be experientially significant as well as an enabler for wider segment affordances (Results Part 3.3). As noted, however, during the real-world problems discussion (Chapter 2), current professional design decision-making regularly suppresses these qualities and thus the opportunity for inside and outside realms to experientially and physically merge. As a result, this also restricts the potential

for experientially multi-directional street edges. However, the discussion also accepted that on occasion a strict and materially harsh realm division needs to occur in order to defined public / private thresholds. Based upon this, the argument forwarded that a better balance needs to be struck between providing edges that encourage greater ambiguity in definition across inside / outside in contrast to harsh yet functionally and structurally essential edges; transparent / permeable vs. hard / well-defined –

> *A recommendation for future research is therefore to identify under which conditions the various grades of active frontage are appropriate.*
>
> Heffernan et al., 2013, p.101

A possible way of re-balancing this relationship, in response to design decision-making, is to incorporate the progressive evidence and ideas developed within the current investigation with established notions relating to street hierarchy and connectivity. These have recently focused upon street and built form grading whilst examining centrality, linkage and urban morphology, running across a range of street scales from main roads through to alleys and pedestrian routes (Mehaffy et al., 2010; Porta & Romice, 2010; Feliciotti et al., 2016).

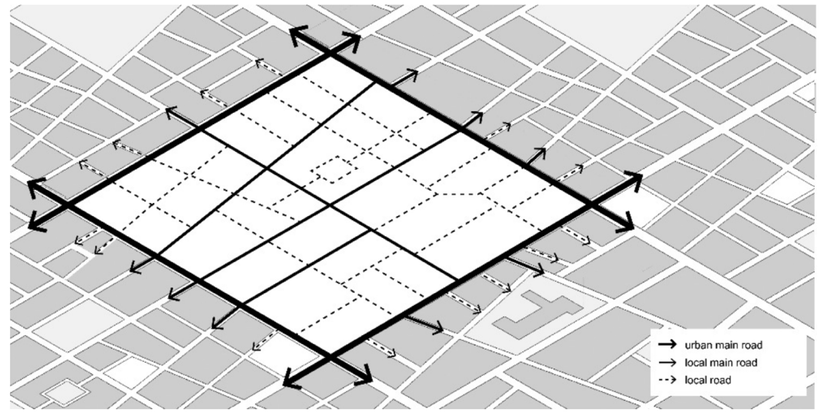


Figure 65 – Street hierarchy (Feliciotti et al., 2016, p. 9)

Figure 65 distils ideas encompassing contemporary street hierarchy and connectivity thinking, whilst examining two-dimensional block morphology and urban resilience. In to such a model is the opportunity to incorporate experiential street edge findings from the current investigation, notably, to begin with, that transparency and permeability significantly increased street edge engagement. Within such a hierarchical model, the *local roads* could be considered as places that hold heightened significance for human non-vehicular movement as well as stationary activity. They are thus places of potential importance for human experience and social engagement, stemming from their human-scaled and focused infrastructure. These could, therefore, be the streets with ground floor edges that seek to promote greater ambiguity in their definition

between indoor and outdoor realms through higher levels of permeability and transparency. Within these spaces there would be greater opportunity for experientially *loose* edges (Franck & Stevens, 2007) with strengthened laterality across them (Thwaites et al., 2013). Here, human sensory experience is able to break the division between adjacent indoor and outdoor realms more regularly and as a consequence encourage the potential for more engaging and experientially rich street edges. This is in contrast to the *urban main* and *local main roads* that generally have a greater vehicular focused infrastructure and dimensions. These spaces potentially require a more structured realm division with less permeability and transparency and thus a stronger material definition between inside and outside.

Building upon these hierarchical ideas there is also opportunity to align design decision-making with multi-directional street and edge thinking. Within this, streets that are considered as more pedestrian orientated (*local roads* in Figure 66) could also be promoted as significantly more experientially multi-dimensional rather than streets that are considered as having a singular, forward-focused directionality. These linear, singular directional-focused streets would be the vehicular urban links (*urban main* and *local main roads*). Such a model would provide opportunity to establish certain edges, and thus streets, more as places with opportunities for significant *hereness* (Cullen, 1971) / points of locational significance running along them (Thwaites et al., 2013), breaking from their often-accepted singular linkage function (Jones et al., 2007a; 2007b; 2008).

These ideas, responsive to grading that spans streets with greater and lesser pedestrian significance, could equip professional decision-making with a foundation for considering how and where change should be promoted in specific street edges. This starts with an initial consideration of the type of street within which the location of intended intervention sits followed by subsequent action. Such action can be the encouragement of more transparency and permeability, creating greater ambiguity between indoor and outdoor. Or, it could be wider intervention promoting the experiential multi-directionality of street and edge.

There is also opportunity to further these ideas by considering who deals with aspects of street edge design decision-making. A similar discussion was undertaken earlier whilst examining the relationship between top-down and bottom-up edge influence. These ideas can now be focused towards how professional knowhow might best be focused in relation to street edges in terms of their experiential multi-directional, indoor / outdoor spanning qualities. Figure 66 highlights a proposal in response to these ideas.

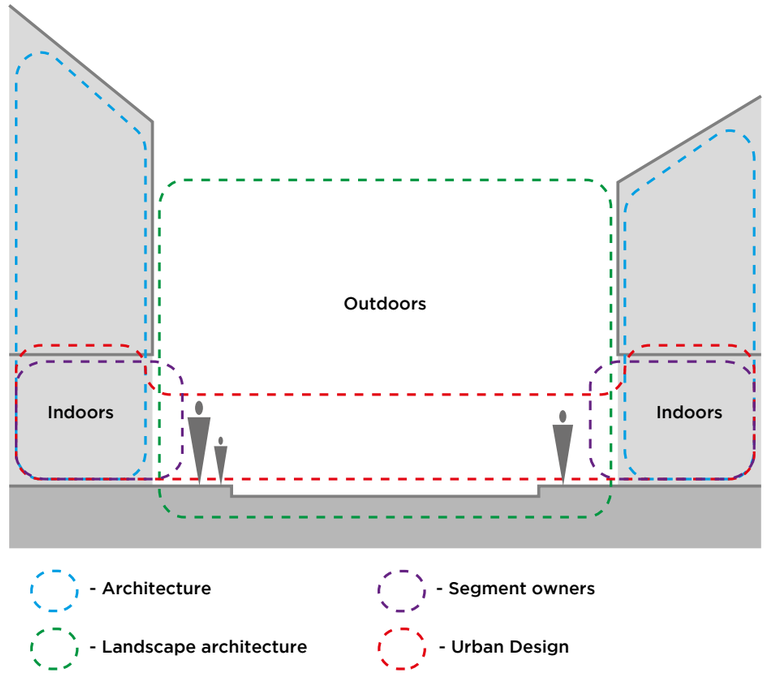


Figure 66 – Decision-making across urban street edges

Key within this proposal is the position that urban design adopts (red within the figure). As a field it again seeks to mediate and communicate across disciplines and realms. Significantly, in this instance indoors and outdoors. As before architecture (blue) and landscape architecture (green) have their roles in terms of providing an infrastructure within which territorialisation is able to take hold (segment owners shown in purple). Positioned within this overlapping assemblage, urban design in its adapted form has the potential to manage the relationship between the creation of edge infrastructure (architecture and landscape architecture) and territorialisation (segment owners / managers) three-dimensionally across indoor and outdoor realms. This is in order to provide the opportunity for an experientially engaging street edge to develop manifested within a loosened relationship between indoor and outdoor as well as a wider multi-directional edge consideration. Important here is the way that much of this interface across disciplines, spanning professional and non-professional decision-making, takes place across the ground floor of edge and street; which is also where the predominant amount of engagement takes place with these realms (Results Parts 2.1 and 2.2). Such thinking responds to practice objectives 1 and 3, whilst providing insight that contributes towards the overall practice aim. This done by furthering a comprehension that potentially no professional expertise can current deal with their needs in response to their experiential manifestation and that the architectural object should not be the primary consideration of street edges. Instead edge ground floors spanning indoor and outdoor realms is where professional reconsideration is required whilst focusing upon their experiential significance and multi-directionality.

Territorially established affordances manifested within ground floor segments impact the extent to which street edges are experientially engaged

The qualities of territorialised segments, nested within street edge ground floors, influence considerably the extent to which a street edge is visually engaged (Results Parts 2.1, 2.2, 2.3). It was forwarded within the CEF (Chapter 3) that these segments can either positively or negatively engage street inhabitants through affordances territorially manifested within them. Such territorial actions take place when personalising and territorialising a segment providing it with a given function, which is subsequently projected, or within some situations not projected, to street inhabitants (Results Part 3.1).

