

FOCUSING

*A DUAL SYSTEMS ACCOUNT FOR THE APPARENT HEMISPHERIC
LATERALISATION OF LANGUAGE*

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CONTENTS

	<u>PAGE</u>
DEDICATION & ACKNOWLEDGEMENTS	vii
ABSTRACT	viii
NOTES ON TERMINOLOGY	ix
INTRODUCTION	1
CHAPTER ONE: THE FOCUSING HYPOTHESIS	3
1:1 Defining terms	3
1:1.1 The dual system	3
1:1.2 'Focus' and information processing	6
1:1.3 Formulae	8
1:1.4 Analytic and holistic processing	10
1:2 The dynamic relationship between the two systems	11
1:3 'Juxtaposition'	15
1:4 Proposition-focused-language (PFL) & Language-focused-language (LFL)	18
1:5 Theoretical objections to the holistic processing of language	19
1:6 The operation of the holistic mechanisms	21
1:6.1 How formulae work in holistic processing	21
1:6.2 Triggers to analysis	23
1:7 Formulae in language processing	25
1:8 The acquisition of formulae	26
1:9 Strategies	35
1:10 The right and left hemispheres	42
CHAPTER TWO: THEORETICAL ISSUES	45
2:1 Introduction	45
2:2 Terminology	45
2:2.1 Vocalisation-focused language	45
2:2.2 'Propositional'	46
2:2.3 'Proposition'	53
2:3 Issues in semantics and syntax	55
2:3.1 The reduction of juxtapositional complexity	55

2:3.1.1	Coordination	61
2:3.1.2	Internalisation	63
CHAPTER THREE: EVIDENCE FOR LEFT HEMISPHERE LANGUAGE		69
3:1	Introduction	69
3:2	Anatomy	69
3:2.1	Post-mortem examinations	69
3:2.2	In vivo examinations	70
3:2.2.1	Gray and white matter	70
3:2.2.2	X-radiology	71
3:2.2.2.1	Introduction	71
3:2.2.2.2	Transmission computerised axial tomography (TCAT)	71
3:2.2.2.3	Cerebral arteriography	72
3:2.2.3	Electrical stimulation	72
3:2.2.4	The Wada test	73
3:3	Clinical	75
3:3.1	Introduction	75
3:3.2	Left hemisphere lesions	77
3:3.2.1	Introduction	77
3:3.2.2	Broca's aphasia	78
3:3.2.3	Wernicke's aphasia	79
3:3.2.4	Conduction aphasia	80
3:3.2.5	Other types of language disorder	81
3:4	Psycholinguistic experiments	82
3:4.1	Introduction	82
3:4.2	Dichotic listening tests	83
3:4.3	Tachistoscopic tests	86
3:4.4	Verbal-manual interference tasks	87
3:4.5	Lateral eye movement	90
3:5	The linguistic rôle of the right hemisphere	91
3:5.1	Introduction	91
3:5.2	The non-linguistic right hemisphere	92
3:5.3	The linguistic right hemisphere	94
3:6	Summary	98
CHAPTER FOUR: INCONSISTENCIES IN THE DATA		99
4:1	Inconsistencies in the monolingual data	99
4:1.1	Clinical data	99
4:1.1.1	Hemispherectomy	100
4:1.1.2	Split brain	104
4:1.1.3	Token test	107
4:1.1.4	Inhibition	108
4:1.1.5	Summary and comment	110

4:1.2	Psycholinguistic data	111
4:1.2.1	Nature & parameters of the inconsistencies	111
4:1.2.2	Within subject variation	111
4:1.2.3	Within group variation	112
4:1.2.4	Cross group variation	113
4:1.2.4.1	Culture	113
4:1.2.4.2	Field dependence	115
4:1.2.4.3	Sex	116
4:1.2.4.4	Age	118
4:1.2.4.5	Language	120
4:1.2.5	Cross study variation	121
4:1.2.5.1	Limitations of the dichotic listening test	121
4:1.2.5.1.1	Free recall	122
4:1.2.5.2.2	Memory capacity	124
4:1.2.5.2.3	Stimuli	125
4:1.2.5.2.4	Data analysis	126
4:1.2.5.2	Stimuli	126
4:1.2.5.3	Procedures	128
4:1.2.5.4	Summary	128
4:2	Theoretical accounts for the inconsistencies	129
4:2.1	Hemispheric competition & the genetic & hormone accounts for lateralisation	129
4:2.2	Age of lateralisation	134
4:2.2.1	Lateralisation at birth	135
4:2.2.2	Staggered language lateralisation	
4:3	Theories for bilingual & polyglot storage and acquisition	138
4:3.1	Storage	139
4:3.1.1	Compound and coordinate bilingualism	139
4:3.1.2	Switch mechanism & monitoring models	146
4:3.2	Acquisition	149
4:3.2.1	Krashen's 'acquisition' and 'learning'	149
4:3.2.2	Critical age in L2 acquisition	151
4:3.2.3	Language acquisition as a once-only event	154
4:3.2.4	Age-stage-manner hypothesis	155
4:3.2.4.1	General	155
4:3.2.4.2	Stage	156
4:3.2.4.3	Age	157
4:3.2.4.4	Manner	158
4:3.2.4.5	Interaction of age, stage & manner	159
4:3.2.5	Other factors	160
4:4	Inconsistencies in the data from studies of normal polyglots	162
4:4.1	The nature of the inconsistencies	162
4:4.1.1	Age	162
4:4.1.2	Stage	163
4:4.1.3	Manner	165
4:4.1.4	Summary	167
4:4.2	Explanations for the inconsistencies	168
4:4.2.1	Procedural shortcoming	168
4:4.2.2	Additions to current theories	171

4:4.2.2.1	Language-specific factors	171
4:4.2.2.2	Task-related factors	172
4:4.2.2.3	Individual variation	175
4:5	Theories in polyglot aphasia	175
4:5.1	Language dissociation	176
4:5.2	Two rules for recovery	180
4:5.2.1	Ribot's rule	181
4:5.2.2	Pitres' rule	181
4:5.3	Other pertinent factors and comments	185
CHAPTER FIVE: DISCUSSION OF THE CLAIMS AND PREDICTIONS OF THE FOCUSING HYPOTHESIS AND ITS EVALUATION IN TERMS OF OTHERS' FINDINGS		188
5:1	Empirical & Non-empirical support for components of the Focusing Hypothesis	188
5:1.1	Introduction	188
5:1.2	Dual systems	188
5:1.3	Optimal processing	191
5:1.4	Holistic processing	192
5:1.5	Strategies	192
5:1.6	Clausal processing: challenge and support	194
5:2	Prediction: language focus in experiments	198
5:2.1	Discussion	198
5:2.1.1	The nature of the task	200
5:2.1.2	The nature of the stimulus	200
5:2.1.3	The test environment	201
5:2.1.4	The type of subject	202
5:2.1.5	The scope for controlling focusing in experiments	203
5:2.2	Subject type as the primary variable	204
5:2.3	The value of psycholinguistic data in evaluating the Focusing Hypothesis	211
5:2.4	Test case: Ambiguity	212
5:2.4.1	Findings in ambiguity research	212
5:2.4.2	The Focusing Hypothesis on ambiguity	220
5:2.4.3	Challenges to the Focusing Hypothesis	223
5:2.4.4	Reassessment of the ambiguity data	226
5:3	PREDICTION: Disruption to the mechanisms in left and right hemisphere damaged patients	236
5:3.1	Left hemisphere damage	236
5:3.1.1	Discussion	237
5:3.2	Right hemisphere damage	242
5:3.2.1	Discussion	243
5:3.3	Other issues	247
5:3.3.1	The Token Test	247
5:3.3.1.1	Discussion	249
5:3.3.2	The observed abilities of the right hemisphere	253
5:3.4	Summary and comments	254

5:4	PREDICTION: Neurophysiological evidence	255
5:4.1	Introduction	256
5:4.2	Radioactive tracing	257
5:4.2.1	Xenon-133	258
5:4.2.2	18-F-Fluorodeoxyglucose	260
5:4.3	Electrical impulse monitoring	261
5:4.3.1	Alpha wave measurement	261
5:4.3.2	Auditory Evoked Potentials	263
5:4.4	Summary	264
5:4.5	Discussion	265
5:5	Bilinguals and Polyglots	268
5:5.1	Introduction	268
5:5.2	Psycholinguistic experiments	271
5:5.3	Clinical studies	280
5:5.4	Summary and comment	285
5:6	Towards a model for output	286
	CHAPTER SIX: EXPERIMENTAL INVESTIGATIONS	296
6:1	Introduction	296
6:2	Experiment I: Investigation of possible strategy differences in responding to visuo-spatial stimuli presented tachisto- scopically	297
6:2.1	Introduction	297
6:2.2	Aim	299
6:2.3	Modifications to O'Leary's design	299
6:2.3.1	Subjects	299
6:2.3.1.1	Sex	299
6:2.3.1.2	Age	299
6:2.3.1.3	Pool	300
6:2.3.1.4	Sample sizes	300
6:2.3.1.5	Handedness	301
6:2.3.1.6	Reading-age	302
6:2.3.2	Apparatus	302
6:2.3.3	Stimuli	303
6:2.3.4	Method	306
6:2.4	Procedure	309
6:2.4.1	Preparation	309
6:2.4.2	Experimental trials	310
6:2.5	Results	313
6:2.5.1	Results of the handedness test	313
6:2.5.2	Experimental results	315
6:2.5.3	Summary of results	322
6:2.6	Discussion	322
6:3	Experiment II: Investigation of possible strategy differences in completing a propositional and a nonpropositional lingui- stic task using monaural block presentation	328
6:3.1	Aim	328
6:3.2	Design	331

6:3.2.1	Tasks	331
6:3.2.2	Subjects	332
6:3.2.3	Material	333
6:3.3	Procedure	335
6:3.4	Results	339
6:3.4.1	Scoring	339
6:3.4.2	Analysis	341
6:3.4.3	Summary of results	348
6:3.5	Discussion	349
6:3.6	Conclusion	355
6:4	Comment and directions for future research	356
CONCLUDING REMARKS		360
APPENDIX		365
A4		366
A5		371
A6		374
REFERENCES		387

DEDICATION

In memory of my father,
who didn't make it

* * * * *

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ABSTRACT

A model termed the *Focusing Hypothesis* is presented. It is proposed that language processing is shared by an *analytic* and a *holistic* system, according to a task specific balance of demand and efficiency. The analytic system could function alone, but it is more economical, in normal communication, for holistic processing to operate up to clausal level and analysis to deal with the evaluation of propositions. The severe limitations on the abilities of the holistic system originate from its use of formulae to recognise familiar words in familiar structures. Where problems arise, the analytic system 'trouble-shoots', by focusing attention onto the language, at the expense of propositional focus. The relative involvement of the two systems is variable, according to the *strategy* selected from a task specific *strategy option range*; the strategy option range and preferences within it are built up as a response to the environmental requirements placed on the individual. Apparent evidence for left hemisphere lateralised language is re-examined in the light of this hypothesis, which proposes that the test environment of most psycholinguistic and clinical assessments induces a language-focusing strategy and thus deactivates the right hemisphere (holistic) mechanisms. It is predicted that careful modifications to the methods of test administration could reveal right hemisphere activity by permitting it to occur. Support for the hypothesis is drawn from the literature relating to neurophysiological (dynamic) studies and from the reported symptoms of left and right hemisphere damaged patients. Accounts of polyglot (bilingual) acquisition and storage and of differential language loss in polyglot aphasia are also examined. Output processing is examined with reference to one specific hypothesis (Pawley & Syder 1983) which closely aligns with the one for input presented by the Focusing Hypothesis. Two experiments attempt to examine contrasts in strategy as a function of age (Experiment I) and stimulus type" (Experiment II). Neither displays strong patterns of the kind predicted to be associated with contrasts in hemispheric superiority according to strategy choice, and it is suggested that, despite the attempt, the experimental designs failed to enable consistent access to the proposition-focused strategies held to be operational in normal communication, that is, those involving holistic processing.

NOTES ON TERMINOLOGY

1. ANALYTIC AND HOLISTIC

Analytic processing is contrasted here with *holistic* processing. *Holistic* is used in preference to *synthetic* even though the terms are largely interchangeable in the literature. This distinction is made because, according to its etymology, *synthesis* means 'the construction of a whole out of parts', which is at odds with the *holistic* approach to processing described here.

2. LEFT AND RIGHT HEMISPHERE

References to the left and right hemispheres are made in lieu of the terms *dominant* and *nondominant*, which are considered inappropriate in the context of the hypothesis presented here. *Dominant* is widely used by others to refer to the left hemisphere, with the *dominance* relating to language (as opposed to any other) functions, but the terms are problematic in any case (Buffery 1974:229). Not all individuals are *left hemisphere dominant* for language, but it is generally considered that some 96-98% of right handers and 70% of left handers are (O'Leary 1982:55) and, in keeping with current practice, it is this majority which is referred to in the discussion. There is an advantage in the use of the terms *left* and *right* in this way, as it avoids the assumption that the remaining 2% of right handers and 30% of left handers simply have reversed dominance. Some evidence indicates a *bilaterality* in some of these individuals (O'Leary 1982:55). The question of how such apparent *bilaterality* could be accommodated in terms of the Focusing Hypothesis is not addressed.

3. BILINGUAL AND POLYGLOT

With the exception of chapter 4:3-4, where the term *bilingual* is used in the context of discussing the theories of others, a single term is used to refer to the "condition of all those who are not unilingual" (L'Hermitte et al 1966, referring to a definition by Haugen), but that term is *polyglot* and not, as Haugen specified, *bilingual*. L'Hermitte et al's (1966) exploration of the usage of these terms points up some (mis)applications such as *bilingual* for *multilingual*, and also notes that *polyglot* is primarily used in the medical literature (p.727). They consider that all references to bilingualism should be accompanied by details of age, circumstances and mode of acquisition, usage and affective value for each language (p.728), which is a practical concession to the looseness with which the terminology is generally employed. Nevertheless, confusion inevitably pervades the continuing equation of *bilingual* and *polyglot*, encompassing indiscriminately individuals with a range of skills and linguistic experiences, from no more than a little formally acquired knowledge (e.g. Carroll 1980, Chernigovskaya et al 1983, Galloway 1981), to simultaneous childhood acquisition (e.g. Pichon, cited in L'Hermitte et al 1966). Kotik (1984:236) and Obler (1984:200) are careful to avoid the too liberal usage of *bilingual*. For attempts to quantify bilingualism see Cooper & Greenfield (1968).

Doyle et al (1978) and Lipsky (1978). Ascertaining the standard of an L2 is, of course, most problematic in clinical studies, as even the patient himself may have little idea whether a language has recovered to the pre-aphasic level of competence:

Some non-native speakers without cerebral trauma might speak like Broca's aphasics. (Galloway 1981:36).

The term *polyglot* has been less abused and is preferred for that reason. It is deliberately used to refer to all non-monolinguals because the Focusing Hypothesis draws its own, separate, distinctions between types, by invoking the effect of different preferred acquisitional and processing strategies. The terminology within quotations has, of course, not been altered.

4. MASCULINE PRONOUN AS THE UNMARKED FORM

In referring to individuals of unspecified gender it is now common practice to systematically interchange *he* and *she*, to use forms like *(s)he* or *he/she* or to extend the use of the plural pronoun to the singular (though, in this case, the reflexive forms leave the writer little scope to defend themselves). In the hope that the important statements about equality have now been firmly made by others, and in keeping with the general contention of this thesis, that it is detrimental to the evaluation of the propositions to draw the reader's attention to the language in which they are expressed (which these bisexual forms probably do), the (hopefully relatively) innocuous masculine pronoun is used throughout where an unmarked form is required. This is not intended to imply that males are superior, nor that they are sexless.

INTRODUCTION

The question of hemispheric lateralisation for language has now been under examination for more than 150 years. Models of function have been closely related to observations made in the aphasia clinic and, more recently, in the psycholinguistic laboratory and the neurosurgical unit. The results are both sophisticated and detailed and they adhere in general to the Occam's Razor Principle by relating what can be observed to anatomical structures in the most straightforward way.

It is the contention of this thesis that certain observations which do not easily fit the commonly-accepted models, and which have been assigned secondary importance by invoking random or systematic external influences on a system, actually form a pattern. This pattern acts as a pointer to a new account.

Previous models have envisaged linguistic processing as a single analytic system, with a peripheral holistic involvement in what is termed *automatic speech* and in certain paralinguistic levels of communication. The account presented here proposes that there is a dual system of processing, operating across the gamut of language functions. That is, there is the option for either the *holistic* or *analytic* handling of most levels of language processing. Where accounts so far have tentatively mentioned *strategy* as a confounding factor in a simple account, here strategy is considered to be of primary importance, and the preference for one strategy over another is seen as one determining factor in an individual's range of potential performances in the psycholinguistic laboratory, the speech pathology clinic and the classroom.

The model itself relates to input processing only, though some references will be made to output too, particularly with regard to the aphasic literature. A more formal examination of input and output is made in chapter 5:6. This is done with reference to work by Pawley & Syder (1983), whose stronger hypothesis, pertaining to output only, both complements the Focusing Hypothesis and is, to a considerable extent, rationalised by it.

CHAPTER ONE

THE FOCUSING HYPOTHESIS

1:1 DEFINING TERMS

1:1.1 THE DUAL SYSTEM

The account which follows will be referred to as the *Focusing Hypothesis*. This is because, within it, the selection of language processing strategies^{is} seen to be determined by the *FOCUS* of the individual's attention.

The dual system to which the account will refer is one which is well recognised in the field of psychology. This is the opposition of *analytic* and *holistic* processing (see, for instance, O'Leary 1982:64; Bogen 1969 and Bogen & Bogen 1969, cited in Van Lancker 1987:65). Some types of information which the brain routinely deals with appear to require a specifically analytic approach (e.g. calculation, temporal order processing (Van Lancker 1987:64)). We may define *analytic* in terms of the breaking down of large units into smaller ones and/or the building up of large units from smaller ones¹. This leads to an understanding and/or identification of a large unit in terms of the relationships between its constituent units.

An analogy of analytic processing might be the construction of a mechanical device. The pieces of the machinery must fit together in a specific way in order for the machine to work. And it can be dismantled, too, by removing the pieces in reverse order. The whole machine is complex, but it can be 'understood' in terms of the presence and func-

1. This is termed in some contexts 'synthesis'. This term, however, is avoided here as it is also widely applied to the holistic approach to processing by the right hemisphere (see Notes on Terminology).

tion of its components.

For various reasons which will be described and in some cases challenged later, it has been widely assumed that language is and must be analytically processed. Language has been described in terms of complex wholes which consist of combinations of simple constituents. The approach to language both of traditional grammars and, more recently, of syntactic theory, has been to divide sentences up into smaller units and/or to build them up from smaller units. Recent psycholinguistic accounts recognise some language-related processing which is not analytic. This concerns prosodic aspects of language including intonation and emotional colour (Van Lancker 1987:53-4). Making the customary associations between analytic processing and the left hemisphere and between holistic processing and the right (see section 1:10), Van Lancker (1987) thus states that, roughly speaking:

the unit-and-rule kinds of phenomena described by generative grammars are lateralised to the left hemisphere whereas complex patterns, not reducible to component parts, are specialised to the right hemisphere. (p.50)

The left hemisphere knows what is being said while the right hemisphere knows how it is being said (with what kind of affect, mood, or attitude) and who is saying it (what sex, age, and in some cases, which person). (p.54)

In addition, some now consider certain units of language, especially empty phrases and idioms, to be non-analytically processed. Indeed, as Van Lancker observes, "the idiom...must not be analysed in those [i.e. analytic] terms" (p.67), because this will lead to an inappropriate, literal interpretation.

The account presented in the Focusing Hypothesis will not attempt to deny that language is ordered according to a constituent structure. Neither will it deny that language can be and often is processed accor-

ding to analytic strategies. But it will be argued that the analytic processing of language does not usually occur.

Holistic processing involves a very different approach to information. Because there is no *analysis*, it is inevitably difficult to describe its operation in analytic terms:

The only 'explanation' of how you recognize something as a *Gestalt* is that you recognize it as a *Gestalt*. (Marshall 1981:72)

One type of information which appears to be processed holistically is visuo-spatial input (e.g. Harris 1978). The appreciation of a three-dimensional form, of a route or a location is not achieved by a dissection of the input information into constituent units. Similarly, the recognition of a face (e.g. Levy 1974:155-6) does not appear to proceed via the separate recognition of the individual features².

Although the existence of parallel analytic and holistic systems is not generally disputed, no in depth consideration appears to have been given to the possibility of their both being involved in linguistic processing. O'Leary (1982) summarises the general viewpoint extant in the psychological literature as follows:

It seems reasonable to conceptualize the human brain as a dual channel information-processing device. One channel (the left hemisphere) processes information in a sequential and linear manner, while the other channel (the right hemisphere) processes information in a wholistic and parallel fashion. The interaction between the two channels has not yet been studied in detail. It is not known, for example, whether both channels simultaneously process all incoming information, or whether some executive mechanism selectively activates the two channels. (p.65)

2. In section 1:10 a connection is made between holistic processing and the right hemisphere. One of the shortcomings of such a simplistic association is that it tends to imply that one hemisphere is responsible for a particular kind of processing. The recognition of faces is not achieved by the right hemisphere alone, it seems, but by the combined action of the two hemispheres, specifically the underside of the temporal and occipital lobes of both (Geschwind 1979:164). See also Concluding Remarks.

1:1,2 FOCUS AND INFORMATION PROCESSING

Focus can, with one exception (described in section 1:9), be taken as an abbreviation for *focus of attention*. This is in keeping with others' definitions, such as Brown (1983):

to cognise an object in an analytic mode requires a discrete or selective type of attention. The perception is built up around object features. Conversely, holistic or global perception accompanies a more diffuse attention which is distributed over the object field... The attentional state of the left hemisphere can be characterized as focused, and that of the right as diffuse....
(p.48)

Thus references to *focus* directly relate to what the analytic mechanisms are occupied with. The conscious individual is probably always focusing on something or other. Thus his analytic mechanisms are always operating. If one opts to view analysis in this way, i.e. as an exclusive operation, then it becomes clear that the way the world is viewed will be highly dependent on what attracts focus; other aspects of the input than the focal one must either be processed in some non-focal, non-analytic way, or ignored.

One axiom of the Focusing Hypothesis is that focus on language inhibits focus on anything else. Yet, quite apart from the numerous other things that are competing for our attention at any given moment, language itself consists of many 'layers' of information, from the basic acoustic or visual signals right up to the complex ideas which it is employed to express. It is proposed that there is a considerable limitation on the capacity for more than one of these levels to be focal at any one time.

In what will be termed *propositional focus*, a process of *evaluation* compares one idea with another in the same discourse sequence (e.g. to see if an argument follows logically) or with ideas from elsewhere

(e.g. our knowledge of the real or some other relevant world). As ideas require such evaluation in order to make any contextual sense, they can only be handled analytically. If some other level of the input is focused upon (e.g. the linguistic form) or if focus is upon some other unrelated input (e.g. a co-occurring event), then the analysis (and therefore appreciation) of the ideas cannot occur. In the terms of the Focusing Hypothesis, ideas cannot be assessed in relation to each other by means of the holistic mechanisms. Therefore, those to which attention is not paid (i.e. upon which there is no focus) will not be evaluated at all.

In the process of dealing with ideas conveyed in language, our attention is focused upon the nature and interrelationship of the ideas, not the form and sequence of the language itself. Thus, an assessment of the validity of ideas is most effective when the form of the language used to convey them is not permitted to intrude into our consciousness, because any such intrusion will cause a temporary hiatus in the evaluation of the ideas.

What, then, is happening to the language when the ideas it conveys are focal? It is somehow being decoded into large semantic units (*ideas* or *propositions*) without drawing any attention to itself. It would be fallacious to claim that it follows from this observation that the language processing is not analytic but holistic. Any number of other accounts could be submitted. These might invoke a semi- or unconscious analytic mechanism³ or a system of parallel analyses in terms of which *focus* was a misleading term.

3. Unconscious analysis does, in fact, feature in the Focusing Hypothesis (see section 1:9).

However, it is not the purpose of this discussion to explore and evaluate these possibilities. Rather, this one specific line of reasoning has been selected for exploration.

1:1.3 FORMULAE

Formulae, according to which the holistic system is considered to operate, are not to be equated with clauses. They are *templates* for clauses, which specify the syntactic and semantic relationships between constituents. How many of them there are available to an individual will depend upon the productivity of the analytic mechanisms in constructing them (see the discussion of acquisition in section 1:8). The selection of a formula is effected by the use of a scanning procedure (see section 1:2) which recognises but does not decode constituents. Specifically, it assigns a formula to the clause, using word order and lexical clues, particularly so-called *function words* like grammatical particles, some morphological patterns and, probably, the verb. It is not new to suggest that verbs might be marked in the lexicon for details such as transitivity etc. Thus, a formula might look something like (1), recognising many essentially 'novel' (i.e. spontaneous) strings including (2)-(5):

- 1) NP - speak-TENSE - to-NP - about-NP
- 2) I've spoken to Henry about the new carpet.
- 3) Have you spoken to the gasboard about the leak?
- 4) She's going to speak to the committee about Dr.Peterson's conduct.
- 5) The Prime Minister will speak to the nation about the state of the economy.

Clearly, much more needs to be said about the mechanisms of formula selection and decoding (see, for instance, section 1:6.1 below). At present, however, the precise nature of the formulae is of secondary importance. Formulae of this kind also figure in Pawley & Syder's (1983)

account of processing, described in chapter 5:6.

The value of clausal size formulae is that they permit the use of semantic information from later in the clause to contribute to the interpretation of earlier constituents. This means that (in holistic processing) ambiguity will not surface if any information in the clause specifies the interpretation intended (see the discussion in 5:2.4).