Building upon the affordance theory foundations of Gibson (1979); Maier et al. (2009) and Chiesi (2015), a range of segment specific affordances were developed during the CEF and examined during the mobile eye-tracking investigation. Firstly, distinctiveness was found to be experientially significant (Results Part 3.2). This builds upon the concept of *imageability* (Lynch, 1959; Ewing & Clemente, 2013); understanding visual attention and specifically saliency modeling (Itti, 2005; Rothkopf et al., 2007; Cerf et al., 2008; Borji, 2012). It relates to the ability of a segment to be identifiable and memorable through high-level aspects, encompassing definable objects that comprise a segment and features housed within them, and low-level aspects, relating to the constituent parts and make-up of these objects. Transitional quality, as discussed before in response to the experiential potential to break indoor / outdoor realm divisions, was found to be experientially significant (Results Part 3.3). This transitional affordance also relates to engagement along the length of an edge (Results Part 3.4). However, such an affordance is more nuanced due to its influence being established through the way segments come together in a series and how they are engaged in relation to each other. As a result segments can impact the extent to which surrounding segments are engaged. The affordance of sensory complexity was found to be an experientially significant (Results Part 3.5). This is through a segment's ability to capture multi-sensory attention, notably encompassing visual complexity as well as the sounds and smells that project from street edges. However, audio and olfactory stimulation was often minimal with visual qualities dominating. Related to all these affordances, temporality was found to be experientially important (Results Part 3.6). Here, shifts and changes to the make-up of a segment over time, notably the wider affordances introduced, was found to influence segment engagement. Overall, noticeable levels of these affordances within a segment, and across a series of segments, were often creates an engaging segment and as a result edge when combined (Results Part 3.1). Significant within this, however, is the way that such affordances never exist in isolation, often requiring each other to become activated, e.g. distinctiveness is often obsolete without a level of transitional quality laterally across the edge.

Inherently more work is required to explore the affordances initially shown to be experientially significant within the current investigation. So far, no specific measures were applied to the examination of segments and affordances within them, as carried out within similar work by

Porta & Renne (2005) and Ewing & Clemente (2013). Aligning with these is the opportunity to attempt to quantify in some way the affordances of interest, to examine in greater detail their individual and collective influence upon urban street edge experience. Whilst this is the case, the findings from this current investigation do add new insight into how urban street edges are engaged (knowledge aim) from a first-hand experiential perspective (knowledge objective 2).

Implications of experientially significant affordances within territorialised segments for practice when seeking to change street edges

The way in which territorialised affordance manifested within segments have the potential to create an experientially engaging street edge has implications for design practice. Importantly, building upon insights gained and previous discussion, is the fact that professional design processes rarely play a role in the creation of these territorialised edge qualities. Instead, design decision-making has the opportunity to provide an infrastructure (*form*) which people can subsequently territorialise and establish such affordances, through the personalisation and appropriation of segments (*place*) (Habraken, 1998). The multi-scalar discussion has already introduced this, setting out the potential of plinths and plots as the foundational infrastructure within which segments can become territorially establish. Into this, the affordances explored subsequently become manifested through territorial actions.

Significance also lies in how to inform people who territorialise segments, notably non-professional decision-makers like segment owners and managers, about the beneficial experiential potential that specific segment affordances hold. These are regularly people who do not consider ideas associated with evidence-based design thinking and it is often challenging, if not impossible, for them to utilise and get hold of insights from academic research and professional guidance. As a response, urban design, in its refined role, is again a profession that has opportunity to be an informant. Previously within the current investigation, this professional discipline has been positioned as a mediator, acting as a go-between spanning professional and non-professional remits. In terms of segment affordances, inline with this position, it has a chance to also inform about the significance of, and manage the manifestation of, affordances within street edge segments. In doing so it is a discipline that can promote positively territorialised segments, which when brought together in a series can create an experientially engaging street edge. As before, this evidence-based thinking contributes towards addressing the practice aim forwarded and how top-down and bottom-up design intervention can impact edge engagement (practice objective 2).

When thinking about and the seeking to change the urban street edge - moving forwards

There are 4 core considerations developed within the current investigation when thinking about the socio-spatial assemblage of urban street edges and how street inhabitants phenomenologically engage them. These build upon progressive conceptual ideas within existing discourse

(Chapter 3); evidence attained through mobile eye-tracking (Chapter 7) and the subsequent exploration and application of findings within the current chapter. These are visualised within Figure 67 and highlighted in the following.

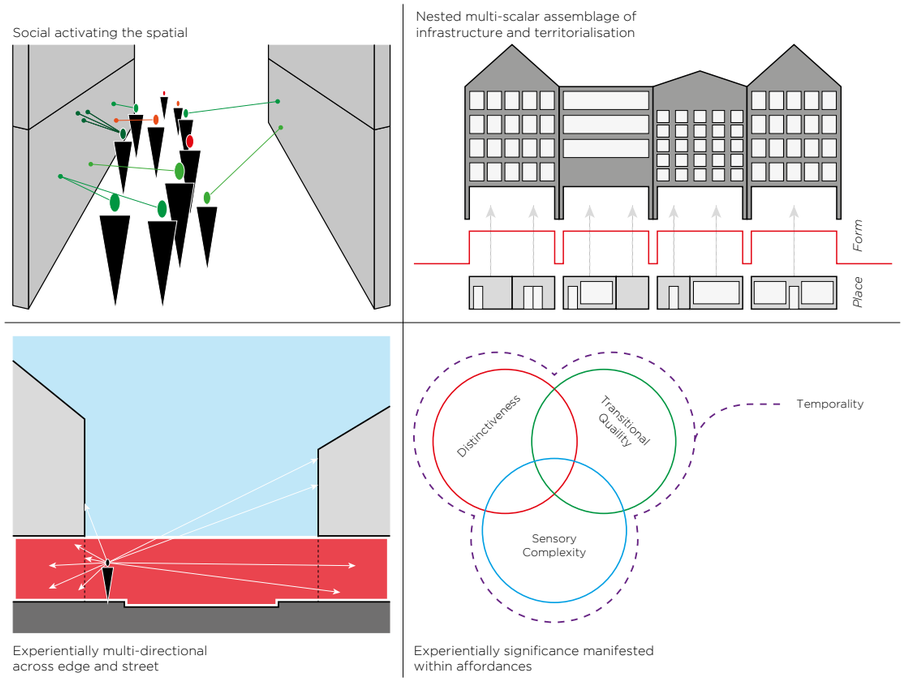


Figure 67 – Considerations when thinking about urban street edges

i) Street edges are engaged as socio-spatial realms with the everyday social actions of people inhabiting the street, spanning optional and necessary tasks, being required to activate its spatial and material manifestation. The street inhabitant, what they are doing and their everyday mind-set therefore play a key role in defining street edges – their *beholder's share*.

ii) Street edges are not engaged as singular entities but as nested multi-scalar assemblages comprising a complex relationship of morphological infrastructure and territorially appropriated and personalised realms. Within this, there is an experiential focus upon the segment scale of street edges, which are realms where territorial processes have the potential to take hold. When these territorial actions positively engage street inhabitants there is the potential to create experientially engaging segments and wider edges when a series of engaging segments come together.

iii) Street edges are complex realms in their own right, yet experientially part of and entwined multi-directionally with streets. Here, when permitted, engagement is able to project across the indoor / outdoor division of the edge, breaking the separation of realms creating ambiguity in realm division. Street edges also influences the linearity of the street, fragmenting its experiential directionality so that the street is not always engaged as solely a link but has the potential to be a place / series of places expressing variable levels of *hereness*.

iv) Street edges are predominantly engaged through their ground floor segments, which are influenced by territorialising actions whilst establishing affordances within them. These interconnected affordances have the potential to create an engaging segment and thus edge when positively territorialised segments, from the perspective of the street inhabitant, come together in a series.

As discussed throughout, these ideas address aspects of the knowledge issues highlighted within the problems chapter, regarding to how we think about urban street edges (Chapter 2). They provide practical and focused insight that is street edge specific (knowledge objective 1), detailing how these realms are experientially engaged by people inhabiting the street (knowledge objective 2). Through this, a progressive and up-to-date account of how urban street edges are engaged as socio-spatial realms has been empirically established (knowledge aim).

Significantly, the knowledge platform developed has also provided a chance to better understand the influence of professionalised change within urban street edges as well as highlight future opportunities in order to address existing practice issues (Chapter 2). Incorporation of ideas like the *beholder's share* has begun to establish a more integrated decision-making processes that is responsive to peoples' everyday actions within streets and how such actions influence the way design intervention is engaged. Much has also been discussed in terms of professional decision-making and its ability to create a more experientially engaging street edge through providing an infrastructure for bottom-up processes to take hold at a segment scale. Here, urban design has been reconceptualised as a discipline with a key role in terms of mediating top-down and bottom-up actions across the edge's multi-scalar assemblage as well as across its indoor outdoor gradient. It has also been positioned as a discipline that might be best equipped to help inform those with power over segment change about the experiential significance of specific affordances. Through these evidence-based developments, it has been highlighted how experientially street edges currently sit awkwardly across professional expertise and that urban design might be best suited to deal with mediating and managing its nuanced requirements (practice objective 1). It has been detailed how bottom-up factors can significantly impact street edge engagement through segment territorialisation, which are manifested within top-down established infrastructure (practice objective 2). Lastly, ideas have explored how considering urban street edges in terms of architectural objects is not experientially responsive. But, they should be approaches as a series of experientially significant territorially established ground floor segments (practice objective 3). As a result, a considerable amount of reconceptualisation has taken place in relation to how design decision-making should approach urban street edge change in the future (practice aim).

Part 2: Considerations in response to real-world urban street edge issues

The ideas forwarded within Part 1 establish a progressive knowledge and practice platform. This can now be used whilst reflecting upon real-world issues impacting how engaging urban street edges are for street inhabitants. During this, the evidence-based ideas within Part 1 will looked to be applied in order to influence issues associated with street edge homogenisation and scale, the abruptness of realm division between indoor and outdoor as well as issues associated with street edge decline. As throughout, the focus of attention will predominantly be upon the way new ideas can influence design decision-making. However, during the conversation a number of real-world example situations will also be detailed. These attempt to capture the essence of the ideas being forwarded in a succinct manner, highlighting opportunities where street edges and associated decision-making can progress in line with the progressive ideas already detailed.

Considerations for issues associated with homogenisation and scale

It was argued within the problems chapter that contemporary design decision-making solutions have resulted in the creation of urban environments, of which the urban street edge is a core component, which are homogenised in terms of their physical and sensory manifestation as well as functions provided. Linked to this the way street edges are disconnected in scale, in relation to the proportions of street inhabitants. There are three considerations that could begin to start addressing these issues.

People activate the spatial edge – the significance of the *beholder's share*

The integration of the beholder's share concept into street edge thinking and practice shifts the emphasis away from the production of complete, physical architectural entities, which may physically homogenise street edges, towards the establishment of a more socially responsive and adaptable decision-making mind-set. It places greater importance upon considering the significance of people and the way in which their cultural, economic, social, aesthetic, ideological, geographical and experiential identity within a given context impacts how they engage, use and experientially finish design intervention within street edges. This aims to avoid *placelessness* (Relph, 1977) whilst focusing upon the nuances and needs of people in a specific locale, rather than the perceived homogenising trends of society at large (Bobic, 2004; Thwaites et al., 2013; Ellard, 2015; Goldhagen, 2017). Significant also is the way that people become the measure of design intervention rather than architecture itself, with change thus being scaled towards people not surrounding existing infrastructure (Bobic, 2004; Gehl, 2010; Glaser et al., 2012; Porta & Romice, 2010; Speck, 2012). Design decision-making solutions intend to therefore be more grounded and responsive in accordance with the potentially rich and varied identity of distinct urban contexts, places and people (Habraken, 2005). Current, homogenised street edges often fail to take this into account by regularly providing a singular aesthetic / style / function / opportunity that suppresses potential for people to use and engage these realms in accordance with their individuality – their *beholder's share*.

> *Where the planners and architects need to create for mass use comes into conflict with the psychologist's emphasis upon individual differences.*
>
> Levitas, 1986, p.227

As Levitas details, correlating architectural intervention with people's individuality is not easy. However, a potential way to make design intervention less homogenising and human focused / scaled, thus aligning it with beholder's share thinking, is to forward decision-making that is more responsive to co-production, participation and tactics (Petrescu & Petcou, 2013; Petrescu et al., 2016). Through these processes there is greater potential for those who live within urban contexts to have a say in how the street edges they engage and use should function and be manifested based upon their everyday needs and desires. Within current planning processes this is already undertaken at some level through consultation and engagement with people (Blundell Jones et al., 2005; Romice et al., 2010), however, this is often top-down focused and prior to change being instigated (a new building for example). In a more co-produced framework everyday people have strengthened, bottom-up focused, opportunity to influence the existing places they engage (Petrescu & Petcou, 2013). This in turn provides potential for more grounded decision-making that is directly responsive to people's needs and at some level their beholder's share. Examples where this has worked successfully at a broad scale can be seen within the work of Atelier d'Architecture Autogéré and their urban tactics work focusing upon enabling people to participate in the appropriation of city spaces, notably, their Passage 56 project. At a smaller scale, Union Street Cafe in Sheffield is an example where people have had a choice in selecting how the café and workspaces function on a day-by-day and week-by-week basis. These cases, from the perspective of the user, don't homogenise but provide responsive human focused solutions that ground interventions within the context they are manifested.

Figure 68 – Community involvement at Passage 56 (left, www.urbantactics.org/projets/passage56) and Union Street (right, www.twitter.com/UnionStCowork/media)

The experiential significance of segments nested within a multi-scalar consideration of street edges

The make-up of segments, territorially established within street edge ground floors, significantly impact the extent to which street edges are visually engaged. A greater empirical and direct understanding of their experiential importance, as gained through the eye-tracking investigation undertaken, strengthens a justification for their consideration as well as street edge thinking that is responsive to multi-scalar ideas.

In response to the disconnected scale of contemporary street edges, these notions place significant emphasis upon making sure that street edges have an infrastructure that allows for human-scaled segments that are easily territorialised (Gehl, 2010; Glaser et al., 2012). By breaking down street edges into nested parts the emphasis shifts away from edge ground floors that are dictated by the often experientially disconnected scale of the buildings and wider morphology within which they sit. Instead, a finer grain of scalar understanding is promoted that has opportunity to be more responsive in accordance with small-scale appropriation and personalisation, thus aligning with edge characteristics that people engage to a greater extent. These ideas further the understanding, which is experientially manifested, of an interdependency between the unit of development (plots and plinths) and the unit of ownership (territorialised segments) (Porta & Romice, 2010). As a result, this starts to provide opportunity to break the trend of edge homogenisation caused by large-scale chain store cloning; a requirement stated by Wrigley et al. (2002); Simms et al. (2005); Ellard (2015) and Goldhargen (2017). The emphasis shifts towards smaller, easily adapted street edge spaces rather than large, investment-heavy edge ground floors that only homogenising companies are able to take over.

To aid in achieving this transition towards street edges that are more responsive to multi-scalar and segment thinking, insight can be gained from examples regularly found within many UK urban contexts, especially when moving away from city centres that have been affected by recent inner city building surges and trends (UTF, 1999; Punter, 2011; Madanipour et al., 2018). Outside of these central areas can often be found a number of distinct high streets, which have now been incorporated into the wider urban areas of large cities (Griffiths et al., 2008; Carmona, 2015). These streets regularly follow a build infrastructure that is more responsive to segment territorialisation due their more multi-scalar and nested morphology. Here, instead of block-based development, with a lack of a plinth scale and thus limited potential for experientially significant segments, these situations often have easily definable plots, plinths and territorialised segments. Such an urban structure has already been forwarded as socially and economically resilient by Porta & Romice (2010) and Feliciotti et al. (2016), and socially responsive by Thwaites et al. (2013). Examples of such areas can be seen in Sheffield along Sharrow Vale Road and Fulwood Road in Broomhill; in Manchester along Barlow Moor Road and Wilbraham Road in Chorlton-cum-Hardy; along Otley Road and North Lane within Headlingly in Leeds; in Bristol along Stokes Croft; in Edinburgh along Raburn Place in Stockbridge... and numerous other UK

urban locations outside of core inner city areas. Through suggesting these examples the intention is not to look back and seek to replicate such typologies often developed in the past. But, highlight situations where more socially and experientially responsive multi-scalar edges exist and take inspiration from them. Within these example situations, street edges have regularly managed to remain human-scaled and resist homogenisation, continuing to be engaging and reactive in accordance with the populations who use them daily. To some extent this might be because of economics, however, the built infrastructure established also lends itself to opportunities that can counter these issues.

Figure 69 – Plots, plinths and territorialised segments along Wilbraham Road (left) and Sharrow Vale Road (centre and right)

Experientially engaging street edges through territorially established segment affordances

The importance of territorialising acts during personalisation and appropriation have been discussed throughout the current investigation. Such a process has been shown to impact how engaging or disengaging urban street edges are, through the manifestation of affordances within a street edge's segments. Significant within this, building upon the previous discussion, is the ease with which segments can be changed (affordances adjusted) in line with the desires of their owner. Segments that are easily adapted, at an appropriate scale, provide greater opportunity for a range of people with a multiplicity of intentions to take ownership of these spaces and adapt them as they see fit. The result is inherently street edges with greater potential for variety; an experientially rich range of functions and subsequently affordances that can engage street inhabitants. Street edges that cannot be effectively appropriated and personalised, due to their scale and *form*-heaviness, suppress territorial opportunities and in doing so further add to the widespread issue of experientially and functionally homogenised street edges. This is because large chain-based functions are often the only people / companies who have the power and capital to manipulate these realms (Wrigley et al., 2002; Simms et al., 2005; Jones et al., 2007a; Ellard, 2015).

Significant within this is how the adoption of affordance thinking (CEF – Chapter 3, Part 3) moves beyond a fixation upon function towards a more open interpretation of use and experiential significance (Chiesi, 2015). Rather than thinking in terms of shop / office / house such a

mind-set emphases broader attributes encompassing within the current investigation – distinctiveness, transitional quality, sensory complexity and a degree of temporality. In combination, at a segment scale, these affordances were found to be experientially important. Territoriality that can establish such affordances and positively project them to street inhabitants therefore has greater potential to create a more engaging street edge. Scale and the ease with which ground floor realms can be adjusted are again important in establishing these affordances. The result is the potential for street edges that might be able to counter homogenisation as we move beyond function to a focus upon affordance and experience.

Recently, there has been the creation of urban settings, and loosely street edges, that begin to address some of these factors in a novel manner through thinking in a more territorially tolerant and modular way. This is noticeable, at a somewhat extreme level, through the use of shipping containers to provide infrastructure that can be effectively personalised and appropriated; for example – Boxpark in Shoreditch; Krynkl in Sheffield; Hatch in Manchester; Silo Park, Auckland, NZ and Manifesto Market in Prague. Whilst these boxes might not offer a perfect solution for all street edge situations they do highlight how an almost off-the-shelf product can be adopted to provide people with spaces they can easily adapt and make their own. Importantly, these containers are at a scale that allows for speedy territorialisation with limited resources. They also provide an infrastructure that is not *form*-heavy or dictated by architectural styling but spaces that are relatively blank in terms of significance. This means that the point of experiential focus is upon what goes inside the containers, and significantly the affordances territorially established, rather than the containers themselves. Design decision-making in relation to street edges can take a lot from this approach, in an attempt to become more adaptable and in some ways modular at a human-scale. This could allow a greater range of people to territorialise segments, establish experientially engaging affordances and counter the homogenisation of street edges.