Not all formulae will be clause-sized. The scanning procedure (see section 1:2) which enables the recognition of constituents is also envisaged as using formulae and these too could be decoded. But that would mark the end of the holistic processing because the output of that decoding could not be dealt with further except by the analytic mechanisms. To recognise rather than decode constituents, therefore, enables the bypassing of costly analytic decoding in early stages. If a recipe states "*add the flour, eggs and sugar*" this is taken to mean that all three may be added at once and then stirred in. It is less time consuming to do this than to add each ingredient separately and stir it in before adding the next. But if the recipe stipulates that they must be added and stirred in separately, then this must be done, despite the extra effort. In the same way, the Focusing Hypothesis proposes that it is less expensive in processing effort to gather a number of constituents and decode them all at once than to decode each separately and incorporate it into the accumulating clause before the next one is decoded. This is because that 'incorporation' is achieved by means of evaluating each constituent's value in relation to that of others, which requires *juxtaposition* (see below). *Juxtaposition* is an analytic process, and analysis is more costly than holistic processing. The larger the constituent which is finally evaluated, the better, as-

suming that the ultimate aim of the processing is to evaluate, in one way or another, those largest constituents (i.e. propositions). If, on the other hand, the very focus of interest is the relationship between some phonological or syntactic constituent and the others around it, then the processing must proceed via a lower-level analysis, even if it is costly.

1:1.4 ANALYTIC AND HOLISTIC PROCESSING

The difference between the systems lies in the use or else oversight, for processing purposes, of information about the autonomous semantic and syntactic function of constituents when they themselves form only a part of the unit being decoded. Returning to the analogy of a mechanical device, a skilled mechanic could identify the function and value of every piece and justify its inclusion within the whole. An unskilled worker on an assembly line could also construct the device but he would not have the understanding of why the pieces were there and how they functionally interrelated. Instead, he would construct it in accordance with a formula, that is, a set of instructions which was the same every time. In both cases a working machine would result. A factory might employ both skilled and unskilled workers but it would be a waste of the skilled one's talents if he were employed only to construct machines which conformed to the formula, as an unskilled worker could do this. However, the skilled worker would be invaluable for 'trouble-shooting' when, for instance, a component was the wrong shape or missing, or when a new or less familiar design of machine was being constructed. He could locate malfunctions and irregularities in a way which the unskilled worker could not. The latter could only identify

that the formula was not being adhered to and relinquish his responsibilities to the skilled worker. If the irregularity related to a stage which was late on in the construction of the machine, it would be most economical of resources for the unskilled worker to construct the machine to that point and then pass it over to the skilled worker so that the latter was not involved until the specifically problematic stage. The more efficient and plentiful the formulae used by the unskilled worker, the less often the skilled one would be called upon to intervene. This would leave him free to deal with other tasks which only he could do.

In holistic linguistic processing as defined in this chapter, semantic decoding occurs at the level required by the analytic mechanisms, as determined by the focus of attention. In normal communication the focus is upon the propositions (see 1:4). Therefore the holistic mechanisms decode up to such a level that propositions are the unit which is transferred; this level is the clause. For discussion of why the clause is associated with the single proposition, see chapter 2:2.3.

1:2 THE DYNAMIC RELATIONSHIP OF THE TWO SYSTEMS

Both types of processing observe constituent boundaries. That is, both recognise phonemes, morphemes, words, phrases and clauses. But they do so in different ways and they also use in different ways the information they compile about an utterance. The holistic mechanisms use formulae to recognise constituents but it is only recognition, not identification. It is not a process of assigning syntactic or semantic status to them, but of assuring that such an assignment, when it does

occur, will be trouble-free. They locate the area of the lexicon in which searches will occur and they delimit the selectional range of structures. Again, an analogy is helpful.

In a hardware store the customer tells the assistant what he requires to complete a D.I.Y. job. The assistant makes a list of the items, checking each, as it is named, against his stocklist. When he is sure that all the items are in stock, he takes the whole list into the stockroom and fetches them all together. If an item is not on the stocklist, he knows he will not be able to find it in the stockroom. In this case he stops the proceedings and tells the customer that the item is not available. This is important because without that item the whole job which the customer is preparing to do is jeopardised. The checking off of the items against the stocklist is the parallel to *recognition*; recognition is not the same as retrieval, but it assures that the retrieval procedure will be problem-free.

So it is that the holistic mechanisms *scan* the input to assure that all the items and structures are recognisable. That such a scanning occurs independently of comprehension has been suggested by Garnham (1985) and is discussed in chapter 5:1.6. Some sort of scanning device is required in any case in any processing system which recognises constituent boundaries, because to be sure that a clausal (or any other) boundary has been reached some examination of at least the immediately succeeding information must have been carried out.

Of considerable assistance in the scanning of input in this way would be intonation cues, which would help to identify constituent boundaries and the relationships of words along an independent parameter to the as yet unavailable semantic one. This means that the inton-

ational information would be used before the semantic, and would therefore have more power in the delimitation of the range of possible interpretations. Semantic decoding, when it finally occurred, would be effected against a backdrop of the intonational pattern. This predicts that where intonational and lexical information contradicted each other, precedence would be given, in the interpretation of the utterance, to the former. This appears to be what happens in normal communication.

The decoding itself would be postponed until the size of constituent was reached which formed the basic unit of focus. Thus, if focus were on the propositional level (as in most communication), the holistic mechanisms would gather the constituents, recognised but not decoded, up to the level of the clause, and then apply the relevant clausal formula to enable the semantic decoding of the whole clause to occur. If the focus was on the meaning of the individual words, on the other hand, then the words would be decoded separately and passed to the analytic mechanisms for evaluation. If the focus were on the phonological or phonetic form, then the words or sounds as required would be sent over as single units without any semantic decoding at all. This dynamic relationship is represented in Figure 1:I. As described above, the most economical use of the analytic mechanisms is in the juxtaposition of propositions as expressed by single clauses. This is effected by the passing of each proposition to the analytic mechanisms after it has been holistically extracted in a process of clausal level semantic decoding. This use of the mechanisms is depicted in Figure 1:I by the unbroken line. It is this route which could be referred to as the *optimal processing route*, because it accesses the highest possible

level of information for juxtaposition, the proposition, at the least cost to the analytic (attentional, focusing) mechanisms.

However, it has been stated that the analytic mechanisms can become involved at lower levels too. Possible alternative processing routes incorporating this lower level focus are depicted in Figure 1:I by the broken lines. Essentially, the analytic mechanisms 'decide' what is to be focal (e.g. the proposition, the syntactic structure, the phonology.

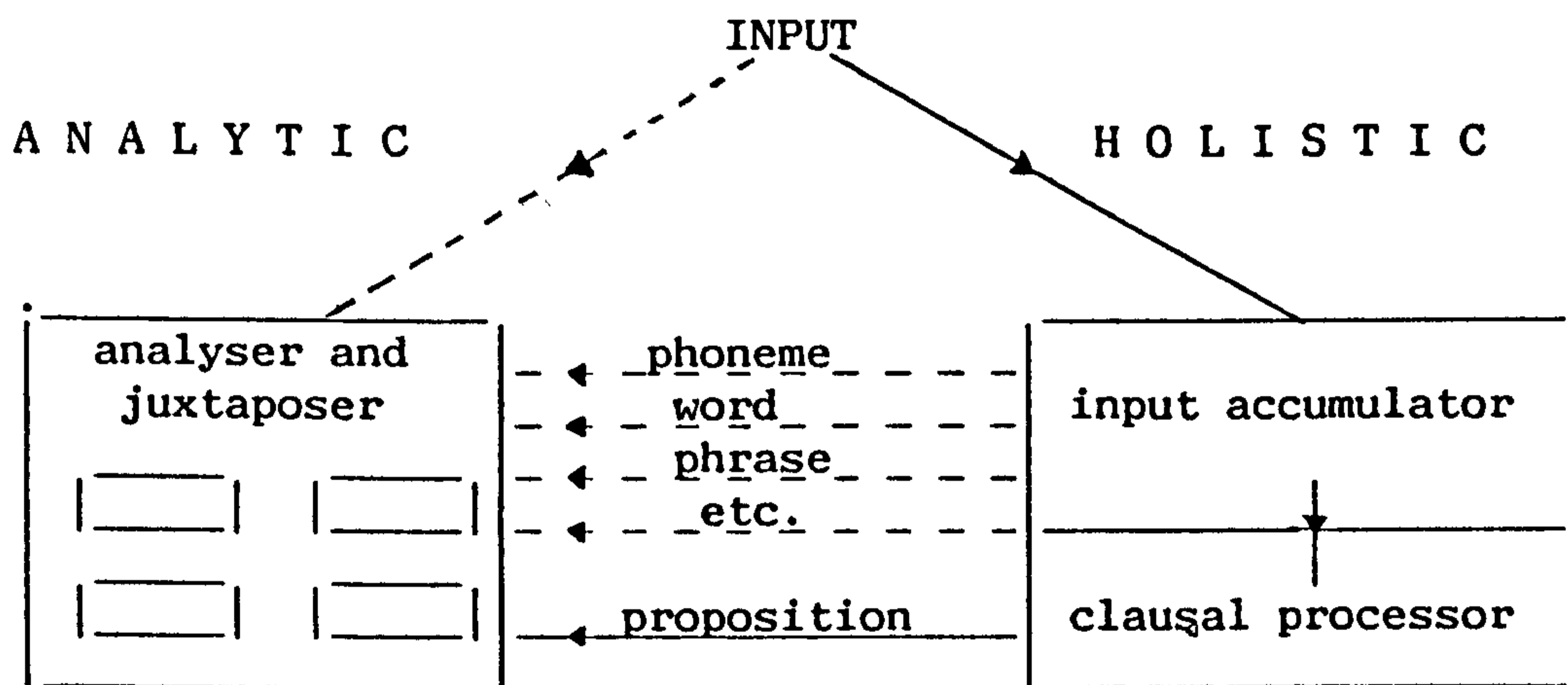


FIGURE 1:I

of the lexical item, etc.) and the holistic mechanisms feed in that level of ready-processed information. Thus, when there is attention to the semantic content of a lexical item, semantic decoding of that item will have already occurred holistically; for phonological attention, the information will be passed on in phonological form, but already cleared of irrelevant phonetic detail. In this way, the analytic mechanisms are never concerned with detail below the level of the focal interest and, crucially, that information is not available to them without some backtracking and reconstruction.

As the holistic mechanisms operate by recognising formulae, they can equally well recognise when a structure is not familiar, or not

manageable. This triggers the intervention of the analytic mechanisms, either for metalinguistic attention, or to juxtapose any items or sequences (in phonological or semantic form as required) up to the size of a clause. This process is described in more detail in section 1:6.2.

The conversion of a sequence of phonemes into a word entails the sacrifice of the individual phonetic detail; the word adopts a standard phonological identity. This predicts that the phonetic detail of, say, the regional accent with which words may be spoken is discarded once the word has been identified. Any analysis of that accent must, therefore, occur at phonemic level and not lexical level. Similarly, in the process of conversion to *idea (proposition)*, the phonological information relating to individual words is lost. This predicts that once semantic decoding has occurred, the potential to recreate verbatim the exact lexical sequence will depend upon how uniquely the idea can be expressed: synonyms and semantically inconsequential constituent reorderings may routinely occur. Sachs' (1974) work, which indicated that information about the form of input is lost after semantic decoding, may support this.

1:3 'JUXTAPOSITION'

To recap, the Focusing Hypothesis proposes that there are two systems for linguistic processing, the analytic and the holistic. How they share between them the decoding of a given sequence of input depends on what attracts the focus. Focus is an analytic process, and holistic processing can operate only on levels below the focal level.

It is proposed that the evaluation of whatever is focal in relation

to other items of the same kind (e.g. proposition with propositions, word with words, sound with sounds) occurs by means of the *juxtaposition* of those items. Juxtaposition is not possible for the holistic mechanisms as they can deal with only one unit (albeit a complex one) at a time.

The units juxtaposed may be of any type, from sounds, through phonemes to phonological or semantic representations of words, phrases or clauses. The Focusing Hypothesis submits that it is the juxtaposition of semantic representations of clauses, containing a single proposition (idea) that usually occurs in communicational interaction. However, in rhyming poetry the focus might be upon the phonological form of the words, with a juxtaposition of words to appreciate rhymes and of larger units to appreciate scansion. Similarly, the juxtaposition of semantic units smaller than the whole proposition might occur in attempts to decide on the appropriateness of a word or phrase and to detect parody.

Where phonetic or phonological information is required, juxtaposition of the specific units involved must take place, because this information is lost at the time of conversion. Semantic information, however, may be collected either at word level or at any subsequent stage. If the specific requirement is the semantic comparison of two words, then word-level juxtaposition must occur. However, if the ultimate aim is an accumulation of semantic information to extract propositions, then it would be inefficient to juxtapose single words, and the most efficient use of the resources would be for juxtaposition at the *idea* stage. To state it another way, it is considered a poor use of the analytic mechanisms to decode individual words semantically and then fit them together, as is suggested in some accounts of on-line

processing (e.g. Tyler & Marslen-Wilson 1977). In the case of a word not being routinely semantically decodable in its clausal context, a backtracking procedure could be adopted, whereby lexical-level analysis would take place after all. The juxtaposition of ideas may perhaps only occur successfully when that word has been clarified and then placed in the clausal context. Backtracking in at least the case of phonological (as opposed to written) input must involve, for reconstruction purposes, access to a phonological trace. The Focusing Hypothesis holds that an abstract phonological representation is normally carried to clausal level before semantic decoding takes place.

If, in circumstances of holistic processing, language is dealt with phonologically until whole clauses are semantically decoded, then it follows that there has been no point at which a discrete lexical semantic representation existed. Rather, a word will be inextricably bound to its clausal semantic context. This predicts that all ambiguities which are clarified within the clause will go unnoticed. However, they may, in other circumstances, be identified by either of two means: firstly, after semantic decoding, via a phonological reconstruction using echos or visual traces from short term memory; secondly, when semantic decoding occurs, by juxtaposing semantic information at lexical rather than clausal level. In the latter case this will be at the expense of the juxtaposition of ideas. Thus lexical ambiguities would be easily identified if they are being looked for, but would be overlooked (if the clausal context disambiguated them) where attention was focused on the ideas conveyed in the language. Ambiguity is discussed in depth in chapter 5:2.4.

The nature of juxtaposition is then, essentially simple. It invol-

ves the evaluation of relationships between items, whether they be syntactic constituents or semantic units. When the focus is on language itself (see section 1:4 below) juxtaposition will be the means of evaluating syntactic structure in much the same way as any other processing account proposes. But when focus is on propositions, then language is not decoded by means of juxtaposition but via the application of formulae (templates) which specify the relationships between the constituents in a non-dynamic, rigid way, determined by precedent. That is, a clause is attributed syntactic and semantic interrelationships for its constituents according to the formula it is mapped onto.

1:4 PROPOSITION-FOCUSED LANGUAGE (PFL) AND LANGUAGE-FOCUSED LANGUAGE (LFL)

Proposition-focused refers to language which is produced and/or interpreted for its communicational intent, which normally means for the ideas which it carries. In PFL, the language itself is a tool, a means to an end, and is only of interest insofar as it conveys ideas. It is the ideas which are the focus of attention. Via juxtaposition, these ideas are analysed at a level which establishes their relationship to other ideas and to the individual's knowledge of the real or some other relevant world.

Language-focused refers to 'non-communicational' applications of language. This includes listening to speech sounds for their own sake (e.g. accent identification), some types of reading aloud (see Concluding Remarks), of dictation writing, text-copying, repetition and recital, and some instances of the detailed monitoring of one's own output (e.g. in L2 production).

One type of LFL is metalinguistic attention, such as Strawson

(1963) employs in order to illustrate the limits of the notion of *inconsistency*.

Suppose I write on the blackboard the following two pairs of sentences:

- i) 'I am under six foot tall' and 'I am over six foot tall'
 - ii) 'The conductor is a bachelor' and 'The conductor is married'.
- In writing the sentences on the board I have, of course, not contradicted myself, for I may have written them there with a purely illustrative intention, in giving an English lesson. (p.3)

As Strawson illustrates, metalinguistic reference renders the message contained within the object of that reference irrelevant to the real world. The syntactic form of that language is also firmly contained within the quotation marks which surround it and the whole referent is embedded into the metalinguistic context as if it were an NP:

- 6) Why did you use an 'if' if you were certain?
- 7) It is tiresome to write the lengthy 'and so forth', so we usually use an 'etc'.

Wray (1982) has examined the demarcation of metalinguistic referents in some detail.

1:5 THEORETICAL OBJECTIONS TO THE HOLISTIC PROCESSING OF LANGUAGE

[The] creative aspect of language is quite incompatible with the idea that language is a habit-structure. Whatever a habit-structure is, it's clear that you can't innovate by habit, and the characteristic use of language, both by a speaker and by a hearer, is innovation. You're constantly producing new sentences in your lifetime - that's the normal use of language. When you read the newspapers or walk down the street you are constantly coming across new linguistic structures which you immediately understand, which have no feeling of lack of familiarity, but which are nevertheless not in any definable way similar to others that you've experienced before. So much for the notion of habit-structure.
(Chomsky 1968:687)

At first glance, this dismissal on Chomsky's part of 'habit-structure' appears to present probably the most obvious and potentially serious threat to the notion of formulaic processing. However, this is

not the case.

Chomsky does not draw a distinction between the individual's acquisition and knowledge of the language on the one hand and his subsequent use of it on the other. The Focusing Hypothesis recognises the complexities of analysis which go into the process of acquisition (see section 1:8 below). Thus there is no quarrel with Chomsky's observation that:

it is quite impossible to formulate as a system of habits or as a network of associations the processes which will account for the sound-meaning relation that all of us know intuitively when we've mastered English. (p.687)

But it is proposed that it is wasteful of the analytic mechanisms for them to continue to operate on the routine structures of language once they have been identified and a linguistic system has been compiled to deal with them.

The Focusing Hypothesis does not deny that units as small as single words can be broken down and analysed. Neither does it deny that this can and does occur in some circumstances. However, it designates such analysis wasteful of the analytic resource, except where that specific information is desired or there is no formula to deal with that structure.

The objection which has always been posed to accounts of clausal level language processing is that an infinite inventory of sentences would be required. If there were not such an inventory, novel sentences could not be recognised; for sentences which have never been produced or heard by a given individual before are quite likely to occur (Chomsky 1968:687). However, it is not being suggested in the Focusing Hypothesis that each individual carries around in his head an infinite inventory of sentences. The strength of the dual system account is

that the non-analytic system, justifiably seen to be limited in its capabilities, works in tandem with an analytic system. The old *sentence inventory* account fell foul of the observation that, as a complete list of potential sentences is not feasible, there would be no way of dealing with the unexpected, that is, with any sentence that was not on the list (e.g. *colorless green ideas sleep furiously*). But the holistic processing mechanism proposed in the Focusing Hypothesis does have a way of dealing with the syntactically unexpected or the semantically irregular. It passes the processing over to the analytic mechanisms.

1:6 THE OPERATION OF THE HOLISTIC MECHANISMS

1:6.1 HOW FORMULAE WORK IN HOLISTIC PROCESSING

The formulae used by the holistic mechanisms are seen as having a constituent structure of the type familiar in phrase structure theory. But, to recap, what makes holistic processing different is that, in PFL, the constituents are only recognised and are not decoded until the clausal boundary. Then the whole clause is taken into account at once.

It is easier to imagine that language might possess a finite set of clausal formulae than that there might be a finite set of possible sentences. But even so, the existence of recursion in language means that the formulae can, in theory, multiply in number without limit.

Radford (1981) exemplifies five types of recursive agent: the clausal complement (8), the relative clause (9), the coordinate (10), the adjective (11) and the adjective modifier (12).

8) Fred said that John said that Mary was ill.

9) I chased the dog that chased the cat that chased the rat.

10) I met Debbie, Noam, the Dustman and Harry.

11) John is a sensitive, tall, dark, handsome man.

12) Debbie Harry is very, very, very, very attractive.

(Radford 1981:19f)

Of these, (8), (9) and (10) link clauses and so fall outside of the proposed abilities of the holistic mechanisms. (11) and (12) are not problematic because only short strings of this kind occur in normal communication⁴.

The strength of the formulaic processing account is that it does not have to deal within that one framework with all existing linguistic structures. Holistic processing as envisaged in the Focusing Hypothesis relies not on the potential for the unexpected in a given utterance but upon the statistical likelihood of the expected.

This account, then, states that any aspect of an utterance (in input) which does not strictly adhere to the formulae employed by the holistic mechanisms will be passed over to the analytic ones for closer examination. As the analytic mechanisms are far from standing idly by waiting for such a thing to turn up, this new task actually distracts them from their other analytic tasks, most specifically the assessment of propositions in relation to each other and the real world. Thus the prediction is made that the appreciation of the underlying propositions in an utterance will be hindered by the use of an unexpected word or structure. This will occur not only where that word or structure is essential to the understanding of the clause, but also where its rôle is peripheral or even irrelevant.

It follows that the more efficiently the holistic mechanisms can

4. That is, longer strings can occur, but do not usually; when they do, they draw attention to themselves and thus initiate language focus. For example, the person who produces a sentence like (12) is not incrementing the emphasis on the adjective so much as indicating a particular (emotional) reaction to the NP. He effects this by using the linguistic package as a pointer and 'very' is, in a sense, therefore being used 'nonliterally'.

deal with input, i.e. the more words and structures they can routinely process, the more efficiently the analytic structures will be able to manage the complex sequences of propositions.

1:6.2 TRIGGERS TO ANALYSIS

This section describes how the analytic mechanisms are alerted by the holistic mechanisms to operate. As has already been stated, the clause, as the unit which contains the proposition, marks the upper limit of the capabilities of the holistic mechanisms. If the analytic mechanisms intervene at a lower level than the propositional one, this is because attention was focused there in order to examine some aspect of the language, or because, conversely, some aspect of the language was irregular or too complex to be dealt with by the formulae in the holistic system. Clausal boundaries are detected by the *scanning* of the input, so that as items are recognised, landmarks for the formulaic structure are pinpointed. These landmarks include some lexical items with a specific syntactic rôle, e.g. relative pronouns and complementisers. Intonational cues in speech and punctuation marks in written input contribute to the definition of structure which enables the selection of the correct formula⁵.

The analytic mechanisms will be used for linguistic purposes where some item or structure surfaces which disrupts the holistic operation. This could occur when there was incoherence, lack of fluency or an extreme complexity of structures. The hearer/reader would be aware of taking more notice of the language itself, as a prerequisite for ex-

5. Cooper & Paccia-Cooper (1980) discuss the role of phonetic information in the demarcation of syntactic boundaries.

tracting the propositions it conveyed. Other language-focused exercises might include appreciating poetry for its rhyme, rhythm, onomatopoeia or alliteration; attention to any of these would, once again, be expected to make the job of comprehending and juxtaposing the propositions more difficult.

The use of formulae to recognise and decode structures means that passive sentences would be dealt with independently of their active counterparts. But while the holistic mechanisms could not make any direct connection between active and passive, the analytic mechanisms certainly could, particularly (but not only) if the acquisition of passive formulae had involved a procedure which identified the syntactic and semantic relationship between them.

In most multi-clause sentences the clauses are joined together in such a way that one or more could not stand alone in its 'surface structure' form. There is no problem for the Focusing Hypothesis in accommodating such incomplete clauses in its clausal processing account. They can simply be considered to possess their own formula, which carries minimal syntactic information about the missing constituent. Example (13) is taken from Radford (1981:184).

13) John seems to me to have perjured himself.

To deal with a sentence like (13) holistically, there would need to be two (independent) formulae which contained 'traces'. The occurrence of the first clause (John seems to me...) could instigate an expectation for the second, or for a set containing the second. The holistic processing of each clause would occur independently of the other to the extent that the semantic link between them would be unspecified. The

information passed from the holistic mechanisms for propositional juxtaposition would contain semantic gaps no more specific (even in the second clause (...to have perjured himself)) than 'some act, which you'll find in place x in the next clause' and 'someone, which you'll find in place y in the previous clause'. The holistic mechanisms could have, so to speak, no memory of the identity of the subject of the previous clause as they processed the subjectless succeeding clause.

The same approach can be taken in dealing with embedded clauses:

14) The long list of instructions that you left me got eaten by the cats.

At each clausal boundary a formula would be identified which included something rather like a trace or at least some recognition of the 'parasitic' environment:

15) The long list of instructions t

16) (that) you left me t

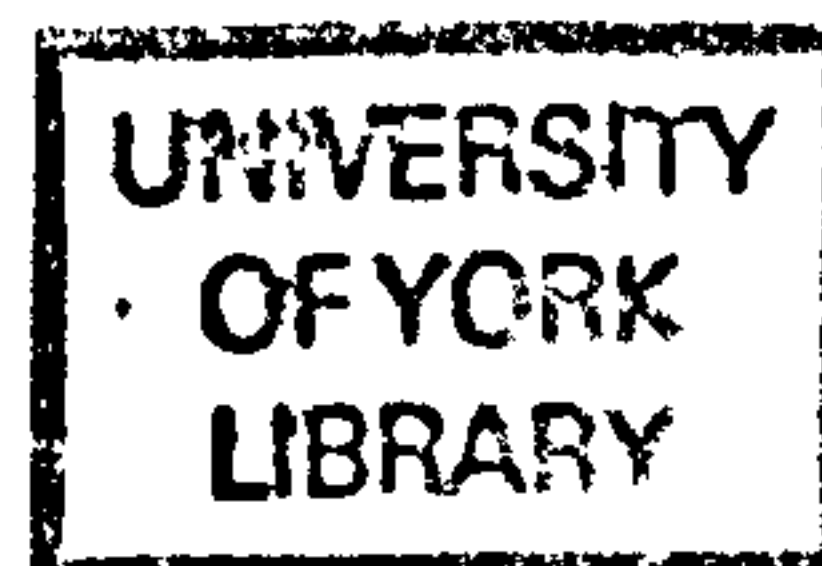
17) t got eaten by the cats

Juxtaposition would relate the three semantically. In contrast, the holistic semantic decoding of each individual part-clause would not involve any direct identification of t (or the antecedent of 'that') in relation to anything that had already been processed (because the holistic mechanisms cannot juxtapose semantic units). There would only be non-specific pointers saying, for instance:

17') t (to be restituted from the initial part-clause) got eaten by the cats

1:7 FORMULAE IN LANGUAGE PROCESSING

As already stated, the principle of operation for the holistic pro-



cessing of language is that although language has the potential for unpredictability, it is, the majority of the time, predictable within certain definable bounds. Therefore, while no specific or formulaic inventory could deal with every aspect of grammatical (and, of course, ungrammatical) language use, such an inventory could perform a valuable function in coping with what we might term *routine processing*.

Routine processing is not intended to refer only to the handling of those empty phrases and idioms which are commonly termed *automatic language*. One of the characteristics of automatic language is that it is low in semantic content and not 'propositional' in the sense of conveying novel ideas in a custom-built linguistic package (Van Lancker 1972: 24). Rather, we are speaking here of novel as well as idiomatic expression, so long as the constructions involved are recognisable as conforming to one of the formulae. A more detailed examination of the term *automatic language* can be found in chapter 2:2.2.