Figure 70 – Territorialisation of shipping containers at Manifesto Market (left, https://www.prague.eu/en/object/places/3296/manifesto-market), Silo Park (centre) and Krynkl (right)

Considerations for issues relating to the abruptness of realm division across indoors and outdoors

The real-world issues section forwarded that there is currently a noticable trend towards urban street edges that divide indoor and outdoor realms in an abrupt and harsh manner. Whilst accepting that on occasion such a division is required, the discussion argued that a better balance needs to be struck as currently the extensive manifestation of harsh street edges is having a negative impact upon establishing engaging urban street edges. Others have argued a similar point (Bobic, 2004; Glaser et al., 2012; Speck, 2012; Heffernan et al., 2013; Thwaites et al., 2013; Montgomery, 2013; Ellard, 2015; Kickert, 2016). Findings from the current investigation provide the foundations for three ideas that could aid in addressing such an issue.

Finding a balance towards more ground floor segments that are transparent and / or permeable

Empirical insight from the current investigation highlights how urban street edges were engaged the most when their segments allowed engagement, notably vision, to project into them and sensory qualities to dissipate from them encompassing sights, sounds and smells. Within these situations a lateral transitional quality across indoor and outdoor realms was noticeable and afforded through the presence of transparency and permeability. The examination of segment photos provide real-world examples where the lateral quality across edge segments influenced engagement with them. Often the most engaged segments within each edge were those that were transparent with a degree of permeability, in contrast to the segments that were engaged to a lesser extent, which were often considerably harsher in terms of their realm division.

As detailed, it is clear that transparency and permeability cannot be within every segment and street edge. Potentially it is, therefore, beneficial to consider where it might be most effective to make sure such edge characteristics are promoted for the benefit of those inhabiting the street. For this, ideas relating to street hierarchy were discussed during the current chapter in order to aid decision-making (Mehaffy et al., 2010; Porta & Romice, 2010; Feliciotti et al., 2016). The edges of streets with heightened pedestrian significance were forwarded as the spaces best suited for greater levels of permeability and transparency. In contrast, vehicular dominated routes were considered as spaces that do not require such edge qualities as much.

An abrupt division of indoor and outdoor suppresses the potential for wider segment affordances

Building upon the overall importance of permeability and transparency is also the impact that these edge characteristics have upon the experiential significance of the wider affordances that influence segment and thus overall street edge engagement. During the current investigation the affordances of distinctiveness, sensory complexity, transitional quality and the temporality of each were explored. It was examined how each has the potential to influence segment visual engagement. It was also explored how they rarely occur in isolation and instead often work in conjunction with each other. During this, the heightened importance of transparency and permeability was highlighted. This was especially how such characteristics, manifesting lateral transitional quality, can enable or disable the wider affordances found to be experientially significant.

Such importance gives the rebalancing of abrupt real divisions across street edges increased significance.

A real-world example of such an influence, in relation to street edge change, was observed within two segments that were engaged by the study participants within the current investigation – Bar 1.1 and 1.2 on the walked side edge of Street 4. During the mobile eye-tracking study these were two of the least engaged segments of this street edge. Even though transparent to an extent (opaque) they lacked full transparency and permeability, as well as the wider affordances forwarded as experientially significant. Following the study, a considerable overhaul of these segments was undertaken by those who have territorialised them (owners and managers). The results of this are shown in Figure 71.

Figure 71 – Changes made to Bar 1.1 and 1.2 on walked side of Street 4; before on top, after below

As shown within Figure 71, the left segment had its area of opaque transparency vertically dropped so that street inhabitants can look into the segment more easily, especially at people who might be occupying tables near to the windows. As a result, the segment's distinctiveness, through high-level as well as low-level saliency (CEF – Chapter 3, Part 3), and temporality, through different people socialising within the edge, were increased. The right segment often had its door closed. Now, during opening hours, it often remains open improving permeability. This subsequently influenced the sensory complexity of this segment by allowing sounds (people chatting, music) and smells (pizza and beer) to emanate from it. Transparency through reducing the opaque window areas was also increased, which occurred at the same time as the creation of a new bottle-shop. The increased transitional quality across this segment allowed its new distinctiveness (high-level and low-level); sensory complexity due to the mass of varying colours and textures along with temporality, as different bottles often fill the window on a day-by-day basis, to be engaged by people in the street.

Even though no empirical evidence was collected to highlight the experiential impact of the segment changes it is anticipated, based upon the insights from this current investigation, that these changes would have had considerable influence upon the extent to which these two segments were visually engaged. Overall, this example highlights, from a real-world and everyday perspective, how segment affordances work in conjunction with each other and importantly how adjusting the experiential division between indoor and outdoor realms can influence the potential of wider affordances territorially established within segments. Such thinking needs to be taking into consideration when seeking to address the abruptness between indoor and outdoor street edge realms, with transparency and permeability being able to enable wider opportunities for street edges to be experientially engaging.

Don't think of the edge and street as distinct and separate entities but as experientially intertwined

When inhabiting streets, the surrounding edges play a major role in influencing how the setting is engaged (Bobic, 2004; Glaser et al., 2012; Heffernan et al., 2014; Kickert, 2016). In terms of a street and edge relationship, edges can experientially manipulate the directionality of the adjacent open space manifesting them as a forward focused *link*, with dominant *thereness*, or as a more experientially multi-directional *place*, with fluctuations in locational significance and *hereness* (Cullen, 1971; Jones et al., 2007a; Thwaites et al., 2013). In line with this, insights from the current investigation highlight how it is potentially detrimental to consider street and edge as experientially separate. It is more accurate to think of them as intertwined within a complex socio-spatial assemblage that is more multi-directional than often considered. Significant within this, notably in response to the abruptness of real divisions, is the way that transparency and permeability have the ability to experientially and physically merge inside and outside, further contributing to the edge and street's three-dimensional interconnectedness (Franck & Stevens, 2007; Thwaites et al., 2013; Mantho, 2014). In certain situations, where these edge characteristics promote a level of transitional laterality to the edge, the division between indoor and outdoor might be so ambiguous that a consideration of these realms as separate is counter productive at the point of human edge experience (Thwaites et al., 2013; Mantho, 2014). Here, inside and outside need to begin to be considered, to a greater extent than currently exists, as experientially interconnected and overlapping spaces rather than as separate realms.

Within many contemporary UK urban streets, the edges that experientially and socially define

these spaces often suppress an experiential overlap between indoor and outdoor (Chapter 2, Part 1). It is, therefore, potentially beneficial to take inspiration from wider contexts that accept for and actively work with a more integrated approach to indoor and outdoor edge relationships. Such a situation, where this regularly happens, can be seen within street edges of numerous Mediterranean, notably Spanish, urban contexts. The city centres of Seville, Madrid, Valencia and Cordoba, for example, often have street edges where indoor and outdoor are experientially less easy to define. Within Figure 72, street and edge merge to a considerable extent, through permeability, allowing experience to transition across them as well as physical occupation of indoor and outdoor to be more ambiguous. Obviously, these significantly more open edges are because of the climatic conditions of these areas. However, it is also in response to how people actively engage these realms on a daily basis whilst encouraging rather than suppressing social and experiential engagement.

Figure 72 - Ambiguity between indoor and outdoor along Calle Lineros, Seville

Considerations for the issue of decline

Even though predominantly forwarded as a problem related to social and economic factors, decline has been discussed within the current investigation as an issue compounded by the infrastructure and design of urban environments and street edges (Porta & Romice, 2010; Speck, 2012; Tarbatt, 2012; Goldhagen, 2017). From the findings gained and ideas developed there are two potential areas that might aid in addressing such an issue, specifically from a decision-making perspective.

Facilitating territorial appropriation and personalisation

The findings highlight how ground floor segments were often at their most engaging when affordances within them were territorially manipulated to serve and project a given function. In response to this, as discussed throughout, is the way that offering opportunity for segment personalisation and appropriation provides not only a more engaging street edge but also potential for a greater degree of experiential variety. Significant within this is the ease with which segment owners can manipulate a segment's physical and material manifestation, and thus affordances within it, with scale and the infrastructure provided impacting opportunity for territorial change. Consequently, such ideas have implications when considering decline.