1:8 THE ACQUISITION OF FORMULAE

Where do these formulae originate? Not from a simple process of observation, that is clear. Even in the light of observations like Moskowitz's (1985) that, in fact, nothing like as many of the utterances directed at the child as often claimed are ungrammatical or even unduly complex, it is clear that any account of formulae acquisition must not attribute too large a rôle to raw observation, even cumulative raw observation.

It is proposed here that a formula is constructed as the result of observation and rule-building by the analytic mechanisms. This means that there is a system underlying the construction of formulae, which

successfully prevents an ungrammatical string being judged grammatical and incorporated into the processing inventory simply by virtue of something as perverse as the Bellman's *rule of three*.^{6,7}

Where the Focusing Hypothesis parts company with the more traditional views of language acquisition is in what it considers is done with the information amassed. Implicit in most accounts of language learning is that routes to the decoding of input and encoding of output are forged and then adhered to for the rest of the individual's communicatory life. The sole exception to this is that idioms are somehow immune to the original breaking down procedure and are reproduced as a package when required for output. Idioms are considered to be exceptions because they are "transformationally defective" (Weinreich 1969, quoted in Van Lancker 1972:28), often have an idiosyncratic and/or anachronistic structure and, most particularly, are "low in semantic content" (Van Lancker 1972:28).

The analytic system constructs hypotheses about language, simple at first, and then increasingly complex, until one is found which can deal with the adult language⁸.

The other, holistic, system is not equipped to deduce rules from data, to deal with new information or to perform according to analyti-

6. "What I tell you three times is true" (Lewis Carroll, 'The Hunting of the Snark, Fit the First, stanza 2; also Fit the Fifth, stanza 8-9.

7. As the child continues to focus on propositions while it analyses language in an unconscious manner, it is proposed that there is an 'unconscious analysis' which complements language focused conscious analysis. This is described in section 1:9.

8. In fact, as discussed presently, it could be that some aspects of syntax and some items of vocabulary never become integrated into the final set of formulae, and require specific recall; it could be tentatively suggested that this 'shortfall' of holistic 'knowledge' in relation to analytic 'knowledge' forms the basis of the performance-competence dichotomy.

cal procedures. However, it is highly efficient at applying sets of immutable formulae, even ones which are internally highly complex.

Thus, these two systems are functionally complementary. Once the analytic operations have produced a hypothesis containing a finite number of patterns for the cooccurrence of constituents, these can be most effectively applied holistically. This frees the analytic system to home in on other input features, including occurrences of new vocabulary and any so far unanalysed structures. In addition, it can take note of input constructions (including the corrections of adults (see below) which the current hypothesis does not generate and, in time, use that information to form a new hypothesis. Crucially, however, this new information cannot be used in spontaneous output until it has been incorporated into a new hypothesis. Until the analytic system has constructed new rules to generate the new structure and has passed these on, in the form of a closed set hypothesis, to the holistic system, production (except in the case of deliberate repetition or of attempts, on the part of the analytic system, to use a half analysed structure for particular effect) continues to proceed according to the old hypothesis. An analogy might be the continued application of a law as laid down in the Statute Books, while parliamentary debate takes place regarding its substantial alteration or abolition.

The acquisition of formulae is considered, then, to proceed in the following manner. In much the same way as is proposed in other accounts of acquisition, the child observes input and constructs rules.

The first rules are simple and enable only the production of one-⁹ or (later) two-word utterances. However, the signs of production competence eclipse the importance of the considerably greater comprehension ability of the young child. This advanced comprehension forms the basis for the development of the dual system.

The very first communicational elements which the baby appears to respond to and to reproduce versions of in its own output are the facial expressions and intonational contours in the speech of the mother and/or other caretakers. Both of these are considered to be processed in adulthood by the holistic mechanisms of the right hemisphere (Code 1987:99ff, Geschwind 1979:165, Heny 1985:171). It seems, then, that the backdrop against which the first verbal elements are decoded is one of holistically processed information. In accordance with Piaget's¹⁰ principle of using old, familiar information to contextualise the new (Moskowitz 1985:57), the first hints of what the mother's words may mean comes from understanding the general emotion being expressed.

The Focusing Hypothesis utilises the principle of *focus on the new*, an analytic procedure, in the context of holistically processing the old, and considers that this principle applies not only to that prevocal stage but throughout language acquisition.

The observations which form the basis of the child's first utterances must clearly be in some way independent of the processes of com-

9. The question of whether one-word utterances have an underlying syntax is not settled. See, for instance, Bloom (1973) who argues that they do not: "There is simply no evidence that children have knowledge of linguistic structure before they use structure in their speech" (p.131); Greenfield & Smith (1976) challenge the assumption that one-word utterances are as simple as they look.

10. Greenfield & Smith (1976:221) attribute this maxim to Werner & Kaplan (1963, e.g. p.175).

prehension. Evidently, not all of the information available to the child as he hears and decodes an utterance is available to him when he attempts to construct one. The child's ability to analyse the language around him and therefore to identify those lexical items which convey the ideas which he wishes to express, appears to be restricted to isolated words taken from within a context of given information. That is to say, from understanding the general drift of an utterance, which the Focusing Hypothesis proposes he does holistically, he is at liberty to 'home in' (or *focus*) on a particular element for analysis, to study its sounds and more exact meaning. It is submitted that it would not be possible for such analysis to succeed if it were not for that backdrop of comprehension. And, furthermore, if that backdrop were produced by means of analysis at the time, this would make the job of isolating target items for potential production considerably more difficult.

Much as any other account of acquisition, it is proposed that hypotheses are constructed and that production proceeds according to them. In the initial stages these will be hypotheses about the applicability of words, later about possible combinations of words. However, the Focusing Hypothesis adds the following:

When a hypothesis has been formulated, it is transferred, as a set formula, to the holistic mechanisms, which operate it without any 'appreciation' of how it came to be constructed. To use an analogy not quite identical to the one presented earlier, it is like the process of constructing a complex machine which, once made, can be managed by an unskilled operator with no comprehension of how it works, only a knowledge of how to switch it on and what the end product will look like.

The value of transferring hypotheses would lie in the freeing of

the analytic mechanisms for the next stage of analysis. There would be no conflict, then, between the comprehension and production of utterances according to the transferred hypothesis and the focusing upon new items or more complex structures that would be required for the construction of the next hypothesis. One important prediction of this account is that recently acquired information about shortfalls in the current production hypothesis, whether inferred or taught to the child by an adult, would not be immediately incorporated into the production of the child. This is because the old hypothesis would continue to operate, independently and without regard to the new information or its relevance, until a new hypothesis had been formed (on the basis of sufficient data and a logical system) and transferred. At this point the old hypothesis would be over-ridden and the differences between the old and the new become evident in the production of the child. In the terms of the analogy, the machine operator would continue to perform his tasks on the old machine, quite oblivious of new breakthroughs in engineering and machine design, until one day there was a new machine, ready-designed and operational, to replace the old. This would result in a gap between the learning of a new word or structure and its appearance in performance. Moskowitz (1985) reviews reports of the apparent failure on the part of children to take account of linguistic correction by their parents (see also Brown 1973a). But, as they do presumably ultimately develop the adult usage, it is equally plausible to suggest that the information is shelved rather than ignored. The dual systems account proposes that new information has no direct way of entering the normal holistic processing system, which uses immutable formulae. Instead, it must be stored up until it is surrounded by a large

enough corpus of systematic supportive evidence to enable a new hypothesis to be formed. When that is adopted by the holistic mechanisms, new structures will begin to appear quite naturally, being either adult forms or forms laid down by a new temporary working hypothesis.

This proposed scenario of hypothesis construction, transferal and the accumulation of new information to create a new hypothesis, predicts that language development will occur in a pattern of punctuated equilibrium rather than entirely smoothly. However, this may be obscured by simultaneous progress being made in several hypotheses and also by the necessity for several different hypotheses to be constructed and superceded before the adult rule is finally approximated.

To invoke a process of punctuated equilibrium in the acquisition of formulae entails the following pattern. At any moment there is a set of formulae already constructed and a *remainder*, i.e. a body of information not yet incorporated into a formula. In time, enough of the same type of information may be in the *remainder* for a new formula to be constructed to replace the one already in operation. This will remove all the relevant 'loose data' from the *remainder* but leave other items and structures which have not yet been rationalised in terms of the system. As more and more formulae equate with adult norms, the acquisitional process will slow down and very few new items will become added to the *remainder*. But it may also be that not all items ever get incorporated into formulae at all, because they have occurred too rarely to be adequately supported by additional observations, or because they were part of an alien system which was never fully rationalised. These structures or items would be understood, if and when they occurred, only by the analytic mechanisms, which could probably make a fair

attempt at working out their function in the context, but only, of course, by focusing upon them. As there would not be any formula to deal with them, the holistic mechanisms would not recognise them in the initial scan and this would be the trigger to focus. Furthermore, if it were to be the case that the same hypotheses operated for output as well as input processing (and Pawley & Syder's 1983 work suggests that this may be largely so, see chapter 5:6), then *remainder* items and structures would not be available for use in the production of proposition-focused language, only for language-focused language. In other words, they could be produced, but only if the primary focus was meta-linguistic. This is reminiscent of Krashen & Pons' (1975) observations regarding an L2 monitor user, as cited by Krashen (1978). Krashen (1978) quotes and expands on Krashen & Pons' (1975) comments as follows:

The fact that the vast majority of [the subject's] errors were self-correctable suggested that 'she had a conscious knowledge of the rules' but did not choose to apply that knowledge. '...In writing, and in careful speech, she utilizes the conscious linguistic knowledge of English, while in casual speech she may be too rushed or preoccupied with the message to adjust her output' [Krashen & Pons 1975:126]. (Krashen 1978:178)

It is proposed in the Focusing Hypothesis that the mechanisms which effect acquisition are not lost or dismantled but rather remain throughout the individual's life. However, certain external factors may tend to prevent their operation. Some of these could be associated with general cognitive development and change and, it cannot be certain that these latter play absolutely no part in, for instance, the alleged tendency for adults to be bad at foreign language learning. One major factor possibly responsible for a change in the way language is processed is literacy. By the time the child begins to read and write in

earnest, he has mastered his language to quite a complex level and can express himself via hypotheses which largely resemble those of the adults around him. In one sense we could say that literacy teaches him nothing new except graphemes. It shows him how to write down what he already knows about, that is, sounds, words and combinations of words, all of which have manifested themselves as distinct entities during his linguistic development. But literacy is, of course, more than that. It involves the abstraction of what was, before, fully contextualised. At the very least, it bridges the gap between what was unconscious knowledge, the domain of the language faculty, and conscious knowledge. It adds, alongside linguistic knowledge, metalinguistic knowledge. This is perhaps most acutely observable where the school teaches a standard language which does not entirely coincide with the vernacular spoken by the child. The child's school success depends upon his ability (in the classroom at least) either to monitor his output and to alter it to fit the new standard (cf. the discussion of Krashen in chapters 4 and 5), or to alter his own production hypotheses, i.e. to adopt the standard as his own (though not necessarily his only) norm. The latter will only be possible in the presence of the conditions which have previously enabled the creation of a new hypothesis, i.e. enough information to establish a system and enough motivation to do so. It is suggested that in the former case the analytic mechanisms will remain involved in monitoring language, to the detriment of the other activities it could be embarking on, e.g. the acquisition of new words and structures and the development and analysis of ideas.

However, all individuals in the education system, whether they experience the vernacular-standard conflict or not, will be required, to

some extent, to monitor and analyse linguistic material which might otherwise have been dealt with entirely holistically. For output, this would make the task of expressing ideas more difficult, because both the processing and the manipulation of propositions would be competing for the same functional mechanisms. The tactic of *monitoring* tends to be adopted in this environment because of the constant correction and improvement which the child receives in the classroom in relation to the form of his expression on paper, including the numerous unwritten 'rules' which characterise written as distinct from spoken language (cf. Perera 1986). This increased (conscious) awareness of the structure of the language may, when L2 classes begin, contribute to a tendency to analyse and to compare L1 and L2, even in an immersion situation. Formal L2 tuition positively encourages this (see chapter 5).

1:9 STRATEGIES

The Focusing Hypothesis places great significance on the brain being multi-systemic and programmable. The *blue-print* for language, to use a Chomskian term, is seen as non-specific, determining approaches to learning which enable certain types of sense to be made of the world, but not determining what is learnt. What is learnt and which approach to learning is selected is decided by the environment in which the individual is placed. Those things perceived as important will be singled out for learning. Some things may be most successfully approached holistically. Others may require, or be presented as if they require, analysis, and then analytic processing will be preferred. There is more than one way of learning and/or processing a piece of information and the brain has the capability to use all those ways. But

in any given circumstance it selects one as the most economical; in consideration of the kinds of responses which need to be made. As one example, returned to later, the child manifests a high profile for holistic processing during L1 acquisition because this makes the most economical use of the holistic and analytic mechanisms in spoken communication. When it is faced with learning literacy skills, however, that precise sharing of functions is no longer as uniformly valid and the child has to learn to focus onto language at specific points in order to meet the new demands of the environment.

Strategies, which will be often referred to in subsequent chapters, are combinations of holistic and analytic involvement. That is, the term *strategy* is not used here to refer to an analytic or holistic operation *per se*, but to a combination of the two, selected as most appropriate for the specific task in hand. For example, a young child learning to write may employ holistic processing with propositional focus for formulating the sentence to be written, analytic processing with language focus for writing it and checking it, and holistic processing with propositional focus coupled with a lexical focus (thus placing a high load on the analytic mechanisms) for reading it through. This entire pattern would be termed a *strategy*.

The range of strategies available for coping with a task will be determined by the precise results which the individual has learnt to access from that task. When tired, or writing a difficult passage, an adult might use the same strategy as has been described above with reference to the child. But he will also be capable of writing a sentence down without language focus, because he has learnt to automatise the transcription of lexical representations in the brain onto the

page. If he is prone to bad spelling, he may have taught himself to check every word as he writes it. But if he is not a bad speller, he will not have had to learn to do this. If he is writing in a foreign language he may have taught himself to focus at the syntactic or morphological level etc. Although such habits might become engrained, they would be avoidable too, as other strategies remained available. But the more automatically one was selected in preference to the rest, the more economical the whole operation to achieve the goal. If the goal changed, the individual would have to retrain himself to select a different strategy, one that perhaps felt unnatural for a while, but which would soon become the preferred one, leading with least effort to the new goal.

In many cases, several strategies could be retained as preferred options, because a selection of different goals remained desirable. This can be exemplified with reference to learning music.

Both the conceptual and motor operations that every person is capable of learning will be mastered only by those who 'teach' their brain to handle them. One such motor skill is playing the piano, which requires the translation of a written code into unique sequences of precise motor activity. But the recognition of harmonies is a conceptual skill, which is not simply a matter of hearing differences between tuned chords, but of being able to categorise them according to their components. For the trained musician, listening to harmony componentially is an option amongst a range of potential strategies when he hears music. The other options include ignoring it, listening to the melody, listening to the tuning, enjoying its emotional impact etc. The last of these options has been associated with right hemisphere holistic

processing, while those which involve a specific level of attention and evaluation are associated with the left hemisphere (Bever & Chiarello 1974). Untrained musicians will not have that range of options - they may enjoy music for its emotional impact but have little facility for paying attention to specific aspects of the tune or harmony because they have never learnt to do this. What variables operate to lead to one strategy choice over another could differ greatly from musician to musician. Those who are highly critical, or who spend all their working lives being analytical, (e.g. instrumental teachers who do not perform), might have an automatic tendency to discard the option of holistic processing for access to the emotions and impressions conveyed by a piece of music, and may never listen to music simply for enjoyment. Others may have retained that option and be able to bypass the analysis and enjoy music even if it is not technically perfect. For brief general reviews of research into hemispheric activity in music processing see Harris (1978:421-5) and Code (1987:92f).

It is contended that in language processing in adults the optimal strategy would be the one which kept analytic focus on the propositional level while the holistic processing dealt with the language up to the clausal stage. But other strategies would be available and would be preferred where the desired outcome of the task was different (see section 1:3). Crucially, however, the range of strategies would depend on how many the individual had needed to develop to meet specific demands; the monitoring strategies of the literate individual would not have been developed by an illiterate. The preference amongst the strategies would depend on the individual's priorities when faced with a task which could be processed to produce different results relating to

its various levels. The most preferred strategy in the range would be selected by default. In addition, selection within the range might be restricted by the virtual exclusion of some options, because a single preferred option was exclusively employed for some reason. For example, someone who was very self-conscious might always select a self-monitoring option, even if one involving a less self-conscious approach was actually more conducive to the desired results (cf. in this respect also Krashen 1976, 1978, Krashen & Terrell 1983 on Monitor use in L2).

It is clear that in L1 acquisition the analysis which occurs in making sense of input and the construction of hypotheses is not conscious and does not require attention to be paid in some metalinguistic manner. *Unconscious analysis* is considered here to be a left hemisphere function and to compete for processing space with other levels of analysis, so that it will be easier for a child to understand the propositional content of an utterance in a familiar structure (holistically decoded) than in one which is still being dealt with by the mechanisms of unconscious analysis.

Clearly, the acquisition strategy utilising unconscious analysis would be used less for learning after childhood, but would still be available for the occasional encounter with an unknown word (to extract the meaning from the context) or, more rarely, structure. However, it might be frequently useful for identifying words which were obliterated by extraneous noise etc. (and it would be valuable in L2 'acquisition'¹¹). In, say, a noisy room, then, a strategy involving unconscious

11. This is a technical term used with reference to L2, which contrasts with 'learning', as defined by Krashen (e.g. 1976). Where 'acquisition' is written without inverted commas, it is intended in a neutral sense.

analysis might be operational just to enable some kind of comprehension. This would, like L1 acquisition, not involve conscious attention to the form of the utterance, but a certain approach to the information that was heard, to create hypotheses about the likely propositions and try to assign identities to the unheard items. Once identified, the proposition could be confirmed and added to the contextual information being used to assist in the predictions. This association of an everyday adult processing strategy with the one used for acquiring L1 and L2 seems plausible; the process of acquiring a language does require propositional projection of this kind, using given information to access the values of new items (Moskowitz 1985:57)¹².

Other strategies may develop less naturally. If we must be taught to recognise and identify harmonies, perhaps we must also be taught to focus on specific levels of language which will be useful to us in a certain environment. Many aspects of western style education may provide such a training, which encourages the development of and preference for certain strategies, beginning with literacy itself. A child must be taught to read and write and in the process learns to formally identify words and, if his language is alphabetic, to break words up into sounds. What has until then been achieved by a proposition-focused unconscious analysis and, subsequently, a holistic execution, is now brought into the domain of conscious analysis and metalinguistic awareness. The literate individual's formal knowledge of his language in this respect is, inevitably, greater than the illiterate person's. His knowledge of a formally taught L2 may be even greater.

12. Is this perhaps why we (allegedly) tend to shout at foreigners, as if they failed to understand because they missed hearing some key words?

The tuition which the child receives in school to help him express himself better on paper involves, as one example, the highlighting, in the form of corrections, of certain phrases and spellings which are not 'acceptable'. Thus he must learn, if he is to be successful at school, to recognise and avoid those items and to use the ones which have been pinpointed as 'good'. This requires a certain kind of monitoring of his own production, so that certain phrases which he formulates, and which may be perfectly acceptable in speech, do not find their way onto paper. Later, he may be taught to rephrase and précis and also to identify rhyme, onomatopoeia, alliteration and metaphor. All of these will contribute to an awareness of different levels of language; and an awareness that they exist is, perhaps, a prerequisite to focusing upon them.

The above discussion suggests that education may be one of the factors operating to produce cross-subject differences in performance on certain tasks which require strategies not necessarily within some people's strategy range. Where these tasks have been devised by individuals who have themselves been successful in the educational environment (e.g. psycholinguistic tasks and I.Q. tests) they may mostly give an advantage to those using the same strategies, learned in that same environment. In other tasks, an analytic strategy may be a disadvantage if attention to the operation itself is detrimental to its completion. Many things, (e.g. driving etc.) may come under this heading, characterised often by the remark that the only way to do well in them is to relax. Those who 'think too much' may, by adopting an analytic strategy, prevent the operation of the very mechanisms required to do the task well.

It is a natural extension of this general discussion that attention to language would involve a strategy which altered the whole approach to the task of communication. One potential expression of this could be the effect that linguistic focus would have on the subject of a psycholinguistic experiment or on the aphasic patient during systematic tests of linguistic ability, as discussed in chapter 5:3.

1:10 THE RIGHT AND LEFT HEMISPHERES

Up to now, no firm association has been made between the analytic and holistic systems and the left and right hemispheres respectively, even though it is customary to do so (see below). There are some good reasons why it would be preferable not to do so at all, as Gazzaniga (1977) points out:

[The] popular psychological interpretations of *mind left* and *mind right* are not only erroneous: they are also inhibitory and blinding to the new students of behavior who believe classic styles of mental activity break down along simple hemispheric lines. (p.416)

Gazzaniga makes this remark in the context of attempting to redress the balance regarding the current profile which the notion of differential hemispheric function tends to enjoy. He refers to the "overpopularization of much of the basic data that Roger Sperry and I first reported some sixteen years ago" (p.415) and the failure of "those not directly involved in split brain research" to take adequate notice of later findings, whose variance from the previous ones he attributes to "improved methods of lateralizing stimuli" (p.417) and which indicate not simply that the right hemisphere can perform a considerable range of linguistic and logical functions after all (p.417,419) (see chapters 3:5.3 and 5), but that the most major confounding factor in the supposedly supportive data of lateralisation studies emanates from a tremendous mea-

sure of individual variation. In keeping with Gazzaniga's view, then, it would be overly simplistic to associate analytic functions with the left hemisphere and holistic ones with the right in such a straightforward way. But unless some association is made between them, there exists no basis for addressing the clinical and psycholinguistic data which operates in terms of relative hemispheric participation under different conditions and/or in the face of different stimuli. It is because of this and, in particular, the mileage which can be obtained in support of the Hypothesis from an examination of its relationship to the findings of these research areas (see chapter 5), that that association is now to be made. However, it still remains fundamentally a secondary one. In what follows, one or two issues raised by the bridging of the great divide between abstract concepts and physiologically pertinent empirical evidence are discussed.

The association between the left hemisphere and analytic processing modes and the right and holistic modes appears in more than one guise and is, in an indirect sense, traceable back to the observations of Hughlings Jackson in the 1860's (see chapter 2:2.2), who proposed, in the light of clinical observations, that the left hemisphere was capable of all linguistic functions, and the right hemisphere able to deal with "the automatic use of words" (Hughlings Jackson 1874:130). The association was indirect only, for he did not make the final link of characterising the production of automatic language as holistic. Since then, however, research appears to have justified a more direct association, at least with regard to input processing. For example, with reference to Japanese, Code (1987) says:

...findings...strongly suggest that the right hemisphere is superior in its abilities to deal with holistic kanji script while the left hemisphere is better able to deal with segmental kana script

.... (p.55)

The work of Bogen in the late 1960s (Bogen 1969, Bogen & Bogen 1969, cited in Code 1987) and the early clinical observations of Gazzaniga & Sperry amongst others (Gazzaniga 1977:415) promoted the notion of separate hemispheric functions characterised by propositional (left) versus appositional (right) processing modes. Research of various kinds supported this, with subsequent reports like the following:

While the left hemisphere seemed to analyse the stimulus properties, the right hemisphere seemed immediately to abstract the stimulus Gestalt - that is, as an integrated whole. (Levy 1969:614)

Associated with this was the proposal that the left hemisphere had a preferential relationship with consciousness and self-awareness (Popper & Eccles 1977:304; see also Bever 1983:34), but this, like other aspects of the old *mind left - mind right* idea (Gazzaniga 1977:416) has been rejected in favour of more integrated accounts such as Brown's (1983) and Sperry's (1984):

the conscious mind is normally single and unified, mediated by brain activity that spans and involves both hemispheres.... In the normal state the two hemispheres function together as a very closely integrated whole, not as a double, divided, or bicameral system. (Sperry 1984:669, quoted in Code 1987:4)

CHAPTER TWO
THEORETICAL ISSUES

2:1 INTRODUCTION

Two major theoretical issues will be dealt with in this chapter. The first is terminology and will concern the similarities and differences between the usages of terms in the Focusing Hypothesis and elsewhere.

The second issue involves the contribution which the Focusing Hypothesis offers to some specific aspects of semantic and syntactic theory.

2:2 TERMINOLOGY

2:2.1 VOCALISATION-FOCUSED LANGUAGE

Proposition-focused language (PFL) and *language-focused language* (LFL) were defined in chapter 1:4. *Vocalisation-focused language* (VFL) lies, in one sense, between the other two. It covers language use which is neither language-focal *per se* nor used directly for the communication of ideas. In VFL the purpose of the utterance is to vocalise for some self-fulfilling reason, that is, to 'speak for the sake of speaking'. In VFL the semantic content of the utterance is irrelevant. Examples of VFL include the vocalisations associated with testing a microphone, exclamations of the kind which are just as likely to be uttered when the speaker is alone as when someone else is present, and, possibly, some utterances produced by the young child. Moskowitz (1985) cites the example of a two and a half year old who repeatedly asked the question "*why?*" and was as satisfied with irrelevant replies such as "*Because the moon is made of green cheese*" as with relevant

ones. She contends that this type of exchange was a crucial part of the acquisitional process for that child, during which he "practise[d] the form of social conversation before dealing with its function" (p.53). It is proposed here, however, that this may be an example of VFL, that is, a device for gaining the security of hearing an adult voice and knowing that the adult had not forgotten him. If so, then there was no linguistic or propositional aim, on the child's part, to the interaction. Speaking for the sake of speaking may also cover various other types of utterance, such as some greetings etc. (see section 2:2.2).

The terms PFL, LFL and VFL have been carefully chosen to avoid as far as possible potential confusions when the proposed account is compared with the ideas of others. In the following discussion, an attempt will be made to clarify the relationships between PFL, LFL and VFL and two terms used by other writers, viz. *propositional* and *proposition*.

2:2.2 PROPOSITIONAL

Drawing on his own clinical cases, Hughlings Jackson (1866,1874) made the straightforward assumption that, in the event of considerable damage to Broca's area, residual linguistic ability must be emanating from the intact right hemisphere. The retention by patients of a small inventory of greetings, oaths and other standard or idiosyncratic short strings of words, while all novel utterances were impossible, therefore indicated to him that the right hemisphere was instrumental in the production of such *automatic phrases*.

As right hemisphere damage did not appear to affect the production and comprehension of automatic phrases, it was not possible to say that

the right hemisphere had sole control over automatic language. Rather, it appeared that:

the right is the half of the brain for the automatic use of words, the left the half for both the automatic and the voluntary use. (Hughlings Jackson 1874:130)

He distinguished *utterance* (verbalisation) from *speaking* (active "propositionising", p.130,fn.2) and restricted the latter to the expression of ideas through language. The automatic phrases of the aphasic fell into the former category, being, as he saw it, propositionally empty.

Many of his 'speechless' patients retained good comprehension, being able to extract more or less normally the ideas conveyed in linguistic input. This he attributed to the 'automatic' manner in which comprehension occurs:

[When someone speaks] I am, so to speak, his victim, and the words he utters rouse similar ones in me; there is no effort on my part; the revival occurs in spite of me if my ears be healthy. (p.132)

In his view it was equally clear from his observations that "the man who has no internal speech...can think" (p.131). However, Hughlings Jackson considered the patient to be limited to only those propositional expressions of thought which he received from others. That is, he did not see 'speechlessness' as a result of a failure to find the words for propositions already formulated. Rather:

the speechless patient has lost speech, not only in the popular sense that he cannot speak aloud, but in the fullest sense; he cannot propositionalise in any fashion. (p.131)

Associating the residual abilities of the aphasic with the usage of various emotion- and convention-motivated interjections in the speech of normals, Hughlings Jackson identified four types of language, on a continuum from most automatic to most voluntary:

(1) Receiving a proposition. (2) Simple and compound interjections as 'oh!' and 'God bless my life'. (3) Well-organised conventional phrases as 'goodbye', 'Not at all', 'very well'. (4) Statements

requiring careful, and, metaphorically speaking, personal supervision of the relation each word of a proposition bears to the rest. (p.133)

Items in category (2) were to be viewed as semantically empty. Thus:

The communist orator did not really make a blunder when he began his oration, 'Thank God, I am an Atheist', for the expression 'Thank God' is used by careless, vulgar people simply as an interjection, there being no thought at all about its primitive meaning. (p.135)

The term *propositional*, therefore, contrasts in the writings of Hughlings Jackson with the term *automatic*. Along the continuum between the two extremes could be found, for instance, contextually appropriate automatic phrases such as 'That's a lie', which was "used rather as an offensive missile than as a proposition" but was "a little less automatic than an oath -...a shade nearer to speech" (p.135).

Van Lancker (1972, 1987) uses *propositional* in a similar way. She sees propositional utterances as those which have been expressly constructed for the communicational event. Automatic ones are ready-constructed strings which are fetched as whole, unanalysed entities from the lexicon (Van Lancker 1972:25). She considers the former to be the product of the analytic mechanisms, the latter a product of the holistic¹ ones. Like Hughlings Jackson, she both attributes analytic functioning to the left hemisphere and holistic functioning to the right, and envisages a continuum from 'most propositional' to 'most extreme' (p.22):

the same phrase 'good morning' can occur in different modes: As the automatic greeting; in perhaps 'semi-propositional' use as in 'she didn't say "good morning" to me'; or propositionally, as in 'it's a good morning to play tennis'. The reality of these various modes is reflected in puns, word games, and the shock effect

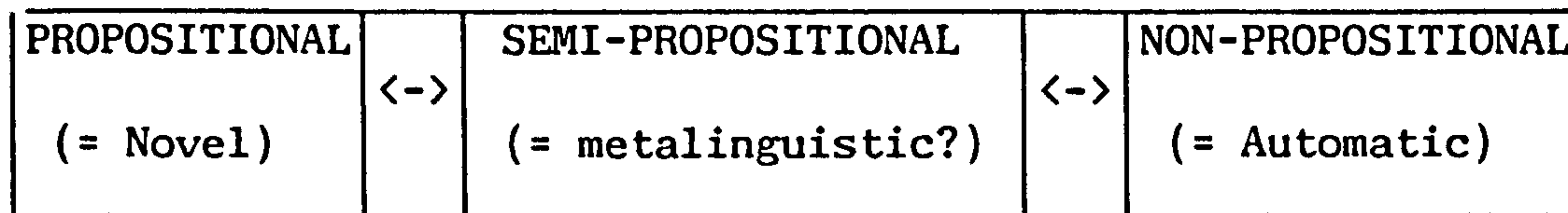
1. The use of 'holistic' has been generalised here in accordance with the observations made in the Notes on Terminology. However, it is not intended to imply that Van Lancker or any other writer necessarily makes the same distinction between 'holistic' and 'synthetic' as is made in respect of the Focusing Hypothesis.

of minor substitutions in overlearned phrases, such as 'A rolling stone gathers momentum'. (1972:28)

She suggests that idioms and automatic phrases may be processed like single lexical items. Evidently not constructed on the spot, they are presumably retrieved whole from the lexicon and possess, like any other lexical entry, a specific semantic value. Van Lancker (1987) cites experimental support for this view and notes several assertions by other writers which agree with it. In one unnamed study to which she refers, normal subjects were tested on their processing powers with idioms and non-idiomatic phrases of similar length. They were able to retain four or five familiar phrases, each five to seven words long, with the same ease as they could retain six or seven words in a non-idiomatic context (p.90).

The Focusing Hypothesis divides language into three types. Van Lancker sees only two basic types but on a continuum, with a possible third type (*semi-propositional*) between them. Figure 2:I below indicates the relationship between the terms. It is not entirely clear what status is afforded in Van Lancker's model to metalinguistically oriented input and output. The only clue is her example of "*She didn't say 'good morning' to me*" (1972:28) which she assigns the status 'semi-propositional'. She presumably does this because the 'good morning' itself is not novel but is being used as one element in a novel (propositional) sentence. However, this deals only with the type of metalinguistic reference that we might term *quotation* and does not in any obvious way relate to the other types of VFL as described above. This oversight is unfortunate, considering the rôle which self-monitoring must be playing both in the speech of the aphasic and in the performance of the psycholinguistic subject (see chapter 5).

A. Distinction between propositional and non-propositional as defined by Hughlings Jackson, Van Lancker etc.:



B. Distinction as defined in the Focusing Hypothesis:

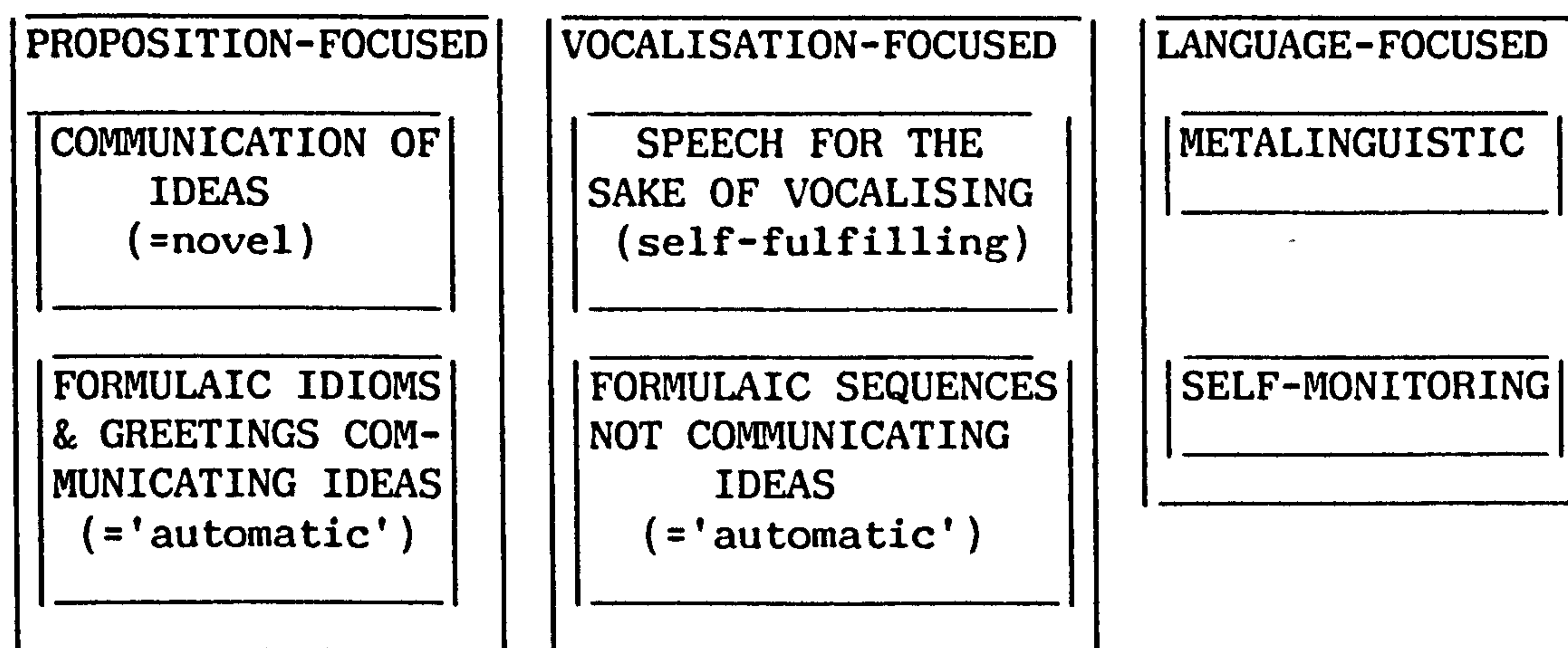


FIGURE 2:I

In comparing and contrasting the two models in Figure 2:I, one major and crucial difference emerges. This is that in model B, *automatic language* can be proposition-focused as well as vocalisation-focused. In the latter case, an idiom would be uttered for the sake of saying something, as for instance in non-turn-winning utterances like 'well I never' and 'did you really?'. The association of *automatic* and *novel* language under the umbrella of PFP is not in any sense an elevation of automatic language to equate it in novelty or propositional intention with original, situation-tailored utterances. The Focusing Hypothesis is drawing different distinctions between utterance types. The feature which is considered to unite novel and automatic language

is that both are proposition-focused. And, as such, it is not automatic language which has been attributed new characteristics - for that is still considered to be holistically processed. Rather, it is the production of novel utterances which has been, so to speak, 'moved in' with it, to also be considered a holistic, not an analytic, process.

In the Focusing Hypothesis, a novel utterance and a clichéd or idiomatic one are considered to be equally propositionally-focused provided that there is some kind of communicational intent which distracts the speaker and/or hearer from the linguistic form of the utterance. Van Lancker (1987) does acknowledge that even apparently 'meaningless' phrases like 'it's a small world' may actually convey a quite complex proposition (p.51), but she does not seem to see this as important.

The reason why Van Lancker's definition does not place primary importance on the communicatory intention of the automatic phrase, despite her acknowledgement that the same phrase can be used novelly as well as automatically (p.28) is that she still defines it essentially in terms of its form. Code's (1987) definition, on the other hand, centres on its function:

A propositional utterance...expresses a unique predicate or statement, itself the product of a voluntary, intentional cognitive act. (Code 1987:59)

Such an approach enables a clearer relationship to be seen between novel utterances, idioms used with a specific semantic intent and idioms used for what would be termed in the Focusing Hypothesis a VFL type purpose. Rather than 'demoting' automatic phrases by seeing them as

lacking functional novelty as well as novelty of form², a function based definition can more directly recognise the deliberate intent of all three types of utterance. To use Grice's terminology (see, for instance, Levinson 1983) the difference between them lies in the flouting of maxims (Levinson 1983:102,109). An idiom used to express a novel idea may flout the Maxims of Relevance and/or Manner if it involves the use of metaphor. An idiom used for the sake of speaking (i.e. as VFL) flouts the Maxim of Quantity (p.101) by proffering semantic information which is not required.

Not only may one person use a phrase for different purposes (see above) but also different individuals may use phrases in different ways:

in scientific literature such phrases as 'theoretical underpinning', 'the more or less consistent finding' and 'recent studies have shown that' are probably used regularly, automatically and maybe relatively non-propositionally by some individuals. For others, however, such phrases would be novel and unusual. (Code 1987:59)

In cases such as this, however, the occurrence of the phrase needs to be constrained to only those contexts where, even if automatically produced and/or holistically processed by the speaker/writer, it will not be misleading for the hearer/reader to take it literally. That is, the non-universality of the nonliteral meaning could lead one hearer to consider the phrase as it stands to be flouting the Maxim of Relevance (Levinson 1983:102) while another hearer took it at face value. To avoid potential confusions, the speaker is obliged to use it only where

2. This is an important distinction. Code (1987) states that "uniqueness is an important hallmark of propositional language" (p.59). It is contended here that the salient uniqueness resides in the idea being conveyed, not in whether or not it happens to be an entirely, or relatively, novel string. Discussion in chapter 5:6 explores this distinction further, with reference to Pawley & Syder's (1983) 'lexicalised sentences' and 'lexicalised sentence stems'.

either interpretation is legitimate.

Code then goes on to associate *automatic* and *emotional* (p.60). In this way he, justifiably, designates non-propositional status to utterances whose sole intent is to create a social effect rather than impart an idea. This highlights the fact that within the confines of the propositional-automatic opposition which he is dealing with, there is no way of formally recognising the purpose behind 'emotional' utterances. In contrast, as we have seen above, the Focusing Hypothesis assigns these utterances a special status (VFL) because the very fact of their utterance constitutes their purpose (e.g. 'Ow!' as an expression of pain and/or to draw attention to oneself; 'How are you?' as a conventional acknowledgement of another individual).

2:2.3 'PROPOSITION'

Code (1987) provides the following definition of the proposition:

A proposition always says something about something. As Luria (1970) puts it, it is a thought 'embodied in a sentence' (p.188), and, he suggests, the fundamental unit of speech. (p.59)

This last aspect is attractive to the Focusing Hypothesis, which makes the proposition so central to its portrayal of the use and processing of language. Hughlings Jackson's (1874) definition formalises the linguistic structure of the proposition:

when we apprehend a proposition, a relation between two things is given to us - is for the moment, indeed, forced upon us by the conventional tricks which put the two names in the respective relations of subject and predicate. We receive in a two-fold manner, not the words only, but the order of the words also. (p.130, fn.2)

In the context of the Focusing Hypothesis, *proposition* refers, essentially, to a *single idea*. It is the semantic equivalent of the syntactic unit *clause*. It would be equally possible to attempt to define

the *proposition* in terms of what a *clause* may contain and to define the *clause* in terms of what syntactic units can express a proposition. Neither would necessarily permit a one hundred percent adherence to standard usages of both terms. It is clearly of some importance that the Focusing Hypothesis should not turn out to be built on terminological air. However, the in depth examination of what *proposition* and *clause* mean would be a lengthy digression and so it is not attempted here. Nevertheless, some brief observations will be made, in the hope of anchoring the terms to some sort of terminological *terra firma*.

Propositions, as the term is used here, are what might elsewhere be termed *simple propositions* (e.g. Purtil 1972:82), that is, expressions relating a subject and a predicate (or, more precisely, predicates of the exact number specified for that syntactic construction). There are two exceptions to this. Firstly, a clause which requires as a predicate another clause becomes a proposition with a semantic *trace* where that clause would go (see chapter 1:6.2). Secondly, the semantic content of a unit smaller than the clause may be treated as if it were a proposition when it is for some reason (e.g. during language focus or when it occurs alone) isolated (see chapter 1:3). The following examples illustrate what is meant at the simplest level by the association of the syntactic unit *clause* and the semantic unit *proposition*.

- 1) York is an ancient city. (1 proposition)
- 2) York is an ancient city but the University is new. (2 propositions).

Where *gapping* occurs, as in (3) and (4), it is generally assumed that there is an ungapped structure underlying it as in (3') and (4').

- 3) York and London are ancient cities.
- 4) She ate a hamburger and went to the cinema.

- 3') York is an ancient city...
.... and London is an ancient city.
4') She ate a hamburger...
... and she went to the cinema.

The Focusing Hypothesis differentiates the two types of coordination illustrated in (3) and (4) by assigning them a one- and a two-clause status respectively in their surface structure form. This is done within the context of an account referred to as *the reduction of juxtapositional complexity*.

2:3 ISSUES IN SEMANTICS AND SYNTAX

2:3.1 THE REDUCTION OF JUXTAPOSITIONAL COMPLEXITY

One feature of language which has often proved problematic for syntactic theory and which has retained a high profile in explorations of semantic theory is *presupposition* (see Levinson 1983 chapter 4 for a review). In its non-technical sense (cf. Levinson 1983:168), presupposition is the essential element underlying Grice's *co-operative principle* because conversation is conducted, according to Grice, on an understanding that there is co-operation of a particular kind, viz. that speakers express the truth as they perceive it (the Maxim of Quality) and that they express ideas which are relevant (the Maxim of Relevance) etc. (Levinson 1983:101f). Examples (5)-(7) below illustrate the way in which presupposition may operate within a discourse context. (5) is referentially meaningless out of such a context, even though it could easily occur within a discourse where the references were already established. (6) presupposes less referential information, but still carries the implications of truth and relevance and therefore a number of presuppositions, (7).

- 5) Well, he doesn't.
- 6) That man you chatted to yesterday doesn't sell ice creams after all.
- 7) a) There is a man.
b) You chatted to that man yesterday.
c) That man does not sell ice creams.
d) We thought that that man did sell ice creams.

As the theories of *presupposition* and *implicature* indicate, it appears to be advantageous to hearers to make certain assumptions about utterances, so that they can more easily fit them into their picture of the world. In other words, although evaluating the truth or relevance of an utterance is possible, it appears to be an option which is usefully bypassed in situations where the hearer is assured, or chooses to behave as if he is assured, of the speaker's co-operation. The flouting of the maxims defined by Grice is a deliberate act on the part of the speaker, who recognises the risk that the hearer will not notice that flouting. In the case of irony, metaphor, the flouting is intended to be detected. In the case of lying and loaded questions (e.g. (8)) it is not.

- 8) A: What time did you see Margaret leave the cinema?
B: About ten-thirty.
A: I though you said you didn't see Margaret all day.

The value of the co-operative principle is presumably that it removes one vital level of propositional evaluation which would otherwise detract from the evaluation of the internal relationships between the propositions presented by a single speaker and from the assimilation of knowledge. A clear example of the co-operative principle at work is the teaching of school children. Their task is to receive ideas and make sense of them in relation to one another. That task would be far more complex if they had to enclose every idea within the questions "Is

this true?" and *"Is this relevant?"*. This is presumably one reason why the issue of school teachers imparting partisan political views to children is considered so important. Similarly, it is mentally exhausting to read a newspaper while applying the questions *"Is this true?"* and *"Do I agree with this?"* and it is an attractive option to choose a single publication whose biases are the same as one's own and, by applying the co-operative principle, to allow the former to reinforce the latter.

The Focusing Hypothesis enters this arena with an account for why such a dangerous set of assumptions as truth and relevance should be continually made by hearers and readers. The analytic mechanisms, which it considers to have only a very limited capacity for juxtaposition at any one time, are pressurised not only 'from below' by the requirements of language decoding, a pressure which is alleviated by the passing of these 'lower' processes to the holistic mechanisms, but also 'from above' by pragmatic considerations. A number of possibilities are theoretically open for dealing with this 'top end' pressure:

a) *Pragmatic and propositional evaluations could be simultaneously dealt with.* This could overload the system, so that that one or other pursuit would be unsuccessful.

b) *They could be successively dealt with, by evaluating the propositions, relating them to the hearer's picture of the 'real world' and then attempting to evaluate their truth.* This is more plausible, but would increase the overall processing time required, with the speaker able to present propositions faster than the hearer could evaluate them, given his need to deal with each proposition at both these levels of evaluation in succession, before the next proposition could be con-

sidered. The result might be either the loss of the thread of the argument or the loss of a sense of which parts were true or relevant and which not. This could be 'relieved' however, if the hearer, having once established that one proposition was invalid in his own terms, made the assumption that they all were. This would not help him prepare a counter-argument, because for this he would still need to establish precisely which ideas were false and why. But, as radio interviews in current affairs illustrate, in most cases disagreement between speakers does not lead to a point by point dissection of the argument but to a general dismissal of the whole speech.

c) The pragmatic aspects could be processed holistically.

d) The pragmatic aspects could be assigned a default value.

(c) and (d) perhaps amount to the same thing, as holistic mechanisms, if they could contribute anything at all, certainly could not operate juxtaposition and so the evaluation of connected ideas for truth and relevance could not occur there. In that case a default value would have to operate; such a default value would have to be along the lines of Grice's maxims, to include the assumption that utterances were true, relevant, gave enough but not too much information and so on, otherwise communication would be highly problematic. Offsetting the default value would occur only by invoking the analytic mechanisms, so that (a) or (b) would apply.

One thing that the holistic mechanisms could do, which perhaps gives (c) the edge over (d), is to contribute interpretational cues about the speaker's emotional state and personality; this is an ability which is closely associated with the right hemisphere (see chapter 3:5.2). If these 'higher level' operations were mediated by the holi-

stic mechanisms in conjunction with a default favouring the co-operative principle, then it might be expected that a hearer would tend to make judgements about the truth and relevance of a speech according to impressionistic criteria such as whether the speaker's voice sounded sincere, whether his eyes looked shifty etc., and perhaps also some less reliable cues, such as the general timbre of the voice, the speaker's manner, his dress, posture and even race etc.

So far, the contribution of the Focusing Hypothesis to the question of implicature has been examined, but presupposition has only been addressed within the context of pragmatics. There is also something to say about presupposition within the immediate sentence. In examples (5) and (6) above, different amounts of information are explicit within the sentence. Specifically, (6) provides considerably more explicit context within which the central piece of information, the same as that in (5), is framed. To put it another way, in a situation where (6) was adhering to Grice's Maxim of Quality, which requires that an utterance contain as much information as necessary but no more (Levinson 1983: 101), then clearly in that same situation (5) would not be adequate and might prompt questions such as "*Who are you talking about?*" or "*He doesn't do what?*". The ways in which (5) and (6) anchor themselves to the real world to enable the evaluation of their meaning are different. (6) anchors to the general co-operative principle and general concomitant assumptions about common knowledge between the speaker and the hearer. All other information is explicit. (5) anchors on two additional facts which have been considered to be true up until that moment: (i) there is a man to whom the hearer was chatting yesterday and (ii) the man sells ice creams. These facts, as knowns, are marked by

the pronoun 'he' and by a 'trace' after 'doesn't' respectively. For one discussion of the contextual relevance of pronouns see Isard (1975: 288ff). The juxtaposition of propositions which are unknown requires contextualisation. The juxtaposition of ones that are known does not. Therefore it seems logical that a contextualised utterance bypasses certain stages of evaluation by 'plunging' into the middle of the part of the world already established as most relevant. Indeed, the success of flouting the Maxim of Relevance as in (9) (where, let us suppose, B is late because he set out late, and the roadworks - which must, of course exist, if B is not to be a liar - were on the opposite carriage-way) depends, if it is intended to mislead, upon the A's failure to see that the comment has detached itself from the context which has been previously specified:

- 9) A: You're two hours late.
B: There are major roadworks on the A1.

Speaker B intends speaker A to receive his reply in accordance with the co-operative principle and A is likely to do so unless the information is impossible to assimilate into the assumed context. In (10) this might well be the case (unless B happens to work for the media or an international charity).

- 10) A: You're two hours late.
B: There was an earthquake in Bangladesh.

If it is the case that precontextualised utterances are more economical of processing space - and this seems plausible given the preference for exchanges like (11) over (6), by which the sudden introduction of context and new information all at once is avoided - then, once

again, the Focusing Hypothesis proffers a processing model which addresses this limitation.

- 11) A: You know that man you were chatting to yesterday.
B: Yes.
A: You know we thought he sold ice creams.
B: Yes.
A: Well, he doesn't.

It also provides an account for how the overload is avoided, viz. that a holistic contextual background to the new information is created. A parallel to this type of assimilation of new material is found in Piaget's suggestion that in language acquisition old, familiar structures and forms are used to contextualise the new (Moskowitz 1985:57). Those familiar structures are considered in the Focusing Hypothesis to be formulae operated by the holistic mechanisms. And indeed this holistic backdrop can be traced right back to the first steps of a baby's language learning process, where the mother's facial expressions and tone of voice provide the context for interpreting utterances as unanalysed wholes, these wholes then themselves contextualising the interpretation of specific elements within them.

Finally, it was noted above that co-ordination might in some cases be party to the reduction of juxtapositional complexity and in other cases not. This is one aspect of syntactic manipulation to the end of reducing the analytic load. Another is the internalisation of clauses. Both will be briefly explored.

2:3.1.1 CO-ORDINATION

In generative syntax there is a constraint on co-ordination which permits only identical constituents to be conjoined (cf. for example,

Radford 1981:59ff). This satisfactorily treats both (3) and (4) (repeated below) in the same way.

- 3) York and London are ancient cities. (NP + NP)
- 4) She ate a hamburger and went to the cinema. (VP + VP)
- 3') York is an ancient city...
... and London is an ancient city.

The Focusing Hypothesis is required to distinguish, however, between (3) and (4) because the holistic mechanisms use formulae which are specified by the verb. Therefore, in (4), two formulae will be required, but in (3) only one. This is not problematic. It simply means that sentences with two verbs³ are treated as two clause constructions. The second clause of (4) would contain a trace in subject position (see chapter 1:6.2) which the holistic mechanisms could not fill but which, in the course of juxtaposition, would be cross-referenced with the NP in the first clause. (3), on the other hand, contains only one verb. There is no reason why the two clauses in (3') could not be separately decoded and then juxtaposed. However, as the formula would be the same in both clauses (as specified not only by the verb but by the constraint preventing the co-ordination of non-identical constituents), it clearly would be advantageous to avoid such juxtaposition and to treat the sentence as one clause and not two. This, again, is not problematic but it does require the existence, amongst the formulae, of both an NP-VP structure (or equivalent) and an NP-conj-NP-VP structure (or equivalent). As discussed in chapter 1:6.1, the question of recursivity

3. Terms like 'main verb', 'auxiliary' etc. are deliberately being avoided here, not because they are not important to the ultimate assessment of the plausibility of the whole Hypothesis, but rather, precisely because they are. A detailed exploration of which verbs determine the selection of formulae and how would be a vast undertaking and so must, unfortunately, be set aside in the present work.

is not as difficult for the Focusing Hypothesis to deal with as it is for other accounts based on formulaic decoding. This is because formulae do not have to exist for all possible expressions of a recursivity rule, only for those where it is useful. Other cases will be dealt with analytically.