An easily adaptable and changeable street edge, notably in terms of its segments, has greater ability to shift and adjust in-line with social and economic transitions, thus potentially allowing it to remain socially and experientially relevant in times of instability (Tarbatt, 2012; Feliciotti et al., 2016). This is whilst also providing opportunity for greater diversity (Gehl, 2010; Glaser et al., 2012; Feliciotti et al., 2016). As a result, an easily appropriated street edge has the capability to transition away from its often-dominant function, currently retail within many UK contexts, towards wider and more variable functions. This in turn offers the chance to alleviate street edge from being dictated by a singular economic driver, at the same time as potentially creating a more engaging edge for people inhabiting the street. Here, the emphasis shifts away from a focus and almost fascination with the function of a segment and edge. This is towards a stronger emphasis upon the significance of territorialisation and the manifestation of experiential affordances within the edge that can engage people inhabiting the street. Such thinking has been detailed by Jenkins (2018) whilst writing for the Guardian under the header –

> *Why high streets don't need shops to survive: Shoe shops and banks may be dying out but the 'experience economy' offers a future for town centres. They must grab it.*
>
> Jenkins, 2018, Guardian Website

In order to enable this experience economy, whilst countering decline, street edges need to become more easily appropriated and personalised. Already detailed is how small-scale spaces, like shipping containers, can be quickly and effectively manipulated by their owners. A reflection upon this, in terms of diversification of edge functions, further justifies the appeal of such a model with these spaces being able to accommodate a broad range of functions and affordances, with examples again being Boxpark and Krynkl. Here, offices, shops, restaurants, gyms, galleries, cafes, beauticians, libraries, breweries etc. have been able to accommodate and appropriate the small spaces created and not be dominated by the *form* of the spaces provided. Here, *place* dominates *form* (Habraken, 1998). In terms of decline, these modular considerations break from the perceived benefit of large-scale spaces, providing new and start-up opportunities for businesses and functions that are potentially not impacted so much by wider economic trends and downturns.

If it is empty, fill it; if it is blank, paint it

The current investigation found that vacant and blank ground floor segments were some of the least engaged aspects of urban street edges. Even though some of the segments investigated might not have been influenced directly by aspects of decline, vacant segments like these are still often associated with economic downturns, social transitions and the resultant closure of facilities housed within street edges. Based upon this insight, it is potentially worth considering how vacant segments and blank walls can be used in a way that benefits people's engagement with street

edges; how new affordances can be created in these edge spaces in order to make them experientially engaging. As discussed by Berwyn (2012) and de Boer (2012), vacant areas in an edge's ground floor should be seen more as an opportunity than a hindrance. Both of these researchers have forwarded the need for segments (in their case plinths, in line with Glaser et al., 2012) to be regarded as sites for the testing and temporary facilities –

> *Our vision for an ideal ground floor is one where vacant space does not exist; that vacant periods are foreseen and 'curated' to give people a chance to test an idea, even for a few days or a few weeks. This requires a transparency of ownership, a flexible approach to bureaucracies, and somewhere to store all the knowledge on an area so it is easily accessible.*
>
> Berwyn, 2012, p. 147

In turn, these ideas have the potential to create more experientially engaging street edges, proving a greater number of affordances with which street inhabitants can engage rather than blank and vacant areas of street edges. Such an opportunity stems directly from the ability of urban street edge segments to be easily territorially appropriated and personalised, a point raised throughout. However, it also requires a mind-set that promotes the potential for pop-up, short-term interventions within street edges to take place (Dobson, 2015). The result can often be the continued success of a street edge, keeping it vibrant and engaging long after permanent facilities have moved out (de Boer, 2012; Berwyn, 2012).

Ideas like this are starting to take hold in many locations. Berwyn (2012) highlights how *meanwhile* spaces have been successful in London and de Boer (2012) has shown the success of pop-up spaces in The Hague. Recently in Chicago licences have started to be granted for short-term, pop-up interventions within street edges in order to reduce the burden of financial and legal requirements associated with long-term leases and licencing (City of Chicago, 2018), i.e. within the context of the current investigation, make territorialisation easier. A key aim within this is to –

> … *bring vibrancy to neighbourhoods by filling vacant storefronts and providing more and varied retail options to all Chicagoans.*
>
> City of Chicago, 2018, City of Chicago Website

Within the urban context used as the study location within the current investigation (Sheffield), people have sought to use empty spaces within street edges as gallery / events locations. Centred around the *Sheffield Showcase* scheme a number of vacant segments, affected by decline, were taken and used to show artwork as well as products that were being produced in the city. This meant that empty edge spaces did not become blank and disengaging but were promoted as continually changing aspects of the built environment that people could engage with. Along with this, the *Feature Walls* project sought to invite well-known artists to paint artworks onto blank walls around the city, reinvigorating edges within the city that might have suppressed engagement (Figure 73). Edges can thus became distinctive places to visit and artworks in their own right, diversifying beyond economically driven functions towards spaces of greater public engagement.

Figure 73 – Feature walls in Sheffield (www.streetartsheffield.com)

Considerations in response to real-world urban street edge issues - moving forward

The intention has been to apply the evidence-based ideas developed during the current investigation in response to real-world issues that have negatively impacted urban street edges. Subsequently, steps have been undertaken towards starting to address the question that was posed at the beginning of the study – *how might we be able to make more experientially engaging urban street edges?* However, prior to answering this there are methodological considerations requiring examination, stemming from the use of mobile eye-tracking. There are also limitations associated with the current investigation that need exploring.

Part 3: Methodological considerations and investigation limitations

Beyond providing new empirical insight into how urban street edges are experienced, along with how practice should start to deal with these complex realms, there has been advancement through the current investigation in terms of how street edges are examined and studied. This was achieved through the use of an underutilised data collection approach – mobile eye-tracking. Alongside this, novel visualisation techniques were developed as well as detailed analytical processes employed to provide a rigorous account of how street edge visual engagement is structured. Through this, there has been advancement in how urban experience is captured directly, articulated and evaluated.

Mobile eye-tracking, within the everyday complexities of real-world urban streets, offered a tool capable of gaining detailed insight into the nature of peoples' visual engagement with street edges as well as the wider components that comprise streets. It is a method that works with the way peoples' vision continually shifts and adjusts in accordance with their surroundings. This is significant when examining urban settings that are forever-changing and comprise a milieu of multi-sensory stimuli. It therefore provided direct understanding, from an direct perspective, of what aspects of streets edges were experientially prominent. Significantly, it allowed an in-depth comprehension of how social actions manifested within everyday tasks in combination with material qualities and spatial characteristics holistically influenced street edge visual engagement. This was at a level of detail,

which has until now, been challenging to capture empirically. In doing so, it provided a method that starts to address points raised by Dovey when considering places –

> *Place is an inextricably intertwined knot of spatiality and sociality. In this context there is a clear need for approaches that cut across the sociality / spatiality divide.*
>
> Dovey, 2010, p.6

Eye-tracking acted as a technique that cut across this socio-spatial divide, providing phenomenological understanding of how a combination of these factors impacted street edge visual engagement. Significantly, this was achieved in a way that did not require the use of observational techniques, with subsequent attempts to interpret the influence of complex socio-spatial factors, or the verbal articulation of experiential phenomena, which people might have struggled to describe (Tuan, 1977). It was, therefore, a method able to go beyond regularly adopted approaches, which might have made the nuanced nature of edge engagement challenging to understand.

Beyond the findings themselves, it is clear that the current investigation has further highlighted the potential of real-world mobile eye-tracking for future research into human-environment interactions. Previous investigation has highlighted its usefulness to urban planning and design within a static laboratory context (Noland et al., 2017). The current investigation, however, furthers its effectiveness within outdoor, real-world settings in order to capture a more realistic account of everyday urban experience.

In order to show how people visually engage with urban streets and their edges, new data visualisation and mapping techniques were developed during the current investigation. These were notably Street DNAs (Simpson, 2018) and three-dimensional gaze mappings. These two techniques specifically, but also the other articulation approaches developed and employed (segment mappings, extent overlays and ranked segment photos) were able to distil what was potentially an incompressible amount of complex data into readable and useable visual formats. In doing so, they provided insight into the socio-spatial nature of edge engagement at a level of detail that has previously been challenging to articulate. Importantly, this was in a way that sought to engage the viewer, aligning with current ideas in contemporary data visualisation (Rose, 2001; Lima, 2011; McCandless, 2012; Dovey et al., 2018). Through this, they become an effective tool for communicating complex information, potentially in the future, to wider design decision-makers spanning disciplinary specialisms as well as the general public. These groups might not fully understand the significance of statistical analyses but can often comprehend the visualisation of information that gets to the essence of the complex phenomena being shown. The graphics, therefore, looked to engage rather than alienate. This is whilst seeking to be visually stimulating for a broad spectrum of viewers who might not be trained in the interpretation certain information types.

The production of data visualisations also offered the lead research with an initial insight into the information collected; their creation was as much to do with process as product. This aligned with

ideas forwarded by Deleuze & Guattari (1987) and Corner (1999) who advocate the need for mapping complex information that would be challenging to interpret and understanding without the action of producing an artefact. Therefore, whilst coding the data in order to produce the Street DNAs; drawing the individual lines during the 3d mapping of peoples' gaze; and arranging the ranked segment photos, a greater insight into the nuances of visual engagement with urban street edges was gained.

The data visualisations produced subsequently provided a grounding from which further analytical investigation could take place. This examined ideas forwarded with quantitative rigor in order to understand in detail the experiential phenomena captured. Building upon a post-phenomenological framework of understanding (Ihde, 2008; 2009), these insights established pragmatic evidence, whilst maintaining a human focused, socio-spatial accepting ontological foundation. The analyses therefore took into account the phenomenological richness of street edge visual engagement whilst attempting to provide useable evidence toward informing design decision-making approaches.

Overall, the methodological processes employed provided a new evidence-based knowledge platform from which the ideas developed could build. Without the use of mobile eye-tracking and associated analytical techniques the notions forwarded would not have been possible.