2:3.1.2 INTERNALISATION

The basic argument presented here is simple: that speakers are in a position to choose whether to express their ideas via syntactic or semantic complexity. It is in particular ways advantageous to the listener (at least) for the complexity to be semantic. This is because the holistic mechanisms are able to deal, within a single clause, with information of any semantic complexity, but are strictly limited with regard to the syntactic complexity they have to deal with, because clausal boundaries sooner or later intervene, or else the sheer syntactic complexity or unfamiliarity of the clause triggers analysis (see chapter 1:6.2). Provided there is a formula to cope with it, then, a single clause of high semantic complexity will be more economical of processing space than two semantically simpler ones. One example in English is illustrated in (13), which expresses in one clause what (12) expresses in two.

12) [I hope that][Margaret will sing well tonight]

13) [Margaret will hopefully sing well tonight]

Somehow a specific complexity which was syntactically expressed in (12) has been moved inside the single clause which constitutes (13). But this has been achieved at a price: whereas the construction in (12) may take any member of the verb paradigm (i.e. 'You hope', 'Marmaduke

hopes'), (13) is constrained to apply only to the speaker, such that (14) cannot be restated as (13).

14) Marmaduke hopes that Margaret will sing well tonight.

However, in a third person narrative, a restatement of (15) is possible, rendering (16):

15) Marmaduke hoped that Margaret would sing well that night.

16) Margaret would hopefully sing well that night.

The interpretational restrictions on 'hopefully' as compared with 'x hopes that' relate to one aspect of what Lyons (1982) terms *subjectivity*. Lyons explores the idea that:

one cannot reduce the speaker's expression of himself in his utterance to the assertion of a set of propositions. (p.104)

Subjectivity relates to the expression of the (psychological) state of the speaker, which feature of language is one of the three specified by Russell (1940), the other two being the indication of facts and the modification of the (psychological) state of the addressee (Lyons 1982: 106). With cases like 'hopefully' the Focusing Hypothesis links subjectivity, as the expression of the speaker's emotional state, with the reduction of the amount of propositional juxtaposition required in processing. In line with the preceding discussion, it is proposed that 'hopefully' does not receive juxtaposition like 'x hopes that' does in order for it to be related to the rest of the clause. This means that it must be entirely predictable in meaning and truth value from the wider context, provided that the co-operative principle is in operation. This is precisely the feature of 'hopefully': it is permitted to refer only to the speaker or, in narrative, the possessor of the context-

ualising thoughts (as in (14)-(16) above); and it is, practically speaking, immune from truth evaluation by anyone but the speaker or thinker to whom it refers, for no-one else can know what that person thinks or feels. (17) and (18) illustrate this. It is possible for (17) to be truth-evaluated by an outsider, but not (18):

- 17) I have a swollen finger.
- 18) I have a pain in my finger.

The price paid, then, for this reduction in juxtapositional complexity is a restriction on the reduced clause (if it is so termed) to refer only to the speaker/thinker and to have to be true. These two constraints remove the need to evaluate it for relevance or for truth, so it does not need to appear in its own clause.

Another type of internalisation used to reduce the complexity of propositions could be the preposing of relative clauses as in (19)-(22) below:

- 19) Don't miss this 'never-to-be-repeated' weekend.
(British Rail publicity leaflet, September 1987)
- 20) A made-for-television feature length film...
(Times, 18th September 1987)
- 21) A hefty increase in rates in North Yorkshire is still on the cards despite a better-than-expected cash handout from the Government.
(Yorkshire Evening Press, 28th October 1987)
- 22) Inflation has gone up because of much worse than expected share price increases.
(BBC news, 17th August 1987)

Sentences such as (19)-(22) are still not common in English and may be judged as clumsy, but they undoubtedly occur. In discussions of language typology, the gradual adoption by a language of such a feature is considered potentially indicative of a shifting in fundamental language type as defined by the position of the verb relative to the subject and

object; the preposed relative clause is primarily a feature of SOV languages (Downing 1978:391ff). There is a far-reaching implication in drawing parallels across language types in this way when dealing with the possible advantages of preposed relative clauses in reducing juxtapositional complexity. This is that some languages would be using this to advantage while others did not. However, this is a welcome justification of the Focusing Hypothesis' proposal that the motivation for finding optimal strategies for dealing with information is processing limitations, and that the strategies most advantageous to an individual (or speech community) will depend upon what he or it already has in the system and what he (it) specifically requires. The whole question of universal types as a rationalisation of language change hinges on equilibrium and, where equilibria are upset, a chain of reactions reflecting instability, until a new balance is established. The limitations on analytic capacity, as proposed by the Focusing Hypothesis, seem as good a motivator as any for such low tolerance to an unbalance in the arrangement of syntactic structures. The existence of devices to reduce the juxtapositional complexity of sentences, such as the internalisation of clauses as discussed here, could be a valuable catalyst, creating opportunities for a new equilibrium to become established, by vacating (or, if the device is, conversely, abandoned, then occupying) processing space so that other features of the language are forced to compensate.

If the question of equilibrium is at the centre of this phenomenon, then it should be the case that languages in a stable condition which do use, say, preposed relative clauses (i.e. SOV languages) possess other structures which are not reduced in respect of their juxtaposition-

al complexity. Unstable languages might possess a larger number of reduced structures pending the establishment of equilibrium. Languages which could be examined in this respect include Hindi (23) which appears to be relatively stable⁴ and German (24) which is generally considered to be halfway between SVO and SOV⁵.

- 23) hamlog makaan ke saamne khelne - vaale bacchō ko
 we house in-front-of playing being children (+erg) to
 aam denge
 mangoes give(+future)

We'll give mangoes to the children who are playing in front of the house.

- 24) Der von mir bis gestern noch nicht kennen gelernte Mann war
 The by me till yesterday yet not known made man was
 heute den ganzen Tag hier.
 today the whole day here

The man who I didn't meet until yesterday was here all day today.

It is inevitably beyond the scope of the present work to pursue such an examination or to discuss the phenomenon in greater detail.

The above discussion cannot be said to say anything particularly new about the possible problems inherent in trying to evaluate too many things at once, or about the involvement of the right hemisphere in emotional and other holistic aspects of interpretation. But it does pre-

 4. "Hindi is almost the paradigm of an SOV language" (Pullum 1974:3). Nevertheless, Ross (1970) has argued that Hindi has an underlying SVO structure, on the basis of its allowing forward and backward gapping in contrast to, say, Japanese (p.256). McCawley (1970), who questions the primacy of SVO at all, argues for a VSO status for Hindi; see also Subbarao's (1974) discussion.

5. There has been much discussion about the underlying word order of German. Ross (1970) believes that German "cannot be derived from deep structures manifesting SOV order" (p.258). Lehmann (1971) argues for a current return towards SOV in New High German after a brief sojourn (in Middle High German) in SVO. Bierwisch (1967) also argues for SOV.

sent an account which directly links these issues in with a number of other aspects of language processing: the dual system, the very notion of which is fundamentally associated with the idea that the analytic mechanisms have a very low threshold to overload, provides a straightforward and principled scenario for the sharing of functions in specific ways (*strategies*) to meet the demands of individual tasks as they arise and become established as routine.

CHAPTER THREE

EVIDENCE FOR LEFT LATERALISED LANGUAGE

3.1 INTRODUCTION

The Focusing Hypothesis makes a controversial claim: that novel language (see chapter 2:2.2) can be and usually is processed holistically, in clausal chunks. Furthermore, it recognises the logical possibility that this processing could be taking place in the right hemisphere.

The purpose of this chapter is to present some of the evidence available in the field of neuropsychology and neurolinguistics which is generally considered to speak strongly against accounts which propose a more than secondary right hemisphere involvement in language production and comprehension.

3.2 ANATOMY

3.2.1 POST-MORTEM EXAMINATIONS

Anatomical measurements of normal adult, infant and foetal brains have been carried out by a number of researchers (e.g. Geschwind & Levitsky 1968, Tetzner, Tzavaras, Gruner & Hécaen 1972, Wada 1974, Wada, Clarke & Hamm 1975, Witelson & Pallie 1973). All of them found that in a majority of brains the left hemisphere was larger than the right in those areas traditionally associated with language. Wernicke's area (in the left temporal lobe) was usually larger than the equivalent region in the right hemisphere, and the shape of the whole lobe was also different (Geschwind & Levitsky 1968, Tetzner et al 1972).

Foetal brains also had this asymmetry (Tetzner et al 1972, Wada

1974, Wada et al 1975), indicating:

that the enlargement of the left planum cannot be a response to the development of linguistic competence in childhood. (Geschwind 1979:166)

Wada et al (1975) note, however, that there was greater asymmetry in adults than in infants, which implies an increase in asymmetrical development with age.

The frontal operculum was found to be half as large again in top surface area on the right as on the left in most of the brains examined (Wada et al 1975). However, the convoluted surface was much more densely packed on the left, leading to the suspicion that:

the total cortical surface area of the operculum could be larger on the left in most brains. (Wada et al 1975:245)

Sex was found to be a relevant variable; of the 10% of brains found to have a larger right temporal lobe, significantly more were from females than males (Wada 1974; Wada et al 1975).

3.2.2 IN VIVO EXAMINATIONS

3:2.2.1 GREY & WHITE MATTER

A search for the neurophysiological substrate of functional asymmetry should begin with an examination of the amount and distribution of various types of neural tissue in the two hemispheres. (Gur, Packer, Hungerbuhler, Amarnek, Obrist & Reivich 1979:24)

Grey and white matter constitute different kinds of fibrous connections in the brain. To find different proportions and arrangements of them in the two hemispheres might be considered relevant to the general differences associated with the handling of information by left and right.

White matter consists mainly of fibres surrounded by the white fat-

ty substance myelin. These fibres link both the peripheral and central brain areas and the various areas of the cortex, besides making the crucial interhemispheric connections. Grey matter, of which the outer surface (cerebral cortex) of the brain is composed, is made up of non-myelinated fibres and closely-packed nerve cells. Grey matter forms the internal connection of individual regions (Gur, Packer, Hungerbuhler et al 1979).

Gur, Packer, Hungerbuhler et al (1979) used a method of bloodflow tracing (in which the radioactive isotope Xenon-133 is injected into the main arteries to the brain, providing a means of tracing the amount of bloodflow to various areas) to establish the relative distribution of grey and white matter in each hemisphere. They found a higher ratio of grey to white fibres in the left hemisphere. This was most marked in those areas associated with abstract thought and with speech, i.e. the frontal and pre-central regions.

3:2.2.2 X-RADIOLOGY

3:2.2.2.1 INTRODUCTION

Two methods of measuring the static-state differences between the hemispheres will be described here. Similar methods which deal with cross-function comparisons are described in chapter 5:4.

3:2.2.2.2 TRANSMISSION COMPUTERISED AXIAL TOMOGRAPHY (TCAT)

The principle of X-radiology is the monitoring of the passage of X-rays through an organ; these are differentially impeded by the various tissue structures. TCAT is able to provide accurate tissue density readings (to 0.5%) through the focusing of the X-ray detectors onto a

specific layer of tissue, so that a number of images can be assembled by computer into a 3-dimensional representation (McAlister 1979). Reporting the work of LeMay, Geschwind (1979) describes the findings of this research:

a peculiar, skewed departure from bilateral asymmetry is observed. In right-handed people the right frontal lobe is usually wider than the left, but the left parietal and occipital lobes are wider than the right. The inner surface of the skull itself bulges at the right front and the left rear to accommodate the protuberances. (p.168)

3:2.2.2.3 CEREBRAL ARTERIOGRAPHY

By injecting into the bloodstream a substance opaque to X-rays, X-ray photographs will highlight the vascular system. This method is used for general diagnostic purposes, but it has proved useful with regard to linguistic research, in establishing the size and angle of the Sylvian fissure, which is the upper boundary of the temporal lobe and passes through the middle of Wernicke's area; the middle cerebral artery follows the Sylvian groove (Geschwind 1979:168). Again reporting the work of LeMay, Geschwind states:

She found that in most people the middle cerebral artery on the right side of the head is inclined more steeply and ultimately ascends higher than the corresponding artery on the left. (p.168)

3:2.2.3 ELECTRICAL STIMULATION

Penfield and Roberts (1959) describe in detail their method of mapping areas of brain function by means of the direct electrical stimulation of exposed brain tissue in conscious patients. They found that although meaningless vocalisation could be inhibited or initiated by the stimulation of either hemisphere's motor cortex, aphasic symptoms in speech were produced only in conjunction with stimulation of the *speech areas* of the left hemisphere, though the boundaries of these ar-

eas and the density of linguistically sensitive sites within them varied from person to person. Fedio & Van Buren (1974) report similar findings. For some brief discussion of more recent work see Code (1987: 23f).

3:2.2.4 THE WADA TEST

The Wada test is considered the most reliable gauge of hemispheric dominance for language. It is on the basis of data from this test that the accuracy of the dichotic listening test (see section 3:4.2 below) has been established (Weinstein 1978:19) and challenged (Kinsbourne & Hiscock 1977:183, Bryden & Allard 1978:396). Developed as a means of studying epileptic discharge between the hemispheres (Harris 1978:493), the procedure involves the injection of the barbiturate sodium amytal into one of the intracarotid arteries; this causes the temporary anaesthesia of the ipsilateral brain hemisphere (Wada & Rasmussen 1960; see also Harris 1978:493 for a description of the procedure). A patient's ability to react to commands while one hemisphere is inactive is considered an indication of what the unaffected hemisphere can and cannot do. Tasks that are exclusively the domain of the anaesthetised hemisphere will be beyond the patient's capability. It has been found that:

during the period of left hemisphere anesthetization subjects, although totally incapable of speech, can understand and carry out simple verbal commands. (Nebes 1978:109)

On the other hand,

injection of sodium amytal to anesthetize the right hemisphere of right-handers only rarely produces any deficit in verbal skills. Usually, as far as can be tested, comprehension and expression are unaffected, outside of some slurring resulting from left-sided facial weakness. (ibid:102)

Right hemisphere anaesthesia does, however, produce some other effects, such as the loss of the ability to sing a tune (Nebes 1978:121, Harris 1978:422). The response to commands during left hemisphere anaesthesia, though limited, is an indication that the patient:

is co-operating and that his lack of speech is not due to disturbances of consciousness or co-operation. (Harris 1978:493)

The Wada test has been used to establish that in some stutterers (15%) there is bilateral representation of speech (for a brief description of this and other research on stuttering see Nebes 1978:108).

By far the most important and widely quoted of the findings of Wada test investigations is that an estimated 96-98% of right-handers have left hemisphere dominance for language (e.g. Rasmussen & Milner 1975, cited in O'Leary 1982). The same researchers estimate left dominance for 70% of left-handers, with the remaining 30% divided equally between right dominance and bilaterality. However, not all researchers agree: Satz (1979) estimates bilateral representation to occur in 70% of left-handers (see O'Leary 1982:55).

Some caveats apply to the use of data from the Wada test to draw conclusions about the lateralisation of brain functions. Firstly, they are administered almost exclusively to patients with a history of epilepsy or, at the very least, with some suspected brain abnormality (Levy 1974). Levy is cautious about drawing conclusions from studies of brain-damaged patients and applying them to theories about the normal population.

Secondly, the period of hemispheric inactivity is very short: 5-10 minutes (Nebes 1978:101). As some of this time is required "for the conscious hemisphere to readjust to the situation" (ibid:101), task

complexity is severely limited by the time constraint. For instance, Nebes describes the test of right hemisphere language competence (during left hemisphere anaesthesia) as being:

fairly superficial...and [consisting] mainly of commands to perform gross left-sided body movements. (p.109)

It is possible that in the period during which the barbiturate is active, the conscious hemisphere does not reflect its full range of abilities. This, and another possibility, that the left hemisphere's inactivity does not prevent its operating an inhibitory mechanism on the right, will be discussed in chapter 4:1.1.4.

Thirdly, it is not possible to get a complete picture of hemispheric activity by introducing substances only into the carotid artery. This artery supplies the middle cerebral artery (and through this the speech and auditory regions) and the anterior cerebral artery (to the frontal and midline regions). But the primary visual area is supplied by the vertebral artery via the posterior cerebral artery and therefore is one of the regions not affected in these experiments (Lassen, Ingvar & Skinhøj 1978:53).

3:3 CLINICAL

3:3.1 INTRODUCTION

Marc Dax in 1836 was apparently the first to publicly speak of a connection between acquired right hemiplegia and language loss, but it appears that Paul Broca's own observations in the 1860's were made without any knowledge of this earlier work (Penfield & Roberts 1959: 56). In 1874, Hughlings Jackson observed that:

The two halves [of the brain] are not double in function in the sense that both are required for speech, since a patient can speak

perfectly well when the right half of his brain is damaged... Nor are they double in the sense that the two halves are such exact duplicates that either of them will do for speech, since extensive damage to a certain region of the left hemisphere will destroy speech altogether. (p.129)

Broca in 1861 and Wernicke in 1874 were able to identify specific regions of the left hemisphere which could be associated each with their own characteristic language deficit (see below). A detailed account of the history of aphasic research can be found in Penfield & Roberts (1959, chapter 4). Since then, research has furnished the field with a substantial corpus of data, from patients who have incurred brain damage through strokes, bullet or shrapnel wounds or motor accidents. In addition, neurolinguistic research has reaped benefits from the advances in neurosurgery and it has been possible to study patients who have undergone hemispherectomy or hemidecortication and others with a *split-brain*, i.e. a surgically severed central commissure, which leaves them with two isolated hemispheres. For reviews of the findings of aphasic research see, for example, Benton & Joynt (1960), Hécaen (1976). For examples of detailed case histories see Basser (1962), Hécaen (1976). There is no doubt that this data has confirmed the very first observations of 150 years ago, which associated language loss with left hemisphere damage:

Everyone must admit that there is at least a statistically significant concentration of language defects due to lesions in given areas of the left cerebral cortex. (Lenneberg 1974:518)

Just what the relationship is between the findings of clinical research and the distribution of functions in the normal brain during conversation, however, can, necessarily, only be inferred. It is the common assumption that "nearly all human beings have their language functions 'lateralized' to the left" (Bolinger 1975:293; see Ten Houten

1982:32 for a similar assertion) which is being challenged by the Focusing Hypothesis.

3:3.2 LEFT HEMISPHERE LESION

3:3.2.1 INTRODUCTION

Drawing from his clinical research, Bassler (1962) said that:

the dominance of one cerebral hemisphere, usually the left, in relation to speech...[is]...one of the most constant and remarkable phenomena of human cerebral physiology. (p.427)

In his examination of case reports relating to children with brain damage, he found 86% of left hemisphere damaged patients to have a language deficit, and 46% of right hemisphere damaged patients. Children have been considered by many to have less strongly lateralised language than adults (see chapter 4:1.2.4.4). Hécaen (1976) challenges Bassler's figures (See chapter 4:2.2) and presents his own, also for child patients (up to 14 years of age): language handicap in 88% of left hemisphere lesions and 33% of right hemisphere lesions. Hécaen considers even his own latter figure to be unrepresentatively high and notes that it is based on only six cases, as opposed to 16 left hemisphere cases, so that:

one suspects an artifact: certain children with right sided lesions without language disorder may not have been referred to us. (p.199)

The symptoms of aphasia after a left hemisphere lesion range from virtually complete loss of comprehension and production ability to minimal word-finding difficulties. Indeed, some problems are so specific and limited that they might go unnoticed in some circumstances. For example, brain damage which was only associated with a loss of literacy skills would presumably not be considered to have had a language-rela-

ted effect if the patient happened to be illiterate. Veyrac (1931) refers to a case of differential aphasic recovery in a polyglot (see chapter 4:5) in which:

if she had never spoken any other language but French, it could have been concluded that the aphasia had completely regressed.
(p.326)

No two left hemisphere damaged patients will have identical post-lesion aphasic symptoms, for each brain injury is unique. Furthermore, there may be individual variation in the location and density of cells associated with linguistic function. The classic symptoms of Broca's, Wernicke's and conduction aphasia, to name but three, function as points of reference in the diagnosis of essentially idiosyncratic combinations of linguistic deficits found in any individual patient. The descriptions below are brief; a more detailed account of the different types of speech, reading and writing disorders associated with left hemisphere lesions can be found in Hécaen & Albert (1978:36ff) and Lesser (1978). Some discussion of the precise type and area of brain damage associated with the aphasias can be found in Code (1987:65ff).

3:3.2.2 BROCA'S APHASIA

The characteristics of Broca's aphasia are a lack of grammatical *function words* and morphological suffixes, and speech which is "slow, effortful and distorted in pronunciation" (Slobin 1979:127). There are severe naming difficulties. While novel expression is severely disturbed, memorised formulae such as prayers, poems, lists and paradigms can often be successfully produced (Veyrac 1931:336, Denès 1914:109). While novel production is non-fluent and 'telegraphic' (for examples see Geschwind 1979:209, Heny 1985:162), comprehension problems are not

considered to be a symptom of pure Broca's aphasia.

Broca made a connection between this particular type of agrammatic speech and damage to the third frontal convolution in the left hemisphere, specifically the posterior end of that convolution (Scoresby-Jackson 1867:704). Broca's area is thus adjacent to the motor cortex, which is partially responsible for linguistic production, in that it controls the articulatory apparatus (Heny 1985:163). Slobin (1979) attributes the continued motor control of articulatory muscles for non-linguistic purposes to right hemisphere activity (p.127). If this is the case, then the failure of the right hemisphere to take over motor control for linguistic functions as well as non-linguistic ones may be considered indicative of the absence of any linguistic processing apparatus in the right hemisphere. However, there is an alternative explanation. The right hemisphere could have linguistic processing mechanisms which remain inactive because inhibitory mechanisms prevent it from adopting the motor control of the articulators from the damaged left. In this case, speech would fail not because the right has no linguistic instructions to give to the articulators, but because, since the damage, the left has not.

3:3.2.3 WERNICKE'S APHASIA

Wernicke's area is situated in the temporal lobe, between the primary auditory cortex and the angular gyrus. The latter is thought to connect the auditory and visual centres (Geschwind 1979:161). The area consists of the temporal portion of a region variously referred to as the *general interpretative area*, the *gnostic area*, the *knowing area* and the *tertiary association area* (Guyton 1981:195), all of which names in-

dicating the importance of the functional attributes with which Wernicke's area is directly or indirectly linked. The linguistic disorders associated with damage to this area are consistent with its proximity to the auditory cortex and the angular gyrus. The angular gyrus marks the meeting place of the auditory, visual and somesthetic sensory areas (Hécaen & Albert 1976:29f). Thus these disorders include difficulties in dealing with auditory and visual input leading to comprehension problems:

A person might hear perfectly well and even recognize different words but still might be unable to arrange these words into a coherent thought. Likewise, the person may be able to read words from the printed page but be unable to recognize the thought that is conveyed. (Guyton 1981:195)

In addition, the production of speech will feature lexical fluency without normal semantic cohesion (see Geschwind 1979:161, Heny 1985:162):

Words are often strung together with considerable facility and with the proper inflections, so that the utterance has the recognizable structure of a sentence. The words chosen, however, are often inappropriate, and they sometimes include nonsensical syllables or words. (Geschwind 1979:161)

Utterances characteristically lack content words, are nonspecific in reference and contain "a preponderance of pronouns" (Slobin 1979:128).

3:3.2.4 CONDUCTION APHASIA

Broca's and Wernicke's areas are connected by fibres referred to as the *arcuate fasciculus*. Conduction aphasia is associated with damage to these fibres, so that the exchange of information between the two functioning *speech areas* is impaired. Speech is fluent because Broca's area is intact. Comprehension is normal because Wernicke's area is processing input normally. But the semantic content of speech is missing because Wernicke's area is unable to provide Broca's area with the

necessary information (Geschwind 1979:161, Slobin 1979:129). Slobin also refers to an inability on the part of conduction aphasics to repeat speech they hear, because the auditory information entering Wernicke's area cannot be passed on to Broca's area for production (p.129).

3:3.2.5 OTHER TYPES OF LANGUAGE DISORDER

As already stated, many other types of aphasic disorder have been identified. Some of these are described in detail by Hécaen & Albert (1978:36ff). One of them, transcortical motor aphasia (p.52f) is discussed at length by Luria & Tsvetkova (1970) under its alternative name, dynamic aphasia. This disorder is apparently caused by a lesion to the anterior part of the border zone immediately surrounding the *language zone* (Hécaen & Albert 1978:52f), this latter consisting of Wernicke's and Broca's areas and the angular gyrus (ibid:27). Motor speech and comprehension are preserved, but the patient is apparently unable to verbalise ideas, to 'propositionalize' (Luria & Tsvetkova 1970:187).

In some patients, secondary linguistic functions are affected, often alongside speech and comprehension handicaps, but also sometimes where there are no primary linguistic deficits. As one example, damage to the angular gyrus appears to affect the comprehension of written language. This implies a failure in communication between the visual cortex and Wernicke's area (Geschwind 1979:161f). Two other well-documented secondary linguistic impairments are *deep dyslexia* and *surface dyslexia*. Marcel (1980) describes their main contrastive characteristics as being, in the former, errors based on the syntactic and semantic characteristics of the words, and in the latter, errors based on

spelling-to-sound correspondences. The dyslexias and their causes are discussed from a variety of angles by a number of authors, e.g. Marshall & Newcombe 1966, 1981, Newcombe & Marshall 1981, Patterson & Marcel 1977, Patterson 1978, 1979, Richardson 1975, Saffran, Schwartz & Marin 1976, Saffran & Marin 1977, Shallice & Coughlan 1980 and the contributors to Coltheart, Patterson & Marshall 1980).

3:4 PSYCHOLINGUISTIC EXPERIMENTS

3:4.1 INTRODUCTION

Inevitably, the types of test which can be conducted without specialist medical equipment and without risk to the subject, and which can be administered quickly and effectively to large numbers, render the psycholinguistic experiments different in content and object to the investigations carried out in clinics and hospitals.