Investigation limitations in order to influence future research

It is accepted that insights gained and ideas developed during the current investigation cannot completely solve the multi-faceted issues impacting urban street edges. Many of the issues raised are also entwined with wider social shifts and economic factors. The intention was, therefore, to provide a valued contribution to on-going ideas and debate regarding how it might be possible to address problems influencing urban street edges, specifically from a built environment research and practice perspective. Alongside this is also the recognition that there are limitations within the current research that are beneficial to point out. This is to aid in future research opportunities whilst refining the approaches undertaken.

Even though multi-sensory accepting, the current investigation was focused towards using visual engagement to build an experiential understanding. This is due to the fact that mobile eye-tracking was used, based upon the understanding that it is currently one of the most effective tools for collecting insight into peoples' experiential engagement with complex stimuli (Uttley et al., 2018). Its use was philosophically, theoretically and methodologically grounded, as detailed within Chapter 4, however, it is worth accepting that there has been a dominant focus towards using vision. This may have suppressed a comprehensive understanding of street edge experience, which is inherently multi-sensory. Eye-tracking is also a technique that is sometimes limited in its ability to capture embedded cognitive insights; an inherent disconnect between eye and mind. This was detailed earlier within Chapter 4 and is the focus of the co-authored Uttley et al. (2018) book chapter. Future

studies could look to use eye-tracking in conjunction with wider sensory exploration and methods as Ladouce et al. (2017) have recently started to examine. This might provide greater multi-sensory and cognitive insight, building upon the understandings gained during the current investigation.

Mobile eye-tracking as a method also has its technical limitations. This is notably due to the complexity of both the equipment as well as data collected. The equipment, even though innovative, can be quite awkward with wires, backpack containing a laptop and cap making for a complicated arrangement of apparatus on the wearer. Even though this is the case new eye-trackers, notably those developed by SMI (www.smivision.com), are being created that are lighter and importantly wireless allowing for a less intrusive setup. The data collected through the technique can often fluctuate in quality, notably, due to sunlight on the tracking cameras. However, measures were undertaken (cap) to reduce the impact of this during the current investigation. The data collected when using eye-tracking is also hard to work with (video output), especially when captured within multi-faceted and shifting settings like urban streets. As a result, coding time (manual) is extensive and labour intensive. This makes it challenging to obtain a large data set, especially when working within a restricted timeframe. Manual coding also starts to introduce potential for human error into the data analysis, although measures were undertaken within the current study to check for this. Future research needs to take these restrictions into consideration. However, with eye-tracker technology continually improving new and refined opportunities will soon be available for built environment researchers.

The current study was urban street edge specific and used a single location – Sheffield. However, it is believed that transferable insights have been gained. Whilst this is the case it needs to be accepted that the understandings attained were constructed whilst capturing data from a single location. Further research is required to explore if the findings are fully generalisable within wider contexts. The edges studied were also characteristic of mixed-use UK city centre streets, highlighting the examination of a common typology. However, modern cities across varying contexts comprise a multiplicity of street types. Again, further research is required to examine broader street typologies.

The ideas developed and insights gained were focused specifically from the perspective of people inhabiting urban streets and experiencing their edges. The exploration did not specifically examine considerations that influence wider groups who engage street edges. For example, people who inhabit street edges, rather than the street, and those who territorially adapt them, notably their ground floor segments. Further investigation could examine the way in which these groups engage street edges, providing further insight into their socio-spatial workings.

Overall, there is considerable scope for further investigation that could build upon the solid foundations that the current investigation has established.

Chapter 9

Conclusion

How might we be able to make more experientially engaging urban street edges?

The current investigation set out to understand in detail, from a new empirical and direct perspective, how people inhabiting streets engage with the street edges around them. With the insights gained, the intention was to then inform *how we might be able to create more experientially engaging urban street edges*. In order to achieve this, the processes visualised within Figure 74 were employed towards a final conclusion.

Spanning the knowledge gained and ideas developed one key notion stands out and runs through much of what has been forwarded –

The need for urban street edges to be able to accommodate and encourage the territorialisation of experientially significant segments within their ground floors.

Urban street edges that are structured in this way, allowing and actively facilitating the appropriation and personalisation their ground floors, provides the best opportunity for experientially engaging urban street edges. However, this notion also builds upon the understanding that street edges, from the perspective of the street inhabitant, are i) spatial realms that experientially require activation through social actions in order to establish significance; ii) multi-scalar assemblages comprising morphological infrastructure and experientially significant territorialised realms; iii) multifaceted realms in their own right, yet experientially entwined with adjacent streets establishing a complex experiential multi-directionality and that iv) engagement with them is influenced by the territorial establishment of affordances within their ground floor segments.

Such thinking has been evidenced during the current investigation through data gained whilst using mobile eye-tracking and associated analytical techniques. This methodology has provided new empirical insight into urban street edge experience from a perspective that has previously been challenging to capture and articulate.

The ideas developed during the current investigation have knowledge, practice and real-world significance, providing opportunity to address issues currently associated with these factors. This is whilst also contributing to a growing body of progressive urban edge and interface thinking that works towards delivering experientially rich and socially beneficial urban environments for people to inhabit and use during their everyday lives. The current work undertaken, therefore, contributes new evidence-based and innovate insights that seek to help ensure the future prosperity as well as social and experiential sustainability of urban environments.

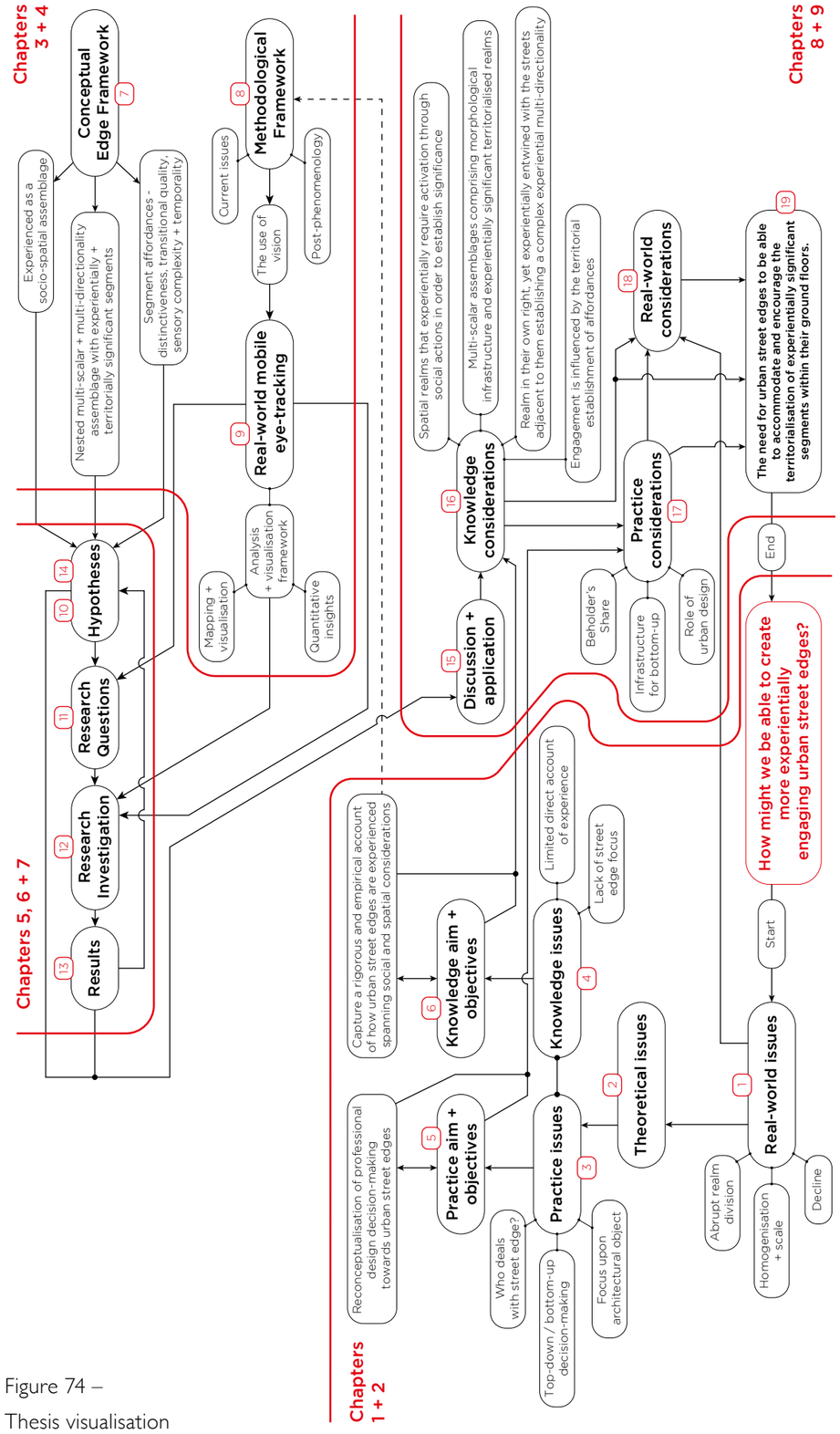


Figure 74 –
Thesis visualisation

Current research output and impact

The output from the current investigation aligns with the aims of the *Centre for Socio-spatial Urbanism* (CfS-sU) at Department of Landscape, University of Sheffield. As a result, the application of insights gained have been structured in a manner that has implications for research, practice and teaching.