Measurements are indirect and usually relate to induced processing difficulties, in the expectation that the two hemispheres may perform differently in adverse circumstances. The difficulty of the task may lie in requiring the response to be given as quickly as possible, or in having to deal with competing stimuli. As with all behavioural experiments, there is an inherent problem in distinguishing relevant and irrelevant variation in within-subject and across-subject performance. Furthermore, the overall interpretation of results inevitably involves inference, which leaves the way permanently open for alternative interpretations. Even the most consistent evidence for *right ear superiority* in a dichotic listening test cannot therefore be considered to prove the left lateralisation hypothesis. It is certainly consistent with the predictions of that hypothesis, but no direct connection can be

drawn between the behavioural trends of individuals listening to competing auditory stimuli and actual activity in a specific area of the brain. On the other hand, behavioural data is currently the best we can gather in the circumstances (but see chapter 6:4). A brief review of *haptic* processing experiments, which are not discussed here, can be found in Code (1987:30ff).

3:4.2 DICHOTIC LISTENING TESTS

In the dichotic listening test (d.l.t.) the subject is played two stimuli or sets of stimuli, one into each ear. He is required to report what he has heard, usually in a free recall condition, i.e. where items may be reported in any order. The pioneering work in this field was done by Broadbent (1954) and Kimura (e.g. 1963, 1967; Knox & Kimura 1970). Kimura used as linguistic stimuli randomly ordered and paired monosyllabic single digit names (i.e. one to nine, excluding seven). In the d.l.t. the stimuli are heard through headphones and the onset of each word in a set is in exact alignment with that of the corresponding word in the set presented to the other ear.

Ear advantage is determined on the basis of accuracy in recall. This is not wholly satisfactory, however, as the order of recall tends to be different according to the speed of presentation, favouring the report of all stimuli to one ear and then all those to the other in fast presentation, and, in slow presentation, alternate ears, in order of the stimulus pairs as they appeared (Bryden & Allard 1978:393). Bryden & Allard also note that free recall permits the choice of which ear to report first. A general preference for the right would lead to that ear being reported first and thus most accurately, giving the ap-

pearance that information to that ear is subject to superior perception and/or decoding efficiency. However, there is evidence that even when the order of report is specified and therefore controlled, a right ear advantage (REA) is still to be found (Bryden & Allard 1978:394). There is further discussion of procedures in dichotic listening tests in chapter 4:1.2.5.1.

Results have been consistent in showing a right ear (left hemisphere) advantage, almost always statistically significant, for linguistic stimuli (Bryden & Allard 1978:393). This advantage is manifested in the more accurate reporting of right ear stimuli. It applies to adults and to children as young as four (Kimura 1963). In appropriately modified tests, Entus (1975) and Best & Glanville (1976, cited in Ten Houten 1978:25) found that babies responded more to an alteration in the right- than the left-ear item of dichotic pairs of speech sounds, indicating an REA for language at an age when there are not yet any signs of systematic language acquisition.

In contrast, non-linguistic stimuli such as clicks, melodies, sonar signals and musical chords elicit a left ear (right hemisphere) superiority (see Hécaen & Albert 1978:271). For a general review of d.l.t. results see Ten Houten (1982:25ff).

The cut-off point between what appears to be treated as 'language' and what does not is an interesting one. An REA has been reported not just for digits but also for words played backwards (Kimura & Folb 1968, cited in Dimond 1972:157). Some subjects have been found to have an REA for minimal pairs differing in one consonant but not one vowel (Studdert-Kennedy & Shankweiler 1969). It has been suggested (Tsunoda 1975:169) that the perception of isolated vowels and consonants as lin-

guistic as opposed to non-linguistic input depends on the functional load of the items in the particular language of the subject. Fluent users of morse code have been found to have an REA for morse signals, while naïve subjects have an LEA for sequences over seven segments long (Papçun, Krashen, Terbeek, Remington & Harshman 1974; see also Tsunoda 1969, cited in Tsunoda 1975).

On the other hand, speech which has been chopped into segments of 200 milliseconds or less elicits not a right, but a left ear superiority (Kimura 1970, cited in Dimond 1972:157).

The interpretation of results for the dichotic listening test relies on the assumption that the connection between a hemisphere and its contralateral ear is more direct and more efficient than that with its ipsilateral ear (Hécaen & Albert 1978:271). However, Shadden & Peterson (1981) suggest on the basis of their monaural experiments that attention may play an important rôle alongside any more general lateralisation of functions (see also Hécaen & Albert 1978:413). Soares & Grosjean (1981) removed a difference in dichotic listening test scores between mono- and bilinguals by presenting the stimuli in blocks of a single language.

Kinsbourne & Hiscock (1977) question the validity of comparing the size of REAs to determine extents of lateralisation in different groups, because attentional factors appear to play a decisive rôle in the ear advantage patterns (p.176,182).

Bryden & Allard (1978) survey and assess the results of the dichotic listening test and highlight some inconsistencies. These will be discussed in chapter 4:1.2.5.1.

3:4.3 TACHISTOSCOPIC TESTS

In some important ways tachistoscopic investigations can be considered the visual parallel to dichotic listening tests. They compare the efficiency with which stimuli are dealt with when presented to the left and right visual half-fields. This may be by requiring the subsequent reporting of the stimuli after the simultaneous presentation of items to both fields, or by measuring the speed of responses made to a single stimulus. In the latter case, the subject does not know which field will host the stimulus, so his only way of scoring above chance level is to affix his gaze centrally. This, and the minimal exposure time - too short to enable the eyes to move and focus on the stimulus - assure that a stimulus presented to a part of space only within one visual half-field, remains completely outside of the other. Thus, the information passes, in the first instance, to only one (the contralateral) hemisphere. For a more detailed account of the motivation behind the design of tachistoscopic test procedures, see Kimura & Durnford (1974:25).

As with dichotic listening tests, it has been established that the majority of subjects respond faster and/or more accurately to linguistic stimuli presented to the right visual half-field (e.g. Levine & Banich 1982). For a review of findings see Witelson (1977). The differences in response time between left and right presentation are considered to be :

of the order to be expected for interhemispheric transfer via the corpus callosum on the pathway from the visual cortex to the hemisphere concerned with the discriminative processing of the information. (Popper & Eccles 1977:351)

Moscovitch (1983) is more exact:

It is assumed that a consistent advantage of some 30msec in latency or 10% in accuracy for one visual field or ear over the other

in recognition indicates that the hemisphere contralateral to the favored field is dominant for the task at hand. (p.62)

In tasks of pattern recognition it is the left visual half-field that displays an advantage (see Harris 1978).

One issue raised in relation to the findings of particular tachistoscopic studies has been the rôle of the direction of scan in reading that the subjects are accustomed to (see chapter 4:4.2.2.1).

3:4.4 VERBAL-MANUAL INTERFERENCE TASKS

The premise upon which verbal-manual tasks have been administered and interpreted is that:

people generally cannot simultaneously perform two tasks as well as each one by itself. [Efficiency] depends on which parts of the brain are involved in the two tasks. If both activities are programmed in the same cerebral hemisphere, the time-shared performances will be inferior to those found when one activity is programmed on one side of the brain and one on the other side. (Kinsbourne & McMurray 1975:240; see also Kinsbourne 1978:558)

It has been demonstrated experimentally that subjects' performance on digit naming and tapping with the right hand decreases when both are required simultaneously, in comparison to when either task is done by itself (Kantowitz & Knight 1974)¹.

In addition, performance drops more where the tapping task is more complex:

Thus, not only does the tapping task itself require processing capacity, but even more importantly, an increase in tapping difficulty also requires greater processing capacity. (Kantowitz & Knight 1974:334)

The advantage of such tasks over the dichotic listening test is

1. The general principle of reduced efficiency on simultaneous tasks has been demonstrated elsewhere too, as, for instance, in Foss (1970), where subjects detecting ambiguity and also reacting to the occurrence of a target phoneme were slower in both respects than groups doing only one of the two tasks.

that attentional variations are not a confounding factor. In the former, subjects may shift their attention from one ear to the other just to relieve boredom or out of curiosity. In the verbal-manual tasks, any shift in attention can only be between the two concurrent tasks, so it has no effect of any kind that could be mistaken for a pattern along the parameter of brain organisation (Kinsbourne & Hiscock 1977:184).

Verbal-manual interference has only been found in children: adults seem to be able to over-ride the difficulties (Briggs 1973, cited in Kinsbourne & McMurray 1978). According to Kinsbourne & McMurray, Briggs (1973) found adults well able to sustain tapping with either hand during speech, though at a speed proportionately lower than when there was no concurrent speech task. In other words, assuming left hemisphere speech, right-hand tapping did not appear to be in competition with it any more than left-hand tapping did. Kinsbourne & McMurray attribute this both to an increase in discrete motor control in maturity (p.240) and to a greater automatisisation of repetitious motor tasks such as tapping (p.241).

Kinsbourne & McMurray (1975) tested preschool children in a task of simultaneous tapping with one hand and speech (reciting a nursery rhyme and repeating four familiar animal names). They reasoned that a tendency to interference masked by the adults' maturity in motor control would show in children:

The immature organism has a limited repertoire of synergisms which with increasing maturation can be better differentiated into precise, discrete, and isolated movement. If overflow from one motor program to another within a hemisphere is a special case of this synergistic tendency, then it should be relatively more in evidence in the immature organism. (p.240)

Their results indicated a general reduction in tapping efficiency when it was concurrent with speech and an asymmetry was observed with

regard to which finger was tapping. Right-handed tapping was disproportionately disrupted in relation to left-hand tapping. This was considered to indicate that the mechanisms involved in speech and right-hand tapping were in greater competition than those of speech and left-hand tapping, implying left lateralisation for language. Kinsbourne & McMurray note that the task requiring the repetition of animal names disrupted tapping more than the recitation of the nursery rhyme.

Tsunoda (1975) conducted a whole series of experiments on normal Japanese and Western subjects and also on unilaterally lesioned Japanese patients. His method required a constant tapping pattern (right and left hands were not compared), with stimulus sounds (pure tone and the vowels /a/ & /u/) played synchronously into one ear and with Delayed Auditory Feedback of approximately 0.2 seconds into the other. He assessed cerebral dominance for stimulus sounds according to the relative intensity with which the delayed sounds had to be played into the two ears to create a threshold of disruption to the tapping pattern. By this method Tsunoda was able to collect the following results:

1. Told to pay attention to the synchronous sounds, 71.7% of normal Japanese subjects showed a right ear advantage for vowels and a left ear advantage for pure tones, white noise, buzzer etc. 7.6% showed the reverse pattern, 18.5% showed no difference (p.156).

In the condition of not being asked to pay attention to the synchronous sound, 83.9% showed normal or normal reversed dominance, 6.4% no difference.

2. With brain-damaged patients, in the 'no attention' condition both aphasics with right hemiplegia and those without any motor paralysis showed a left ear advantage for both verbal and non-verbal sounds; dysarthrics with right hemiplegia but no language handicap had normal patterns; left hemiplegics without speech disorders had (8 out of 9 cases) right ear advantage for vowels and non-verbal sounds.

In those cases where verbal and non-verbal functions were in different hemispheres, Tsunoda's test accurately matched the results of

Wada tests (Sodium amytal, see section 3:2.2.4).

By attaching a bone conduction receiver to the forehead during the test, an 'interfering' linguistic stimulus, either a verbal sound (/a/) or a continuous interesting text, could be played to the subject while he continued to tap against the background of dichotic sounds as described above. Tsunoda found that the superimposition of the linguistic stimulus shifted the cerebral dominance for the pure vowel sound from right to left (left to right in reversed dominance subjects).

The following stimuli were treated as 'verbal' by subjects: spoken isolated filtered vowels consisting of only first and second formants (F1 and F2), isolated vowels, CV and CVC patterns accelerated four times (unnatural in sound, four times higher in formant frequencies, but still with the same F1:F2 ratios), whispered vowels, CV and CVC sequences accelerated four times and unnaturally segmented. Complex FM and AM sounds and harmonic sounds produced left ear (right hemisphere) dominance; inharmonic sounds produced right ear (left hemisphere) dominance.

Other verbal-manual interference experiments have used motor tasks other than finger tapping. Kinsbourne & Cook (1971) and Hicks (1973, cited in Kinsbourne & McMurray 1975) investigated subjects' ability to balance a dowel rod on their index finger, and found that balancing was less well maintained by the right hand during speech but left-hand balancing was not affected.

3:4.5 LATERAL EYE MOVEMENT

The use of involuntary eye and head movements during linguistic and spatial tasks has been used by Kinsbourne (1972) to establish dominance

for language and visuo-spatial skills. This is in accordance with other experimentation which has suggested that:

the direction of eye movements indicates contralateral hemispheric activation. (Gur, Packer, Reivich, Hungerbuhler, Goldberg & Obrist 1979:4)

He found that right-handers moved the eyes most often to the right during the linguistic task and to the left in the spatial one. The same applied to horizontal head movements. Some left-handers looked to the right and most others to the left, both in verbal and spatial tasks. The relative patterns lead Kinsbourne (1972) to conclude that:

functions that are widely distributed across the cerebrum in right-handers are more closely packed into one hemisphere (sometimes the right and sometimes the left) in left-handers, or at least are performed by the same hemisphere during the period of the experiment. (p.540)

For further discussion of lateral eye movement experiments see Code (1987:32ff).

3:5 THE LINGUISTIC RÔLE OF THE RIGHT HEMISPHERE

3:5.1 INTRODUCTION

Two lines of thought can be found in the psycholinguistic and clinical literature regarding the rôle of the right hemisphere in language processing. The first is a logical extension to the general, and only relatively recently challenged, assumption that it is the left hemisphere that is, more or less exclusively, the *language hemisphere*, a view which has sprung naturally out of the consistent observation that language loss often occurs after left hemisphere damage and rarely after right hemisphere damage (see section 3:3 above). In this view, the right hemisphere's contribution to language processing relates to the *non-linguistic* aspects of the total communication process, such as in-

tonation, gesture etc. In addition, automatic speech (see chapter 2: 2.2) is 'relegated' to the right hemisphere. All these components of communication are easily linked to the right hemisphere's observed superiority in holistic perception and visuo-spatial tasks.

The other view of the right hemisphere in language attributes to it a direct linguistic rôle of sorts, or at least the capability for such a rôle. Most proponents of this draw on recent observations from the clinic, and attempt to demonstrate that particular aspects of language (e.g. phonetic perception, syntax or semantics) require a cognitive approach consistent with that of the right hemisphere. Thus they argue for a model which has a particular distribution of language functions between the hemispheres. The ways in which these accounts differ from the one proposed in the Focusing Hypothesis is examined in chapter 5. Most strikingly, the Focusing Hypothesis envisages a variable interface in the interhemispheric transfer of operations, which requires a duplication of abilities, though not methods, for processing. In contrast, the theories to be discussed here appear to work towards the identification of a static divider between the capabilities of each hemisphere, implying that a given aspect of language processing is always and must always be dealt with in the same analytic or holistic way.

3:5.2 THE NON-LINGUISTIC RIGHT HEMISPHERE

Until very recently, it has been generally considered that *language processing in the right hemisphere* is restricted to "the noise of people talking at a party...[and] common greetings and overlearned phrases" (Rupp 1980) and to the paralinguistic features of verbal communication, such as gesture and intonation (e.g. Blumstein & Cooper 1974).

These are aspects which it is supposed are most effectively processed in a holistic, non-analytical way, and therefore most effectively by the hemisphere associated with that approach (Rupp 1980:20, Krashen & Galloway 1978:2). Some work by Jaffe (1976, cited in Seliger 1982) involved the selective removal of just the high or just the low frequencies from recordings of normal utterances. Where there were only low frequencies the emotional force of the utterance remained but it was lexically incomprehensible. Where only high frequencies remained there was a clear but unemotive message. According to Seliger (1982:313) Jaffe proposes that the right hemisphere is equipped to deal with the processing of the low frequencies, which carry information about the speaker (e.g. age, sex, emotional state), while the left hemisphere deals with the high frequencies. With regard to hand gestures, Seliger observes that these are usually performed with the right hand and so fall into the left visual field of the hearer, to which field the right hemisphere is most efficiently linked. This raises the question, however, of why, if the production of gestures is also holistic, as we would assume it to be, and therefore also controlled by the right hemisphere, it is not the left hand which preferentially expresses them; Moscovitch & Olds (1982), cited in Code (1987:103) found a right-hand dominance in gestures during speech, though only when there was no co-occurring facial gesture (Code 1987:76).

An investigation of hemispheric specialisation in normal and congenitally deaf signing and non-signing children (Neville 1977) has indicated that gesture can be left hemisphere mediated where it plays a directly linguistic rôle as in deaf sign language. Non-signing deaf children did not show hemispheric differences for the perception of

line drawings. Normal, hearing children showed the predicted left visual field superiority. But signing deaf children showed a reverse pattern, which Neville attributes to either the adoption by the left hemisphere of all visuo-spatial skills, including signing, or to a total reversal of the normal organisation, with language (signs) in the right hemisphere and other, nonlinguistic skills, in the left hemisphere (p.129; cf. also McKeever, Hoemann, Florian & Van Deventer 1976). The question of right hemisphere superiority for visuo-spatial skills briefly discussed in the Concluding Remarks.

Numerous reports from aphasic studies note that after the loss of normal linguistic communicational ability in the wake of left hemisphere damage, some automatic phrases (e.g. swearwords and greetings) and parrot-learned sequences and paradigms (e.g. nursery rhymes and days of the week) remain intact. This again has led to the supposition that these aspects of language are holistically stored and accessed by the right hemisphere. Benton & Joynt's (1960) review of reports of aphasia provides many such accounts. For example:

At the same time she lost all speech with the exception of the words 'yes' and 'and'. She could say no other word, not even a syllable, with these exceptions: the Lord's Prayer, the Apostles' Creed, some Biblical verses and other prayers, which she could recite verbatim and without hesitation, but somewhat precipitously. But it is to be noted that they were said in the order in which she was accustomed to saying them for many years, and, if this regular sequence were interrupted and she were asked to recite a prayer or Biblical verse not in its accustomed place, she could not do it at all, or only after a long interval and with great difficulty.... Then we tried to determine whether she could repeat very short sentences consisting of the same words found in her prayers. However, she was also unsuccessful in this. (Peter Rommel 1683 in Gans 1914, quoted here from Benton & Joynt 1960)

3:5.3 THE LINGUISTIC RIGHT HEMISPHERE

It is only relatively recently that more interest has once again

been taken in the potential rôle of the right hemisphere in the mainstream of linguistic processing. However, caution is still the order of the day:

There is no evidence to date which would clearly indicate that the mature right hemisphere surpasses the left in any aspect of language performance. At best, an aspect of language may be processed by both hemispheres to an equal extent (but not necessarily in the same way). Galloway & Krashen 1980:74)

This is fair comment, but even in the light of that observation, most now consider that the old view of *left hemisphere language* is no longer valid:

language consists of an aggregate of perceptual and mnemonic processes, some of which may be better subserved by the left hemisphere and others by the right. Both hemispheres would, then, contribute to language processing. (Vaid & Genesee 1980:423)

But just which processes are considered to be best subserved by each hemisphere differs from author to author. Chernigovskaya, Balanov & Deglin (1983) suggest that in L1 (but not L2) the right hemisphere deals with deep semantic structure (p.195,212). Experimental evidence (e.g. Liberman et al 1967, Tsunoda 1975, and Tsunoda 1978, reviewed in Sibatani 1980), suggests that vowels may be processed by one hemisphere and consonants by the other within the same language, perhaps dependent upon the semantic load which isolated vowels carry (Tsunoda 1975). Clinical evidence, on the other hand, appears to indicate that:

phonological and syntactic judgements are primarily mediated by the left hemisphere... semantic judgements may call on either of the two hemispheres, depending on whether the input is processed by recourse to a phonological coding (see Zaidel 1978). (Vaid 1984:177)

Gazzaniga (1977) reports a split brain patient who "within a month after surgery was able to show an incredible range of language skills in the right hemisphere" (p.418). This leads him to observe that:

the variation in the amount and kind of language in the right hemisphere is far greater than the consistency, and it is most like-

ly a function of the degree and place of early brain damage to the left hemisphere. (p.418)

Zaidel (1973) found the right hemisphere of a commissurotomed patient to have the vocabulary level of a 10-16 year old and to be significantly better than chance on syntax, including passives. The major constraints on success seemed to be the length of the construction and the word order (Nebes 1978:111-2). More detailed discussion of the linguistic ability of the right hemisphere in split brain patients can be found in Perecman (1983) and Code (1987). There is some indication, too, that the right hemisphere can cope better with concrete and imageable words than with abstract and non-imageable ones (Code 1987:50ff).

Coltheart (1980) proposes that the symptoms of *deep dyslexia* may be a direct indication of the reading ability of the right hemisphere. Galloway (1981) chooses to hold both views of the right hemisphere's functional ability alongside each other. She believes that the right hemisphere's capacity for processing the non-linguistic aspects of language operates alongside its "purely linguistic (grammatical) contribution to language" (p.2; see also Rupp 1980). Bakker, Smink & Reitsman (1973) have suggested that the right hemisphere is involved in the initial stages of L1 reading acquisition. In Levy's (1969) opinion, part of the right hemisphere's linguistic ability is masked by:

competition from the major hemisphere for control of the motor mechanisms for the production of language. (p.615)

The competition question is discussed further in chapter 4:2.1.

The issue of right hemisphere involvement gains even more prominence in discussions of polyglots and bilinguals (see chapter 4:3-6), where it is impossible to ignore the many variations in the side and extent of ear advantage which appear for different groups in the dif-

ferent experiments and their apparent relationship to factors like the age, stage and manner of L2 acquisition. From this L2 perspective, Galloway (1981) looks back at L1 processing to observe that:

It remains to be determined to what extent this [right hemisphere] ability might be used also in first language comprehension. Logically it could be employed to the same extent in L1 as in L2 performance. (p.19)

An important additional consideration is that the right hemisphere may have linguistic capabilities which are not always directly manifest. This is one of the predictions of the Focusing Hypothesis (see chapter 5) but is also suggested as a possibility by others, including Gazzaniga (1977):

[our studies] suggest that the right hemisphere, no matter what its potential for linguistic analysis might be, does not, when normal English words are being read, contribute much to the reading process. The studies do not rule out the possibility that the right hemisphere may be capable of performing simple linguistic functions, but they do strongly imply that the right hemisphere linguistic abilities are not heavily relied upon by callosum-intact persons when they are reading ordinary prose. (p.419)

One of the physiological observations which (indirectly) reinforces such a view is the apparent capability of the anterior commissure to transmit visual, auditory and olfactory information (in split brain patients), but its failure to do so in every case (Gazzaniga 1977:416). If such differences can occur and if, as Gazzaniga also suggests, details of the clinical history can be invoked to account for considerable interpatient variation in right hemisphere linguistic abilities (p.418), then the potential for making useful generalisations about the precise nature of hemispheric functions is drastically reduced. Detailed discussion of the ability of the right hemisphere to deal with language can be found in Code (1987, chapters 3 & 4).

3:6 COMMENT

In this chapter it has been demonstrated that there is a considerable force of evidence from different sources to support the contention that language is primarily associated with the left hemisphere. The right hemisphere may play a peripheral rôle, dealing with some paralinguistic features of communication, or it may possess greater capabilities, though whether these are operational in normals or only come into force after brain damage or surgery is not clear. There is further discussion of these points in chapter 4.

The brief description of some recent accounts of possible right hemisphere involvement in language processing in section 3:5.3 acts as an introduction to the contradictions and inconsistencies which form the centre of the examination given to data in the next chapter. The psycholinguistic evidence is considered by many to be highly convincing. However, it is characteristic of the experimentation in this field that, once a basic method has been established, investigations take the expectation of patterns congruous with left lateralisation for language as read. Thus, though many such experiments have been conducted and, as will be seen in chapter 4, many have produced results puzzlingly inconsistent with those expected, this has always been attributed to variables pertinent to the specific experiment (e.g. sex, age, class, language) rather than being seen as any challenge to the underlying premises.

CHAPTER FOUR

INCONSISTENCIES IN THE DATA

4:1 INCONSISTENCIES IN THE MONOLINGUAL DATA

The last chapter presented an overview of experimental and clinical evidence supporting the belief that language is a left lateralised function. However, the data contains many inconsistencies. These have been interpreted as complications induced by external factors, rather than being considered to challenge the basic premise of left hemisphere language. As a prelude to a closer, thematic examination of the evidence in chapter 5, this chapter highlights the nature of the inconsistency which the data creates and presents some of the accounts which have been offered in the face of that inconsistency.

4:1.1 CLINICAL DATA

One of the most problematic issues for clinical research into the localisation of language functions must be the extent to which generalisations can usefully be made across individuals, each with their own unique brain damage and previous history. Code (1987) raises this question with reference to the differences between groups of CVA and missile-wound patients, which include the size of the lesion and age of onset; characteristic contrasts in the nature and severity of the language problem and the recovery pattern seem likely to be related to these (p.8f).

Where the left hemisphere is damaged and the right hemisphere intact it can not be clear whether the remaining linguistic ability is due to the part-functioning of the former or the new, or continuing,

functioning of the latter. Furthermore, not only may an improvement in language skills be due to some recovery in the damaged (or an adjacent) area, but also, perhaps, to the gradual adoption of more and more functions by the previously 'dormant' right hemisphere; see Code (1987, chapter 6) for an exploration of this.

If one hemisphere has been completely removed, all functions possible for that individual must emanate from the remaining half of the brain. Thus it might seem obvious that a study of such individuals can tell us everything we need to know about the abilities of a single hemisphere. Furthermore, if the two halves of the brain remain but have been disconnected from each other, then it ought to be possible to establish exactly what each hemisphere is responsible for across the whole range of brain functions.

In many respects, however, clinical studies of hemispherectomised and commissurotomised (*split-brain*) patients have confused rather than clarified these matters. On the other hand, there are some legitimate reasons for caution in interpreting the data, reasons which do not challenge the underlying theory of lateralisation (see below). It seems wise, in any case, to note Code's (1987) cautionary observation, that:

an isolated right hemisphere is not the same as a right hemisphere separated from its neighbour, which, in turn, is not the same as a right hemisphere with a damaged neighbour. None of these is the same as a normal brain.... (p.34)

4:1.1.1 HEMISPHERECTOMY

It may not be possible to tell to what extent a remaining hemisphere is still performing all and only those functions with which it was concerned before the removal of the other hemisphere. That is, as

a result of its becoming solely responsible for everything, it may have adopted certain functions previously achieved (or attempted) by the other hemisphere. This might be at the expense of some functions it was previously able to initiate. In addition, it is possible that certain functions may be performed by the intact hemisphere as a result of the loss of inhibitory mechanisms emanating from the hemisphere which has been removed (cf. Popper & Eccles 1977:331). Furthermore, the functions performed by the remaining hemisphere which were its responsibility before the hemispherectomy as well, may only have been so because of a previous transfer of function necessitated by the bad state of the damaged hemisphere (cf. Heny 1985:169). This is less likely to be the case where the damage is recent and acute, but in many cases hemispherectomy follows a long history of hemispheric abnormality. Thus, while we may receive a view of what the intact hemisphere is able to do, this is not necessarily indicative of the normal functions of that hemisphere.