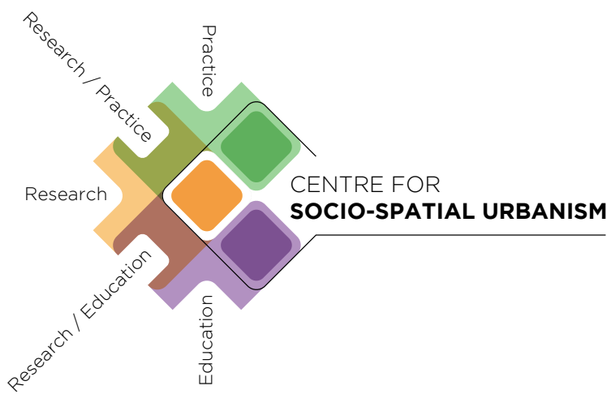


Figure 75 – Centre for Socio-spatial Urbanism

Academic output and publication

Simpson, J. (2018) Street DNA: the *who*, *where* and *what* of visual engagement with the urban street. *Journal of Landscape Architecture*, 13(1), 50-57.

Uttley, J., **Simpson, J.** & Qasem, H. (2018) Eye-tracking in the real world – insights about the urban environment. In: Aletta, F. & Xiao, J. (eds) *Handbook of Research on Perception-Driven Approaches to Urban Assessment and Design.* Hershey, IGI Global.

Simpson, J., Thwaites, K., Freeth, M. & Simpson, K., J. (In Press) Visual engagement with urban street edges: insights using mobile eye-tracking. *Journal of Urbanism.*

Thwaites, K., **Simpson, J.**, Heath, P. J. & Mathers, A. R. (In Review) Microenvironments: towards a socio-spatial understanding of territoriality for urban design theory. *Journal of Urban Design.*

Thwaites, K., **Simpson, J.** & Simkins, I. M. (In Review) Transitional Edges: towards development of a socio-spatial evaluation toolkit for urban street interfaces. *Urban Design International.*

Conference papers / presentations

International Association of People-environment Studies Conference, Timisoara 2014. *Do landscape architects really understand what the public value in urban environments?* (Winner of the Young Researchers Award 2014).

International Association of People-environment Studies Conference, Lund 2016. *Transitional Street Edges: an empirical investigation through eye tracking.*

Practice output and impact

Ongoing collaboration and discussion with colleagues in professional practice, notably Planit-IE, looking towards the incorporation of ideas into urban landscape and design practice. CPD opportunities discussed as well as consultancy work specifically in relation to bid work focusing upon urban streetscape and street edge design.

Presentation and discussion of findings with Sheffield Business Improvement District (BID), to add empirical insight to their decision-making and inform how best to guide development whilst advising property owners within Sheffield city centre.

Teaching output and impact

Incorporation of ideas and empirical insights into teaching within undergraduate LSC337 (Landscape Planning and Urban Regeneration) and postgraduate LSC5030 (Urban Landscape Design) learning. Major re-orientation of LSC5030 undertaken to further incorporate ideas from this current investigation into research-led teaching agenda, see – *'Department of Landscape training future professionals to make a social difference'* – https://tinyurl.com/yctlqu4h

Future output and impact

Whilst the findings and output from this current investigation have already had impact spanning academic publication, practice and teaching there are a number of future opportunities that build upon the foundations established.

Future academic output and publication

Post-phenomenology and the beholder's share in built environment research and decision-making – Using insights from the philosophical foundations of the conceptual edge framework (CEF – Chapter 3) and methodological discussion (Chapter 4) seek to examine further the potential of these two integrated progressive ideas. This is in response to similar papers within fields of geography (Lea, 2009; Ash & Simpson, 2014, Spinney, 2014) and technology (Ihde, 2008; 2009; 2011).

Real-world mobile eye-tracking, 3d gaze mapping and urban street edge research – Expand upon the 3d mapping technique developed within this current investigation to explore the potential of real-world mobile eye-tracking further and such an analytical visualisation technique.

The urban street edge as a multi-scalar assemblage and the experiential significance of territorialised segments – Detail how urban street edges should not be considered as singular entities, based upon evidence of how they are experientially engaged, towards an empirical understanding of the significance of ground floor segments.

The experiential measures of urban street edges: the affordances of territorialised edge segments – Introduce the affordances developed within this current investigation (distinctiveness, transitional quality, sensory complexity and temporality of these) and how they individually and in combination influence edge engagement.

The role of urban design as a mediator – Building upon recent discussion from Cuthbert (2007, 2010); Marshall (2012; 2016) and Foroughmand Araabi (2017), as well as also Heath & Thwaites (in development) to discuss how urban design can be positioned so that it sits between decision-making roles (top-down and bottom-up) managing the relationship between where infrastructure stops and territorialisation begins.

Future research potential arising from investigation insights

Further exploration into the relationship between human experience, territorialisation and adaptability of urban street edges – This current investigation has started to establish the significance of territorial adaptation in relation to urban street edge engagement. Further study could look to build upon such insights incorporating ideas from post occupancy analysis (POE) to explore a more complete understanding that is focused to a greater extent upon understanding territorialising actions.

The experiential impact of urban street edge diversity and variety – The current investigation began to highlight, but did not explore in significant detail, the way in which a varied urban street edge might impact urban street edge engagement. This influencing factor requires further examination building upon the insights already gained.

The theoretical foundations of urban design and its role as a built environment discipline – The beginnings of an exploration into the role of urban design have started to be explored within this current investigation, notably, through its positioning as a mediator across decision-making roles. Further investigation could look to build on this, exploring in detail its theoretical and philosophical foundations towards new disciplinary orientation.

The urban street edge and built environment well-being – Introduced earlier was the influence that

built environments and urban street edges can have on human well-being. Whilst this was not fully explored within the current investigation the foundations for further research have been established, especially through the use of techniques such as real-world mobile eye-tracking to capture an experiential insight into street edge engagement.

Final Statement... *I know what you've been lookin' at.*

The current investigation has made a significant and unique contribution to our understanding of urban street edges. Resulting from the work undertaken, we now have a more detailed and robust knowledge of how these realms are experienced and the factors that impact this experience. Beyond this, we have a significantly better understanding of how to make street edges more experientially engaging for street inhabitants going about their everyday lives.

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Glossary

Affordance – Theoretical concept regarding how physical and material aspects / qualities of an environment can provide opportunity for a certain social behaviours, engagement and experience. (Foundations – Gibson, 1979; Maier et al., 2009; Chiesi, 2015)

Assemblage – Ontological perspective focusing on the connections between social processes and spatial considerations, rather than things themselves (people / places / objects). (Foundations – Deleuze & Guattari, 1987; Dovey 2010; Dovey & Wood, 2015)

Awareness Scales – A series of nested urban street edge scales (city, district, sanctuary area, block) that cannot be physically inhabited but people are cognitively aware of them, providing a location within which the phenomenological scales of the urban street edge are nested. (Foundations – Lynch, 1960; Hillier & Hanson, 1984; Feliciotti et al., 2016)

Becoming – Linked to assemblage thinking where social and spatial dimensions are continually regarded within a state of fluid temporality; stabilised through territorialising / re-territorialising practices. (Foundations – Deleuze & Guattari, 1987; Dovey 2010; Dovey & Wood, 2015)

Block – An awareness scale establishing a link with the phenomenological scales of the urban street edge; creates morphological structure in relation to larger awareness scales (sanctuary area, district) whilst also providing a footprint upon which phenomenological urban street edge is formed. (Foundations – Jacobs, 1993; Bosselmann, 1998; Bobic, 2004; Feliciotti et al., 2016)

Bottom-up decision-making – on-the-ground, regularly not professional, actions that are undertaken by people who engage the locale of intervention. (Foundations – Sabatier, 1986; Habraken, 1998; Thwaites et al., 2013)

Cloning – Issue where urban street edges house the similar functions (often chain stores) regardless of location thus re-enforcing aesthetic and experiential homogionisation as well as placelessness. (Foundations – Wrigley et al., 2002; Simms et al., 2005; Jones et al., 2007a; Griffiths et al., 2008; Ellard, 2015)

Decline – Issue with the urban street edge where social and economic factors impact the functions and vitality of these spaces, however, also linked with the infrastructure of urban street edge and its potential to be territorially personalised and adapted. (Foundations – Jones et al., 2007a; Griffiths et al., 2008; Wrigley & Lambiri, 2015; Kickert, 2016)

Distinctiveness – Affordance of urban street edge segment established through its ability to be identifiable, recognisable and memorable; linked to imageability yet focused at an everyday level through the way salient features / aspects (high-level and low-level) are manifested and come together within a segment. (Foundations – Lynch, 1960; Stevens, 2006; Ewing & Clemente, 2013)

District – An awareness scale, sometimes know as quarter, comprising defined areas that come together to create a city that people can mentally go inside of but not phenomenologically inhabit. (Foundations – Lynch, 1960; Hillier & Hanson, 1984; Bosselmann, 1998)

Extent – A multi-directional quality of the urban street edge, which relates to socio-spatial attributes that influence the intensity of engagement acting along its length; i.e. directional / location emphasis of differing territorialised segments running along an edge's ground floor. (Foundations – Cullen, 1971; Thwaites et al., 2013)