Thirdly, it would be mistaken to view the human's range of abilities as simply the sum of the abilities of individual areas of the brain. Some higher functions undoubtedly emanate from simultaneous operations, much as three dimensional vision results from the combination of two simultaneous two-dimensional images (cf. Zangwill 1974:275).

The data regarding hemispherectomy is compromised by a tendency to underplay in discussion the difference between *hemispherectomy*, that is, the removal of an entire hemisphere, and *hemidecortication*, the removal of the lobes of the neocortex only (Code 1987:11).

Despite the belief of some (e.g. Basser 1962) that bilateral functioning in infancy makes it possible for a single hemisphere to assume

the complete range of linguistic abilities normally accomplished by the two hemispheres if hemispherectomy occurs early enough in life, there is evidence that this does not happen. Dennis (1980b) describes how left hemispherectomised patients of five months old or less did not develop entirely normal language, despite the right hemisphere having what might be considered to be maximum opportunity to take on the functions normally associated with the left.

Popper & Eccles (1977) speak of a ten year old female left hemispherectomy patient who improved her linguistic capabilities between the ages of ten and twelve but did not achieve normal language. She retained the ability to sing, however, and usually used the correct words when doing so. Of particular interest to Popper & Eccles was her retention of "a self-conscious mind" (p.331f; cf. also Zangwill 1974: 270), despite the consensus that it is the dominant hemisphere which houses self-awareness (cf. indications that the minor hemisphere is not self-conscious in split-brain patients, (e.g. Popper & Eccles 1977: 332f). Popper & Eccles account for the retention of self-consciousness in terms of a previous transference of functions necessitated by the history of cerebral abnormality (p.332f).

Popper & Eccles also explain residual right hemisphere linguistic functions in the same way. They quote from Hillier (1954) a description of one 14 year old patient's linguistic ability after left hemispherectomy:

Comprehension of the spoken word is quite accurate. The motor aphasia shows a constant improvement. He is capable of reading individual letters, but cannot formulate words. He is at times unable to name an article in an advertisement, but yet can tell the radio programme and describe the artists who advertise the particular product. (quoted in Popper & Eccles 1977:331)

To attribute to previous transference the post-left-hemispherectomy

linguistic ability of adult patients, as Popper & Eccles do in discussion of Smith's (1966) patient, however, implies a continuing receptivity throughout adulthood on the part of the right hemisphere which other researchers deny (e.g. Krashen 1974).

Examinations of hemispherectomy in adulthood in fact reveal that the right hemisphere has linguistic abilities over and above those predicted by the traditional left lateralisation model. Reports indicate that although there are certainly considerable differences between the two hemispheres, they are hardly consistent with the notion that the right hemisphere is "*word blind* and *word deaf*" (Geschwind 1965, quoted in Coltheart 1980:328). Dennis' (1980a,b) work indicates that there is linguistic competence in the right hemisphere (which may, however, have been abnormally transferred as described above), tempered by a somewhat different method of dealing with not just linguistic but all input:

The two hemispheres, using different encoding operations, both succeed in establishing the deep structure, conceptual or logical meaning.... The theme and focus relations of the passive...are available to the left hemisphere but not to the right...just as the surface feature of entailment is established only by the left hemisphere. (Dennis 1980a:315)

The right hemisphere appears to be more proficient with auditory input than other types of linguistic material. Interestingly it appears to be the lone left hemisphere that is more restricted than the right in its ability to ascertain the focus or topic of sentences with stylistically based different orderings of constituents (e.g. topicalisation); it appears to rely solely on surface structure clues. Galloway (1981) has summarised Dennis' findings as follows:

1) Both isolated hemispheres could identify surface structure lexical information when required to identify the premises of implicative verbs (e.g. that someone (didn't) remember to do something in the sentence 'Jane (didn't) remember to close the window')...

2) Both hemispheres seemed able to determine the lexical rules of

interpretive elements when the task required identification of the presuppositions of factive verbs (e.g. that dinner is ready in the sentence 'Mary (doesn't) know that dinner is ready').

[3] However, only the isolated left hemisphere performed at better than chance level in using interpretive rules (e.g. negation) which operated on surface structures, when the task required judging entailments of implicative verbs (e.g. that the window is (not) closed in the sentence 'Jane (didn't) remember to close the window'). (Galloway 1981:45-6).

To summarise, it seems clear that the right hemisphere possesses more than a negligible linguistic capability in hemispherectomised patients. Discussion largely concerns the nature and limits of that capability. Such observations provide an important contextualisation for the evaluation of the Focusing Hypothesis which proposes a permanent potential rôle for the right hemisphere in normal language processing. However, it is still clear that whatever the right hemisphere's capabilities may be, they contrast with the superior performance of the left. It is this difference which must be adequately accounted for in the terms of any hypothesis attributing normal linguistic processing to the right hemisphere.

4:1.1.2 SPLIT BRAIN

Commissurotomy, the severing of one or more of the interhemispheric connections, is usually effected as a means of restricting the severity of epileptic attacks, by preventing their transmission across into the hemisphere in which they have not originated (Ten Houten 1982:31, Gazzaniga 1967:24). Because the majority of *split brain* patients have a history of severe epilepsy, care must be taken in drawing conclusions about the normal population from observations of this kind (Levy 1974:124). (For a general description of the symptoms of epilepsy see Guyton 1981:185ff). In addition, some brain damage may be caused in the

course of the operation itself (see Millar & Whitaker 1983, cited in Code 197:10f). Further reservations in the interpretation of the data from split brain patients are necessary because of the possibility of alternative internal connections or of external cueing. With regard to the former, while, until recently (cf. Code 1987:40), epileptic patients will presumably have had the corpus callosum, the anterior commissures and the hippocampal commissures severed (Zaidel 1977:2), non-epileptic patients, who may have had a tumour in one of those areas, or who may have a congenital disconnection may have retained, or indeed developed (Gazzaniga 1967:27) some interhemispheric connections.

Gazzaniga (1977) reports a transferal of visual, auditory and olfactory information in some split brain patients whose anterior commissure was intact, but not in others. But Brown (1983) refers to personal communication with Zaidel to the effect that the same phenomenon of transfer has been observed in patients without that pathway (p.50), which challenges Gazzaniga's inference about precisely what it is that he has observed.

External cueing is a potential aid to all split brain patients. Gazzaniga (1967) describes the strategy of one patient who was required to name a coloured light as red or green with his disconnected right hemisphere. Although the right hemisphere 'knew' what colour the light was, it was unable to verbalise its response, whereas the left hemisphere, which could speak, did not know which colour to say:

the right hemisphere saw the red light and heard the left hemisphere make the guess 'green'. Knowing the answer was wrong, the right hemisphere precipitated a frown and a shake of the head, which in turn cued in the left hemisphere to the fact that the answer was wrong and that it had better correct itself. (p.27; see also Slobin 1979:130)

It is interesting to note that the success of this strategy entails

some linguistic comprehension on the part of the right hemisphere.

Experimentation on split brain patients has indicated certain general features about the capabilities of the two hemispheres:

learning and memory continue separately in the two hemispheres such that both can sense, perceive and conceptualize independently. The left hemisphere is shown to be proficient in speech, writing and mathematical calculations, but limited in spatial tasks. The right hemisphere in these same patients has limited verbal skills, but is capable of complex spatial tasks and nonverbal ideation. (Ten Houten 1982:32)

Gazzaniga (1967) discusses the possibility of two separate consciousnesses in the split brain, and the potential for an increase in mental capacity to above normal levels (p.29). For descriptions of other, nonlinguistic, effects of commissurotomy see Gazzaniga's (1967) account (p.24f).

The right hemisphere can act on written and auditory commands, but syntactically complex input is not so easily dealt with and its vocabulary is relatively small (Slobin 1979:123).

Gazzaniga & Hillyard (1971) tested two split-brain patients with a high measure of linguistic ability. A single hemisphere was shown a picture and two sentences were read out, one of which matched the picture. The patient had to nod in response to the appropriate sentence.

The results indicated that:

the right hemisphere is capable of recognising noun objects, but cannot comprehend verbs or respond to printed commands. In the more complex semantic sphere, there is no ability to recognise either the relations between subject, verb and object, the future versus the present tense, or the singular versus the plural case. It has a remarkable ability, however, to discern whether an action sequence is properly represented by an affirmative or negative sentence (p.275)

Nevertheless, as Galloway (1981:8f) points out, various tests appear to have relied on the right hemisphere's ability to understand the test instructions to perform at all.

As far as production is concerned, the right hemisphere of split-brain patients seems to be more restricted in its ability. While the left hemisphere can read words presented to the right visual field (RVF), name objects held in the right hand, read whole messages and do calculations (Gazzaniga 1967:25f), the right hemisphere, dealing with stimuli presented to the left visual half-field or left hand, seems only able to guess when it comes to spoken or written responses:

a pencil placed in the left hand (behind a screen that cut off vision) might be called a can opener or a cigarette lighter, or the patient might not even attempt to describe it. The verbal guesses presumably came not from the right hemisphere but from the left, which had no perception of the object but might attempt to identify it from indirect cues. (Gazzaniga 1967:25f)

Other evidence indicates that it is not a failure on the part of the right hemisphere to perceive or identify the stimulus objects, only to find the appropriate verbal expression (Gazzaniga 1967:26ff).

Slobin attributes the right hemisphere's failure in speech production to the left hemisphere's having control of the speech apparatus (p.123). This implies that the *impasse* could be as late as the motor stage and therefore admits of the possibility that the right hemisphere might have access to linguistic encoding mechanisms as well as decoding ones.

4:1.1.3 TOKEN TEST

One of the most revealing tests administered to brain damaged and post-operative patients is the Token Test (e.g. Zaidel 1977). In this test, sentences of five types are presented to the patient and require a motor response using large and/or small plastic shapes in five colours. The test is administered to aphasics, to hemispherectomised and to split brain patients to assess their comprehension ability. There

are five parts to the test, containing stimuli of the following types (cf. Zaidel 1977):

- I: Touch the red circle.
- II: Touch the small yellow circle.
- III: Touch the yellow circle and the red rectangle.
- IV: Touch the small yellow circle and the large green rectangle.
- V: i) Put the red circle on the green triangle.
ii) When I touch the green circle you take the white rectangle.¹

Zaidel (1977) reports the performance of four-year-old children, aphasics and the right hemispheres of split-brain and hemispherectomized patients (these last two performed similarly enough for him to pool the data on them). Results revealed an ability on the part of the right hemispheres to perform parts I, II and V of the test, which indicates some measure of basic competence in linguistic comprehension and implies some more complex capabilities too. However:

the right hemisphere is selectively unable to remember all the elements of the auditory message in the correct sequential order. That is, the right hemisphere is more likely to decode correctly some parts of the instruction than to get it all, relative to aphasics. (p.6)

Zaidel observing that the items which the "right hemisphere finds most difficult are substantially different from those on which most children or aphasics fail" (p.9), and it characteristically displays:

a failure to decode linguistic messages with multiple references which are semantically nonredundant and refer to context-free information. (p.11)

4:1.1.4 INHIBITION

Although all clinical reports confirm that the right hemisphere's linguistic capability is very limited (see chapter 3:5), it has been

1. Part V contains a range of constructions and at least three verbs, as opposed to only 'touch' in parts I-IV. A full list of the part V stimuli used by Zaidel (1977) is given in the Appendix, A5:4. The Token Test is discussed with reference to the Focusing Hypothesis in chapter 5:3.

noted that the left hemispherectomised patient displays a greater communicative ability than does the commissurotomised patient using his right hemisphere (Zangwill 1974:272fn). It seems as if:

the verbal capacity of the right hemisphere, however small, is not evident until the left hemisphere is put out of action. (Hécaen & Marcie 1974:346; see also Popper & Eccles 1977:331, Levy 1974)

This may indicate that the left hemisphere's very presence causes some kind of inhibition upon the capacity of the right hemisphere. Such inhibition, perhaps the result of hemispheric competition (see section 4:2.1 below), would cease to function when the left hemisphere was removed, if it emanated from there. Why it should, however, continue to operate after commissurotomy is not clear. Zaidel & Schweiger (1984), cited in Code (1987:119) suggest that those left hemisphere lesions causing aphasia involve a failure to disinhibit the right hemisphere to take over the language dominant rôle. If so, the same could perhaps be argued for commissurotomy.

It is also possible that such an inhibitory mechanism could be based in the right hemisphere itself. If so, it is necessary to assume that the right hemisphere is aware of the left hemisphere's absence after hemispherectomy and its presence after commissurotomy. The action of inhibitory mechanisms in the right hemisphere during language processing in normals could explain the symmetrical activity of the two hemispheres which has been detected in measurements of metabolic exchange in brain tissue (chapter 5:4)². This would mean that it was not differences in test procedures which were responsible for the different findings across research methods (as proposed in chapter 5) but that only the direct measurements of brain activity were able to register

2. John Marshall (personal communication) has suggested this.

the constantly operating inhibitory activity of the right hemisphere. But this account is self-defeating. Its purpose is to explain the findings of symmetrical activity without invoking right hemisphere involvement in the language task itself. However, if the inhibitory mechanism functions to prevent the right hemisphere taking part in linguistic processing, then this implies that it is in fact able to do so. Indeed, any hypothesis which allows for such inhibitory mechanisms presumably does so on the basis of an assumption that, were they not to be active, the right hemisphere would become involved in language. The invocation of an inhibitory mechanism is therefore not very useful to general linguistic accounts which do not envisage some direct or indirect involvement (or at least potential involvement) in linguistic processing on the part of the right hemisphere. A similar point is made by Marshall himself (Marshall & Patterson 1983):

How plausible is it that one part of the normal...brain should inhibit the performance of another part which is committed (albeit less effectively perhaps) to the same functions? What principle of biological engineering could demand such organization? (p.426)

4:1.1.5 SUMMARY AND COMMENT

Clinical data drawn from studies of aphasic, hemispherectomised and split-brain patients indicates that there is a clear and systematic difference between the abilities of the left and right hemisphere to perform in linguistic tests. Differences between the performance of these three groups, however, suggest that the presence of the left hemisphere, whether intact or damaged, may inhibit the linguistic capabilities of the right hemisphere. But as already noted, caution is required here, as patients often have a lengthy history of localised brain abnormality and it may be that there has already been a transfer of

linguistic functions to the right hemisphere (Levy 1974:124, Gazzaniga 1977:418-9).

4:1.2 PSYCHOLINGUISTIC DATA

4:1.2.1 NATURE & PARAMETERS OF THE INCONSISTENCIES

While there can be no doubt that the right ear and right visual half-field superiorities for language tasks found in psycholinguistic experiments are largely replicable, nevertheless some interesting deviations from the predicted norm have also come to light. Tables A4: i-iii in the Appendix provide some indication of this. There is no shortage of explanations for why one group should behave differently to another in this respect, and some of these are described in the following sections. The kinds of contrasts invoked in the accounts presented here can be divided into four general categories, relating to variation within one subject, within a group, across groups and across studies.

4:1.2.2 WITHIN SUBJECT VARIATION

Most of the potential within-subject variables are adequately controlled for within a standard experimental design. For instance, by varying the order of presentation of stimuli for different subjects, practice and fatigue effects will not become falsely associated with specific stimuli. Such procedure assumes that individual variation in the strength and duration of the effects will cancel out over a group. However, other perhaps more influential difficulties may remain unnoticed or unmonitored, to the general confounding of the results of a study. Heny (1985) observes that:

A single subject tested twice by one of these [psycholinguistic] measures may show different lateralization for the same task with only one week intervening between the first and second test.

(p.169f)³

Her account of this phenomenon is one which appears repeatedly in different guises throughout the accounts of variation in psycholinguistic results, and which forms the core of the Focusing Hypothesis:

It seems that hemispheric choice is fickle enough to be disrupted by seemingly minor factors. In a phenomenon called *priming*, subjects are asked to memorize a list of words, thus presumably turning on the left hemisphere's circuits. If they are immediately asked to perform some spatial task that normally yields right hemisphere dominance, they will often fail to show the expected result. They will perform the task with the left hemisphere.... obviously, the reliability of tests like these depends on the ability to control such outside factors on choice of processing strategy, and that is no simple matter. (Heny 1985:170)

Shadden & Peterson (1981) demonstrated experimentally a contrast in ear advantage according to whether or not the subject knew in advance of presentation which ear the stimulus would be presented to.

4:1.2.3 WITHIN GROUP VARIATION

Even if the subject performs consistently, there may be important differences between the performance of different individuals. Krashen (1978) highlights one important factor affecting the performance of individuals in situations of L2 learning, namely their personal propensity to use the Monitor (see also Krashen & Terrell 1983 and section 4:3.1.2 below). Other factors identified in the field of second language testing of various sorts, but equally relevant to psycholinguistic studies are *affective factors* (see section 4:3.2.5). Basically, these relate to the individual's attitude towards the task and his motivation to perform well. It is difficult to control for these factors across a group. Similarly, the attentional span of individuals may vary and on-

3. Kinsbourne & Hiscock (1977:182), however, doubt the relevance of the extent of ear effect as a measure at all (see 3:4.2).

ly the fatigue-based aspect of this can be controlled for by varying the order of presentation across the group. That one individual may be in general more distractable than another is a potential confounding factor.

4:1.2.4 CROSS GROUP VARIATION

4:1.2.4.1 CULTURE

Variation across groups within one study is expected and indeed many experiments have been set up expressly to test predictions regarding such variability. Some studies have looked for culturally-based differences. Geffner & Hochberg (1971) administered a dichotic listening test to 4-7 year old children from two different socioeconomic classes (SECs). All the children from the higher SEC showed a significant right ear advantage (REA) for linguistic stimuli (two pairs of digits). But amongst the children from the lower SEC all but the oldest age group showed only a nonsignificant trend towards REA. Geffner & Hochberg speak of a possible delay in the development of language lateralisation in the lower SEC children, caused by a relative lack of intellectual stimulation at home (p.200). This is only one of several potential explanations, however, as they themselves note. The higher SEC children could simply be brighter (p.201), or, as the higher SEC children in their sample were predominantly white and the lower SEC ones predominantly black, there could be some racial difference, perhaps linked to affective factors.

In another contrast of cultures, Scott, Hynd, Hunt & Weed (1979) found significant differences between d.l.t. ear preferences in Navajo and Anglo Americans (male right-handers). The Navajos displayed a left

ear preference, the Anglos the usual right ear preference, and both groups performed significantly better with the preferred than non-preferred ear. This appears to indicate that:

Native American Navajo subjects do, in fact process language in what would normally be considered the minor cerebral hemisphere. (Scott et al 1979:91)

However, Scott et al are unsure whether this is attributable to differences in their predisposition to the development of neuropsychological asymmetries or to language specific factors (p.91).

Hynd, Teeter & Stewart (1980) administered d.l.t and time sharing tests to Navajos and Anglos and found a significant REA in both. However, they did find an initial left ear advantage in the Navajos, which was lost after 15 trials. They attribute the contrast between their findings and Scott et al's to the fact that in the latter study the subjects were college freshmen:

It seems that these oppositional preferences are still evident in Navajo college freshmen...but in successful college students, only a trace of this tendency is still evident. (p.6)

This begs the question: what is it about college success that associates it in some way with signs of strong left lateralisation for language? There are two possible answers. Firstly, that only left lateralised individuals are suited to academic success. Secondly, that academic success involves the adoption of some strategies in dealing with information which are manifested in psycholinguistic tests as a left hemisphere dominance. The initial trend to LEA in Hynd et al's subjects suggests the latter because it indicates that the individuals may have had some measure of indirect control over which ear displayed the dominance.

4:1.2.4.2 FIELD DEPENDENCE

Other related issues come to the fore in this respect too. The Amerindians are attributed an "appositional mode of thought" (Hynd, Teeter & Stewart 1980:6), which is reflected in, or else caused by, the nature of their languages. This apparently predisposes them to right hemisphere dominance for language. Ten Houten (1982) explores the relationship between culture, IQ test performance, cerebral lateralisation and field dependence/independence. The last of these involves the ability to mentally separate a stimulus from its context (Ten Houten 1982:29). Amongst the groups found typically field dependent (i.e. unable to decontextualise the object of focus), are women and left-handers (p.30). Field dependence is associated with bilaterality for language functions, but, more specifically, with a failure to always use the hemisphere most appropriate for the task (p.30). McGlone & Kertesz (1973) note, in their discussion of visuo-spatial accomplishment, Kimura's (1969) proposal, that:

when a task can be performed by either left or right hemisphere mechanisms, males tend to employ right hemisphere, non-verbal systems, whereas females, perhaps because of their generally more developed language skills...may tend to employ left hemisphere, verbal ones. (p.313)

Conversely, Harris (1978) suggests that males may appear less field dependent because most dependency tests are visuo-spatial, which gives them an advantage (p.491). Ten Houten (1982) quotes Ramírez & Castañeda (1974:74-5) as follows:

characteristics of the field-sensitive cognitive style are analogous to those identified with the functioning of the right cerebral hemisphere, whereas characteristics of the field-dependent cognitive style are similar to those identified as functions of the left hemisphere. (p.48)

If field dependency is reflected in differences in appropriate he-

mispheric use, then many cross-group differences will appear, between the sexes and between left- and right-handers, as well as between different social and cultural groups. Furthermore, sex differences will presumably be subject to the same 'acculturation' processes, so that women successful in the field-independent educational system will perform essentially like men.

4:1.2.4.3 SEX

It is not clear how important the sex of subjects should be considered to be as a factor in data interpretation. Harris (1978) reviews findings of sex differences in anatomical structure and the effects that comparable brain damage in a man and a woman may have on their brain functions. She associates implicitly the anatomical dimension with the sex differences found in some psycholinguistic experiments (p.468-72). Some experimenters have checked or even directly tested for sex differences and found none (e.g. Kinsbourne & Hiscock 1977, Scott et al 1979, Geffner & Hochberg 1971, Berlin, Lowe-Bell, Hughes & Berlin 1973). But others have found sex differences in language stimulus test performance (e.g. Rupp 1980, Molfese 1977:204, and Harshman & Remington 1975 and Bryden 1966, both cited in Harris 1978:471). Kimura (1963) found that the girls in her study scored all in all higher than the boys at ages 4,5 and 6. And in several studies, girls demonstrated signs of strong lateral preferences (left hemisphere for language, right for visual stimuli) earlier than boys (e.g. Buffery 1971, Pizzamiglio & Cecchini 1971, Bryden et al 1973, see Harris 1978:458). Buffery & Gray 1972 point out that this phenomenon may not relate to sex-determined laterality differences *per se* but simply to the more advanc-

ed developmental stage of girls relative to boys at a given age (Harris 1978:460). The findings of these experiments contrast with those suggesting that adult females are less strongly lateralised than adult males (see above) and that right hemispheric lateralisation for visuo-spatial skills may occur earlier in males. Harris (1978) addresses this discrepancy (p.458ff) and explores, amongst other accounts, the following explanation:

the male eventually equals and then surpasses the female in degree of left hemisphere lateralization, so that in adulthood, language in females is bilaterally represented. (p.460)

Evidence in support of this hypothesis comes from McGlone & Kertesz's (1973) examination of visuo-spatial abilities in lesioned patients, where "visuo-spatial deficits associated with right-side damage were most clearly evident in men" (p.317).

Harris (1978) cites support from d.l.t. experiments by Bryden (1966) and Harshman & Remington (1975). Bryden found an REA for spoken digits in 67% of left-handed and 74% of right-handed males, and in 50% and 57% respectively of females (normal subjects). Another d.l.t. study by Bryden, using free recall digit pairs, found an REA for 73.6% of males (11 left-handers, 42 right-handers) and 62.2% of females (3 left-handers, 42 right-handers). In another experiment Lake & Bryden (1976) produced similar figures using 144 undergraduates listening to CV dichotic pairs.

Harris later (p.476f), in the context of discussion about visuo-spatial skills, suggests that sex differences in performance may revolve around preferred strategies:

It is conceivable that in addition to sex differences in hemisphere lateralization in adulthood, the different developmental histories of males and females therefore predispose them to the use of different methods of analysis of spatial problems, with females relying more on the less efficient left hemisphere modes.

(p.476)

In summary, it may be seen that the importance of sex as a determiner of performance in psycholinguistic (and visuo-spatial) tests is unclear. Some accounts go some way to exploring the variation in results, particularly given that even a genetic determiner would not produce a clearcut situation in which all men were better than all women or vice versa in a given task (Stafford 1961, Garron 1970; see section 4:2.1 below). Furthermore, the recognition of general cognitive modes and possible sex differences in task strategies is an important pivot in attempting to account for the considerable variation in findings across different studies.

4:1.2.4.4 AGE

As with the sex variable, age seems to prove a significant factor in some studies and not in others. In an experiment using 1-4 month old infants, Eimas, Siqueland, Jusczyk & Vigorito (1971) monitored the non-nutritive sucking rate during exposure to synthesised syllables beginning with bilabial stop consonants. The rate of sucking rose markedly in the group exposed to a change in stimulus sound which crossed the acoustic divide between what adults perceive as /p/ and /b/ (Voice Onset Time changing from +20 msec to +40 msec). The subject groups whose two stimuli were equally different but fell within one phonemic category (VOT -20 msec -> 0 msec and +60 msec to +80 msec) displayed a much less marked reaction. These results are taken to indicate that:

the means by which the categorical perception of speech, that is, perception in a linguistic mode, is accomplished may well be part of the biological makeup of the organism and, moreover, that these means must be operative at an unexpectedly early age. (p.306)

Entus (1977) sought to measure hemispheric specialisation in in-

fants by presenting stimuli dichotically and monitoring sucking rate as a measure of speed of recovery from the novelty of a new sound to one or other ear:

If a novel stimulus in one ear leads to greater recovery of sucking than does a novel stimulus in the other, we may assume that the hemisphere contralateral to the ear associated with a greater recovery rate is more proficient in dealing with the stimulus in question. Thus, a significant difference between ears in the rate of recovery may be taken to reflect differences in hemispheric processing of the stimulus material. (p.65)

Her results indicated a laterality pattern just like the typical adult one, with an REA for speech sounds (CV) and an LEA for musical sounds (A (=440Hz) played on the piano, viola, bassoon and cello (plucked harmonic)). This suggests that hemispheric functional asymmetries are present from birth or very soon after (Entus 1977:71). Molfese (1977) achieved similar results by measuring Auditory Evoked Potentials in infants.