Form (control) – Physical and spatial dimensions of the built environment that provides the material, organisational and stable infrastructure into which human territorial processes establish. (Foundations – Habraken, 1998)

Here(ness) – A setting (part of the urban street edge), which diminishes directional emphasis and sensation through promoting locational qualities; the opposite to thereness. (Foundations – Cullen, 1971)

Homogenisation – Issue associated with street edges where similar design language and edge typologies have been employed, regardless of context, thus suppressing locationally specific qualities and manifesting placelessness. (Foundations – Relph, 1976; Bobic, 2004; Gehl, 2010; Muminovic & Radovic, 2011; Thwaites et al., 2013; Ellard, 2015)

Human scale – Attributes of the environment that are proportional and responsive to the size, speed and sensory system of people going about their everyday lives. (Foundations – Gehl, 1987; 2010; Glaser et al., 2012)

Laterality – A multi-directional quality of the urban street edge, which relates attributes that influence the intensity of engagement transitioning across its indoor/outdoor division of realms; i.e. permeability of a segment allowing engagement across it. (Foundations – Cullen, 1971; Thwaites et al., 2013)

Link (and place) – In response to place, links are streets that are predominantly delineated as functional, transport-focused corridors connecting together urban settings. (Foundations - Jones et al., 2007a; 2007b; 2008)

Locality / Locational – A multi-directional quality of the urban street edge, which relates to attributes that influence the intensity of engagement by diminishing directional emphasis and promoting hereness. (Foundations – Cullen, 1971; Thwaites et al., 2013)

Looseness – Qualities of an environment that provide it with a dynamic level of ambiguity, therefore, allowing opportunity for wider interpretation, appropriation and responsiveness over

time. (Foundations – Franck & Stevens, 2007; Dovey, 2010)

Mobile eye-tracking – Methodological tool for capturing an individual's focus of visual engagement in response to the environment around them and what they are doing within it. (Foundations – Holmqvist et al., 2011; Simpson, 2014; Duchowski, 2017)

Multi-directional – The combined influence of socio-spatial attributes influencing the directional / locational emphasis of the urban street edge at a phenomenological level. (Foundations – Cullen, 1971; Thwaites et al., 2013)

Multi-scalar – The understanding that the urban street edge is not a singular entity but comprises a number of nested scales encompassing plot, plinth and segment at a phenomenological level; city, district, sanctuary area and block at an awareness level. (Foundations – Bobic, 2004; Porta & Romice, 2010; Feliciotti et al., 2016)

Negative segment territorialisation – An urban street edge segment territorialised in a manner that does not engage people inhabiting the street e.g. an impermeable blank wall. (Foundations – Altman, 1975; Gehl et al., 2006; Karrholm, 2012)

Permeability – The potential for access and experiences, often multi-sensory, to transition across a division of realms, notably, the indoor / outdoor interface of edge segments. (Foundations – Gehl et al., 2006; Gehl, 2010; Thwaites et al., 2013)

Phenomenology – Philosophical stance providing ontological and epistemological foundation for comprehending places based upon the importance of lived experience and people's interactions with and within the environments they inhabit. (Foundations – Merleay-Ponty, 1962; Laverty, 2003; Kafle, 2011; Cresswell, 2015)

Phenomenological Scales – A series of nested urban street edge scales comprising the socio-spatial edge (plot, plinth and segment), which can be fully engaged by people when inhabiting the street. (Foundations – Dovey, 2010; Porta & Romice, 2010; Glaser et al., 2012; Thwaites et al., 2013; Feliciotti et al., 2016)

Place – Multi-disciplinary concept used as a tool for understanding the complexity of and relationship between spatial settings and the everyday human processes that establish them and play out within them. (Foundations – Relph, 1976; Tuan, 1977; Casey, 1997; Wylie, 2007; Dovey, 2010; Cresswell, 2015)

Place (control) – Territorial dimension of the built environment established through the appropriation and personalisation of form, creating connections and meanings between people and the settings they own and inhabit. (Foundations – Habraken, 1998)

Place (and link) – In response to link, places are specific destinations where human focused, often-prolonged activities occur. (Foundations - Jones et al., 2007a; 2007b; 2008)

Placeless(ness) – Negatively perceived settings that lack grounding to their context that people fail to establish meaningful connections towards. (Foundations – Relph, 1976)

Plinth – The ground floor of a building / built plot, compressing the vertical scale of the urban street edge to a more human considerate scale. (Foundations – Glaser et al., 2013)

Plot – Portion of land, which when built upon provides the morphological infrastructure of the urban street edge. (Foundations – Porta & Romice, 2010; Romice & Porta, 2015; Feliciotti et al., 2016)

Portal – A setting with high levels of multi-directional connectivity and permeability to adjacent realms, in turn producing a distinct setting with its own unique locational qualities. (Foundations – Cullen, 1971; Thwaites et al., 2013)

Positive segment territorialisation – An urban street edge segment territorialised in a manner that actively engages people inhabiting the street e.g. café with an active frontage (Foundations – Altman, 1975; Gehl et al., 2006; Karrholm, 2012)

Saliency (high-level) – Objects and features of the environment, notably segments, which are often easily definable and relate to its function and way it projects itself to the street, e.g. signs, windows, chairs, walls, doors, posters, objects on sale. (Foundations - Itti, 2005; Cerf et al., 2008; Borji, 2012)

Saliency (low-level) – Constituent, component and material parts of objects and features that comprise the environment and the relationship between them, notably in relation to segments, e.g. colour, texture, orientation, intensity, transparency, motion. (Foundations - Itti, 2005; Cerf et al., 2008; Borji, 2012)

Sanctuary area – A linking scale of the urban street edge, which come together in the creation of districts and comprises urban blocks. (Foundations – Porta et al., 2014; Feliciotti et al., 2016)

Segment (experiential) – A realm that has the capacity to decrease directional emphasis, heightening locationally specific qualities (hereness), whilst also gaining experiential significance through the overlapping and relationship between adjoining realms e.g. indoor and outdoor. (Foundations – Thwaites & Simkins, 2007; Thwaites et al., 2013)

Segment (urban street edge) – A scale of the urban street edge that is the socio-spatial sub-

division of plinths (ground floor of built plots), established through the overlap between physical and material qualities, territorial processes (appropriation and personalisation) and experiential considerations (directional / locational emphasis). (Foundations – Dovey, 2010; Thwaites et al., 2013)

Segmentarity – The conceptual process through which variable fluctuating realms, notably segments, which are in a continual state of change are stabalised and provided significance through territorialisation. (Foundations - Deleuze & Guattari, 1987; Dovey, 2010)

Sensory Complexity – Affordance of urban street edge segment established through the coming together of multi-sensory factors in a manner that is able to capture and hold attention. (Foundation – Rapoport, 1990; Degen, 2008; 2014; Ewing & Clemente, 2013)

Socio-spatial – Fundamental characteristic of urban realms built upon the understanding that they are manifested as a complex interconnectedness of human social actions and spatial / material qualities. This also acts as a tool for through which the nature of urban engagement can be understood – the relationship between where someone is (spatial) and what they are doing (social). (Foundations – Dovey, 2010; Gehl, 2010; Thwaites et al., 2013)

Temporality – The understanding that aspects of the urban street edge, notably affordances manifested within segments, are continually changing over time often though small-scale adaptations within their make-up, processes of territorialisation and re-territorialisation as well as the daily rhythms of urban environments. (Foundations – Lefebvre, 1992; Bobic, 2004; Dovey, 2010)

Territorialisation (habitation and occupation) – Everyday actions undertaken by street inhabitants, spanning optional, necessary and social activities, which subsequently activate the experiential qualities of urban street edges. (Foundations – Lofland, 1998; Gehl, 2010; Mehta, 2013)

Territorialisation (personalisation and appropriation) – Actions of people who have influence over edge space, notably segments, manipulating form in order to establish places of meaning and significance as well as edge realms with which to experientially engage. (Foundations – Habraken, 1998; Bobic, 2004; Thwaites et al., 2013; Mehta, 2013)

There(ness) – A setting (part of the urban street edge), which promotes directional emphasis and experiential sensation through suppressing locational qualities; the opposite to hereness. (Foundations – Cullen, 1971)

Top-down decision-making – Overarching, often professionalised, actions through frameworks, strategies and infrastructure administration. (Foundations – Sabatier, 1986; Habraken, 1998; Thwaites et al., 2013)

Transitional Quality – Affordance of urban street edge segment established through its ability influence engagement across and along the edge's division of realms. (Foundations – Bobic, 2004; Gehl et al., 2006; Gehl, 2010; Thwaites et al., 2013)
Transparency – The potential for experience, notably vision, to transition across a division of realms, notably, the indoor / outdoor interface of edge segments through glazing (Foundations – Gehl et al., 2006; Gehl, 2010; Thwaites et al., 2013; Mantho, 2014)

Understanding (control) – Socially manifested relationship between people and the places they create established through mutual structures and communal meanings. (Foundations – Habraken, 1998)

Visual Engagement – The allocation of gaze on a stimulus tending to reflect overt attention, from which the experiential significance of certain aspects of a scene can be inferred. (Foundations – Findlay & Gilchrist, 2003; Rothkopf et al., 2007; Holmqvist et al., 2011; Duchowski, 2017)