However, Bryden, Allard & Scarpino (1973) failed to find any laterality effect in young children listening to dichotically presented CV syllables contrasting in initial (stop) consonants, which, in the circumstances, is "a very curious finding" (Bryden & Allard 1978:399). Bryden & Allard speculate that the d.l.t. is not an appropriate test for the very young. In particular, the ability to "disentangle the simultaneously occurring sounds" (p.400) may be absent. Bryden et al's results may indicate that the children were largely unaware of having heard two sounds at all. Kinsbourne & Hiscock (1977) concur, suggesting that young children find d.l.t. tasks very difficult because they involve:

an unknown mixture of perceptual, attentional, memory, response set and perhaps other factors. (p.179)

Using a modified procedure in which the subjects were told to listen for a particular item and then asked whether they had heard it, after it had been played in dichotic competition with another item, they found a right ear advantage in subjects as young as three years old.

Two possible confounding factors may interact with age. Firstly, the tendency of subjects to prefer to report first the stimuli presented to one ear and then those presented to the other, which puts the greatest burden of memory on the stimuli of the second ear reported (Bryden & Allard 1978:393). This is discussed in section 4:1.2.5.1.1. Secondly, strategy preferences. Kinsbourne (1970) cited in Bryden & Allard (1978:400) suggested that older children may tend towards *verbal thinking*. O'Leary (1982) tested for this in his picture comparison task, considering it a possible explanation for the changeover he found from LVFA to RVFA by age 8. By presenting visually dissimilar but linguistically similar (rhyming) pairs in some trials, he built in a distractor element operational only if the pictures were verbally labelled for memorising. However, he failed to find any significant effect in this regard (p.71). For a fuller discussion of this experiment see chapter 6:2.

4:1.2.4.5 LANGUAGE

Language as a within-subject variable is discussed in sections 4:3-5. A small number of studies, however, have compared speakers of different languages and found laterality contrasts which, unlike the Amerindian studies described above, appear to relate to the structure of the languages themselves, as opposed to a language or culture related approach to the world.

Tsunoda (1975) found a left hemisphere superiority for both vowels and consonants in Japanese native speakers. This contrasted with a left hemisphere superiority for consonants and a right hemisphere superiority for vowels in native speakers of other languages, including non-Japanese speaking second generation Japanese. Studdert-Kennedy & Shankweiler (1969) found a similar vowel-consonant based difference in their English speaking subjects. Tsunoda attributes the pattern of lateralisation in his Japanese speakers to "peculiarities of the Japanese language", including the fact that:

Japanese vowels form meaningful monosyllabic words...These may be processed in the dominant hemisphere as are the consonants and full syllables of some other languages. (p.169)

Another area of interest has been the comparison of lateralisation patterns of individuals whose native language is written right to left as opposed to left to right. Experiments conducted in Israel have indicated, at any rate, that:

Something about the Hebrew language results in its being more bilaterally represented than English. (Gaziel, Obler & Albert 1978: 196)

4:1.2.5 CROSS STUDY VARIATION

The one most central contributor to the lack of consistency inherent in psycholinguistic studies investigating lateralisation patterns is the variation across studies. Besides the obvious dangers of incompatibility across techniques, a number of factors are not controlled for even within one general procedural brief. Not least among the potential confounding factors are the general limitations of the dichotic listening test itself.

4:1.2.5.1 LIMITATIONS OF THE DICHOTIC LISTENING TEST

The development of the *finger-tapping* task as an alternative measure of hemispheric preference in tasks (e.g. Kinsbourne & McMurray 1975) was motivated in part by the recognition that the reliability of the dichotic listening test may have been over-estimated. Kinsbourne & Hiscock (1977) observe that something like 20% of subjects are misclassified by the test; the baseline for assessments of the accuracy of the d.l.t. is the result of the Wada test performed on the same individuals (see chapter 3:2.2.4). They assert that:

clearly a method that so grossly misclassifies a substantial minority of the normal population cannot be a valid index of lateralisation with individuals when used in the usual manner. (p.183)

They continue by stating that to be more sure of a correct classification of an individual the asymmetry pertaining to their performance should be reflected in statistically significant differences in scores, should be repeatable and should not be subject to attention factors. Heny's (1985) observation regarding replicability in the individual has already been mentioned (section 4:1.2.2).

Bryden & Allard (1978) also express reservations in this respect:

dichotic listening procedure is not a perfect measure of speech lateralisation - in adults some 80% to 85% show a right-ear superiority, not the much higher figure that would be expected from a direct assessment of speech lateralization. (p.396)

Indeed it is open to question whether the principle of comparing response times and drawing conclusions about contralateral processing efficiency is valid at all. Code (1983) cites work by Cohen (1977) which suggests that "interhemispheric transfer time ranges from 4msec to 60 msec and that the size of the differences probably varies between tasks and between subjects" (Code 1983:58).

4:1.2.5.1.1 FREE RECALL

A large number of the dichotic listening tests that have been conducted request the free recall of stimulus words dichotically presented (Bryden & Allard 1978:393). In this condition, the subject is not constrained to list the words in any particular order. The problem with this is clear: should the subject adopt a certain order for his reporting, the limitations of his memory, which might tend to reduce his accuracy on the items he reports last, could be misconstrued as indicative of perceptual and speech inaccuracy. Work by Bryden (1962, 1967, cited in Bryden & Allard 1978:393) has indicated that:

When the successive pairs of items are presented fairly rapidly, most subjects report the items presented to one ear followed by the items presented to the other ear. This has been termed the 'ear of report'.... At slower rates, it becomes more common to find the subject reporting first one pair of items and then the next, in a 'temporal order of report'. (Bryden & Allard 1978:393)

Their own observations, however, indicate that adults who are required to report the left ear stimuli first as often as the right still display a right ear advantage (Bryden 1967). When the right-ear start bias was taken into account in some data relating to second, fourth and sixth grade children, although an REA was obtained at each age, a clear developmental trend was observable, with a greater proportion of older children displaying an REA; this trend had been masked by the considerably greater tendency of the youngest children to report the right ear stimuli first (p.395). Inglis & Sykes (1967) comment, on the basis of their own findings, that:

order-effect and, by hypothesis, short-term memory storage, is a powerful source of variation in [dichotic listening performance], as also is age. Ear-asymmetry, on the other hand, would appear to be a much weaker source of variation; its apparent effect may have been exaggerated by those studies in which care has not been taken to ensure that the influences of laterality and order be separately analyzed. (p.485)

4:1.2.5.1.2 MEMORY CAPACITY

Inglis & Sykes' (1967) results (see above) indicate that given a reporting order preference, a misleading superiority in accuracy will be found for the ear whose stimuli are reported first, simply because of the limitations of short-term memory. They in fact found no preference overall in their subjects to report the right ear before the left. But Bryden & Allard (1978) suspect that there may be one, and ask, as a result, whether perhaps:

items presented to the left ear are not harder to perceive, but are more difficult to remember, than items presented to the right ear. (p.394)

If this is the case, then it seems obvious to ask what it might be about the way that the left hemisphere processes its input that makes it more memorable. Papçun, Krashen, Terbeek, Remington & Harshman's (1974) experiment using morse code dichotic stimuli may shed some light on this. Code sequences representing a single letter (not words or sentences) were presented to code users and instructors, who displayed an REA for these. Naïve subjects, however, showed an REA only for codes sequences with seven or fewer units and an LEA for longer sequences. (A 'dot' counted as one unit, a 'dash' as three units). Papçun et al hypothesise that:

the naïve subjects were able to deal with stimuli of seven or fewer elements by noting the individual elements which comprised the signal and therefore lateralized the shorter stimuli to the left hemisphere. But with the list which included longer stimuli... they were forced to adopt strategies which took account of the holistic qualities of the stimuli and therefore lateralized the longer stimuli to the right hemisphere.... The Morse code operators, on the other hand,...could deal with all the stimuli without losing the details of their temporal structure. They were not forced to switch strategies as were the naive subjects. (p.326)

Input to the left hemisphere was only more memorable where it consisted of a short sequence of seven or fewer items. This is in line

with Miller's (1956) observations regarding the capacity of the short-term memory. However, an 'item' may be a complex construct; in other words, one obvious interpretation of Papçun et al's findings is that the Morse code operators could translate dot-dash sequences into alphabetic items and store the latter in short term memory, whereas the naïve subjects had to remember the dot-dash forms themselves. As Papçun et al state, sequences which exceed the limitations of short term memory are more successfully remembered via holistic strategies.

4:1.2.5.1.3 STIMULI

A criticism that can be levelled at psycholinguistic tests as a whole, and at the dichotic listening test in particular, is the limited range of stimuli used. According to O'Leary (1982), Porter & Berlin (1975) postulated that:

different dichotic tests may tap different levels of language processing. The levels of processing tapped by different dichotic tasks may be lateralized to a different degree or may develop at a different rate. (p.59)

While Berlin et al (1973) did at least admit that nonsense CV syllables as experimental stimuli are hardly representative of real language (O'Leary 1982), Bryden & Allard's (1978) list of "all types of language material" is indicative of a general failure to appreciate this. They mean to illustrate the width of range of stimulus types which have displayed a left hemisphere superiority:

lists of words (Bryden 1967) or numbers (Kimura 1961), sound shadowing connected prose (Treisman & Geffen 1968), portions of backward speech (Kimura & Folb 1968), single phonemes (Studdert-Kennedy & Shankweiler 1970) and even Morse code for experienced operators (Papçun et al 1974) - in fact, virtually any type of acoustic material with a linguistic referent. (p.399)

What is most strikingly absent from this list is any proposition-orient-

ted continuous speech requiring a non-metalinguistic response (but see chapter 5:2 for discussion of some experiments making less explicitly metalinguistic demands).

4:1.2.5.1.4 DATA ANALYSIS

Bryden & Allard (1978) consider it important in analysing data collected from children to examine individual as well as group patterns (p.398). Many studies which found an overall REA across a group may actually contain a considerable number of individual LEA performances.

Arguing that ear difference scores are confounded by alterations in accuracy through increases in the subjects' tendency to guess at some points of the test, Harshman & Krashen (1972) developed an 'unbiased' procedure for analysing results. In this, the *percent of errors* is calculated individually for each ear and variations in accuracy can thereby be taken into account. Krashen & Harshman (1972) reanalyse some data on this basis and find that the revised figures support the theory that lateralisation for language is complete by age five.

4:1.2.5.2 STIMULI

There is no question but that the stimulus presented to the subject plays some part in determining the observed hemispheric advantage. Amongst auditory stimuli which have been linked with right hemisphere dominance are emotional parameters of language (Haggard & Parkinson 1971), environmental sounds, pure tones and white noise (Tsunoda 1975) and music (Knox & Kimura 1970). Visual stimuli creating the same effect include geometric designs (Bryden 1960, cited in Ten Houten 1982: 26), patterns of dots (McGlone & Davidson 1973, McGlone & Kertesz 1973,

Kimura (1966); in addition, Levine & Banich (1982) found no visual field advantage for naming line drawings, in contrast to a right visual field advantage for reading words.

What is of most interest is exactly what it is in the nature of a stimulus that makes it favourable to the processing procedures of one hemisphere rather than the other. The evidence from the Morse code study (Papçun et al 1974) suggests that the ability to construct larger units, or else to make corporate sense of sequences of individual items may be linked to left hemisphere superiority. Additional support is found in studies of hemispheric preferences in the processing of music by musicians and non-musicians. A number of experiments have found a right ear advantage for melody recognition in musicians and a left ear advantage for non-musicians (for discussion and references see Bever 1983:23). Bever interprets this phenomenon as indicating that:

musicians have learned to listen to music in an analytic way, which stimulates the kind of processing natural to the left hemisphere. (p.23)

With regard to speech sounds, Studdert-Kennedy (1975) claims that the left hemisphere's superiority relates to its possession of a device which enables componential analysis specifically relating to linguistic features (O'Leary 1982:58).

Just what constitutes *language* or at least an analysable sequence, appears to be different for auditory and visual presentation. Whilst nonsense syllables (e.g. Studdert-Kennedy & Shankweiler 1969), and backwards speech (e.g. Kimura & Folb 1968) appear to evoke a right ear advantage, visually presented nonsense sequences of letters, including anagrams, do not produce the right visual field advantage obtained with meaningful words of the same length (for a brief review of these exper-

iments see Harcum 1978:164).

The same point has been made about tachistoscopic test stimuli:

Whether or not our brains process a given input as verbal-conceptual or as visuo-spatial is determined largely by the relative ease and utility of such strategies. This is influenced by the methods of stimulus presentation and the constraints imposed by these methods upon initial perception. With limited tachistoscopic exposure, words may have to be processed as fragmentary shapes, whereas, given more time, even doodles can be christened. Such constraints upon perception help to determine the degree of verbal or non-verbal bias of the cognitive strategy employed. (Buffery 1974:228)

4:1.2.5.3 PROCEDURES

Shadden & Peterson (1981) have illustrated that the procedure relating to the presentation of stimuli can have an important effect on the patterns of hemispheric superiority. They presented monotic CV syllables and measured reaction times. The left ear presentation stimuli evoked significantly faster reaction times when the side of presentation was known as opposed to random: in the former condition a block of stimuli were presented to the same ear in succession. This leads them to suggest that alongside a general left hemisphere superiority for linguistic stimuli, attentional factors may differ according to expectations of the side of presentation.

4:1.2.5.4 SUMMARY

It is extremely clear from the psycholinguistic data that lateralisation patterns are subject to a considerable number of wide-ranging influences. Not only are some of the methods of measuring for laterality unreliable but also it seems possible that data gathered from different procedures is not compatible. But, most of all, the considerable variation in performance across different sections of the popula-

tion brings to light the dangers potentially inherent in restricting the majority of investigations to subjects of a particular type, viz. university students, usually reading psychology or linguistics (see chapter 5:2.1.4). Similarly, caution should be taken in assuming that the strategies adopted by subjects in response to the stimuli commonly used in experiments are representative of their strategies when processing language in a communicative context.

4:2 THEORETICAL ACCOUNTS FOR THE INCONSISTENCIES

Two accounts addressing the variation in data have been selected for discussion here. These accounts need not stand in opposition to each other.

4:2.1 HEMISPHERIC COMPETITION AND THE GENETIC AND HORMONAL ACCOUNTS FOR LATERALISATION

The characteristics of a competing stimulus, including its own perceptual lateralization, exert unknown influence on the magnitude of an obtained asymmetry. (Haggard & Parkinson 1971:176)

One aspect of hemispheric interference has already been mentioned in the context of clinical findings. This is the possibility that there exist inhibitory mechanisms (section 4:1.1.4 above), which would prevent the right hemisphere from operating to its full capacity in the course of normal linguistic processing.

Other areas in the competition discussion, however, relate to the simultaneous operation of linguistic and non-linguistic functions. Annett (1964), in a discussion of a possible di-allelic basis for handedness (where dominant homozygotes (i.e. R-R) and most heterozygotes (R-l or l-R) are right-handed and recessive homozygotes (l-l) are left-handed) examines the hypothesis that in the case of early unilateral brain

damage (heterozygotes only) there may be the alternative to use the intact hemisphere for either visuo-spatial skills or for language. She suggests that in such instances language remains in or is transferred to the damaged hemisphere (p.60), so that:

more primary skills of orientation in space can be developed in the opposite normal hemisphere. (p.59f)

She cites supportive evidence for this from McFie (1961) who observed greater verbal than non-verbal impairment in children with early unilateral damage followed by hemispherectomy. She also refers to the existence of evidence showing that:

apparently healthy children of mixed handedness were significantly inferior to matched consistent handers, both right and left, on tests of verbal intelligence. There are strong grounds for believing therefore that in some circumstances heterozygotes may shift cerebral functions at the expense of speech. (p.60)

A report by Levy (1969) is not easy to reconcile with the study described by Annett. Levy tested right- and left-handers on verbal and performance IQ skills (the latter test the *minor hemisphere functions*). She found no difference in verbal scores, but a highly significant difference in the discrepancies between verbal and performance scores: dextrals 8 points, sinistrals 25 points. As Levy did not take homo- and heterozygosity into account as a possible determinant of handedness types, she presumably included within her sample a substantial number of what Annett would term *mixed handers*, that is, heterozygotes with a preferences for the right or left hand only just strong enough for them to identify themselves as one or the other. According to Annett, cultural pressures would encourage most mixed handers to prefer the right hand. Thus, a greater proportion of the left-handers than of the right-handers in Levy's study ought to have had a strong hand preference; in that case, Annett's predictions would include the following:

the right-handers should show a lower mean verbal score than the left-handers, because a greater proportion of the former group are actually mixed-handers by genetic determination. No such verbal difference was obtained. Levy does not specify the method by which she determined handedness; it is possible that a stringent screening enabled her to exclude all but those with a strong hand preference.

Levy's ideas regarding competition relate to the incompatibility of analytic and gestalt skills. Lateralisation is proposed to be:

an adaptation permitting control of the unique vocal apparatus, uncomplicated by competitive antagonism between the hemispheres. (p.615)

In other words, the lateralisation of language to the left hemisphere and of visuo-spatial skills to the right is seen as a compromise solution (in evolutionary terms) to minimize contradictory processing emanating from two different strategical approaches to the same task (see also Harris 1978:463).

Gazzaniga (1977) proposes something rather similar. The succession of the right hemisphere to dominance in visuo-spatial skills is by default, after the preferential assumption for language processing of the left hemisphere neurological space which would otherwise have dealt in perceptual wholes:

we feel that the emergence of right dominance is not indicative of the unique perceptual specialization of the right hemisphere, but instead represents a settlement between the hemispheres whereby it is discovered that less conflict is encountered if each half-brain controls performance for different classes of activities. (p.420)

Thus, the ability of the right hemisphere to perform well in visuo-spatial tasks is not at all remarkable; rather, it is a surprise that the left hemisphere is less good at them (p.421).

Geschwind (1983) has suggested that bilaterality of linguistic

skills will lead to superior visuo-spatial skills. Included within the group whom he predicts will display such an advantage are left-handers. His theory, however, relates not to interhemispheric or inter-functional competition, but to the relative speed of development of the two hemispheres. Briefly, he suggests that a foetus which is exposed to an excessive amount of testosterone during the gestational period will experience a slowing of left hemispheric development relative to the right, allowing the latter to catch up or even overtake it (p.37). This, he proposes, can lead to right hemisphere preference in motor control (left-handedness), superiority in visuo-spatial skills and, in some cases, bilaterality or even right hemisphere dominance for language. He associates the 'abnormal' language representation with stuttering and dyslexia. Other, non-linguistic effects of the increased right hemisphere development which he proposes include a failure of the immune system to fully develop, leading to various allergies such as hayfever, eczema and asthma. All of the characteristics which he associates with a high level of testosterone in the womb are more common in males than females. He accounts for this by noting that the male foetus produces a considerable amount of testosterone during that period (p.36), in addition to the quantity produced by the mother herself. Geschwind is therefore able to draw support for his account from the observation that left-handedness is most common in male twins, who have developed in a doubly concentrated environment of testosterone (Geschwind 1985; see also Bestic 1985 and Netley 1977).

Stafford (1961) and Garron (1970) also provide a plausible account for lateralisation, suggesting that it is genetically determined. Evidence from patients with Turner's Syndrome (phenotypical females with

only one X chromosome (X0)) support their case. Netley (1977) describes how individuals with the abnormal sex chromosome formation XXY are handicapped on verbal tests, while those with Turner's Syndrome (X0) have normal verbal skills but impaired visuo-spatial ability.

This, he believes, indicates that:

the absence of one X chromosome in phenotypic females is associated with some tendency toward right hemisphere processing of verbal material. (p.139)

The genetic explanation proposed for this is that superior spatial ability is carried on a recessive gene on the X chromosome (p.139), so that normal males (XY) display it if they inherit a single recessive gene, but women (XX) require two recessive genes to display the trait.

This account predicts that:

the proportion of females showing the trait will be the square of the proportion of males showing the trait. (Garron 1970:148)

This is strongly supported by Stafford's (1961) work. He found the predicted zero correlation in visuo-spatial ability between fathers and sons (Y chromosome inherited), a significant correlation between both fathers and daughters and mothers and sons (X chromosome inherited) and a smaller positive correlation between mothers and daughters (one of two X chromosomes inherited as one of two).

Garron (1970) discusses Bock's (1967) findings, which also generally support this genetic account, except in one detail. Although Bock found, as predicted, the proportion of females that excelled in the visuo-spatial task was the square of the proportion of excelling males (males = 50%, females = 25%), of those females who did excel (and who would therefore be predicted to carry two recessive genes for superior visuo-spatial skills), six did not have a father who also excelled. This is problematic, because they must have received a recessive gene

from the father, who would therefore also express the trait. Bock attributed this phenomenon to a lack of motivation on the part of the fathers who therefore performed badly.

To account for Turner's Syndrome in these terms it is necessary to explain why a recessive gene on the single X chromosome does not lead to visuo-spatial abilities equal to those in normal males. One possibility proposed by Garron (1970) is that the Turner's Syndrome data is confounded by the failure to distinguish between individuals with no second chromosome at all and those with a defective second X chromosome. In the latter case, there may be a block to the realisation of the superior spatial ability. Another account invokes positive action on the part of the Y chromosome. Ounsted & Taylor (1972) have suggested that the Y chromosome functions to slow the general developmental rate so that there is opportunity for the full potential of the ability to be expressed. This means that males would have an advantage over Turner's Syndrome women with respect to the extent of expression which the sole recessive gene enjoys (Netley 1977:140). Linking the possibility of a rôle for the Y chromosome with Levy's (1969) hypothesis regarding hemispheric competition, Netley suggests that perhaps:

the Y chromosome acts in such a way that hemispheric specialization starts more slowly and terminates at a higher level for males.
(p.140)

4:2.2 AGE OF LATERALISATION

A considerable amount has been written about the age at which one or all of the component skills relating to language processing lateralise to the left hemisphere. Central to the discussion is the question of whether the left hemisphere is already set up for language at birth or whether it becomes so in the course of post-natal development.

4:2.2.1 LATERALISATION AT BIRTH

Although no direct inference regarding functional asymmetry may be drawn from purely anatomical structures, it is nevertheless considered indicative of hemispheric differences in potential to function, that the *speech areas* of the left hemisphere are more highly developed than the equivalent areas of the right hemisphere in the foetus and neonate (Teszner et al 1972, Wada 1974, Wada et al 1975, Witelson & Pallie 1973; see chapter 3:2). The ability of babies to differentiate speech sounds (as determined by sucking rate (Eimas et al 1971, Entus 1975 and section 4:1.2.4.4 above), and the association of AEP asymmetries with speech input in babies (Molfese 1977) further supports the belief that some kind of left hemisphere superiority and/or preference exists from birth.

Clinical support for lateralisation at birth comes from the observation that even very early unilateral lesions to the left hemisphere have a greater tendency to lead to handicaps than those to the right (see Krashen 1974 and Kinsbourne & Hiscock 1977 for reviews of supportive data). Moscovitch (1977) presents a critical re-examination of Bassler's (1962) case studies, which led to a claim that early damage to either hemisphere was equally likely to lead to linguistic handicap. By challenging this data, he considerably undermines the premises upon which Lenneberg (e.g. 1967) based his support of hemispheric equipotentiality for language at birth. Apparent evidence supporting equipotentiality at birth, particularly that relating to aphasias after right hemisphere lesions in children, is treated with scepticism by Kinsbourne & Hiscock (1977). Amongst the points they raise are the fol-

lowing:

a) Basser's (1962) data is unrepresentative of the clinical population because it consists of information gathered from other researchers, each reporting their own selection of interesting cases.

b) Children with brain damage may, in many cases, have additional, undetected anomalies of long standing, which may have led to the transfer of linguistic functions to the minor (undamaged) hemisphere (but cf. Annett's 1964 hypothesis described in section 4:2.1 above).

c) the definition of *aphasia* differs across studies. Of cases at the Toronto Hospital for Sick Children they say:

the evidence for aphasia in clinical charts often is no better founded than "*the child would not talk to the doctor*". There are many reasons why that might happen. (p.175)

d) The occasional case of language loss associated with right hemisphere damage does not prove that young children have bilateral language representation: it is known that a small proportion of the population have language lateralised to the right.

With regard to the behavioural support for a development of lateralisation (e.g. the studies discussed in Bryden & Allard 1978:397), Kinsbourne & Hiscock draw attention to uncontrolled variables such as attention, motivation and cognitive and situational factors.

Left hemisphere superiority at birth could be associated with the faster maturation of the left hemisphere than the right (Marie 1922; see also Geschwind 1983), which would afford the left hemisphere an advantage at every turn in the assimilation of information and the analysis of increasingly complex input.

4:2.2.2 STAGGERED LANGUAGE LATERALISATION

Lenneberg (1967) and others (e.g. Krashen 1974) supporting the belief that there is equipotentiality for language functions at birth believed that lateralisation occurred by the age of five. As described above, there is now considered to be little support for this.

However, more plausible to many writers has been the possibility that different elements of language lateralise at different times. Despite Bryden et al's (1973) finding that children did not display a right ear effect for the phonetic discrimination of CV syllables (see section 4:1.2.4.4), many believe that if language does not lateralise all at once, it is phonetic discrimination which is first to lateralise (Scovel 1969, Seliger 1978). Witelson & Pallie (1973) take note of the fact that, in the case of babies and young children, it is not possible to measure anything other than phonetic discrimination anyway, and this leads them to restrict their claim regarding biological preprogramming for left hemisphere language to speech sounds only (p.645).

O'Leary (1982) takes a similar view, noting that the experiments on neonates have found laterality for "only the most primitive stages of speech perception", leaving open the possibility that:

the more complex aspects of language use (e.g. syntax and semantics) lateralize only gradually. (p.52; see also Moscovitch 1977 and Molfese 1977:198).

Drawing on evidence from childhood aphasia, Hécaen (1976) expresses the same idea, noting indications that:

the different language zones do not achieve their full maturation at the same time, allowing a reorganization even in the same hemisphere of verbal function, a reorganization which, moreover, occurs at the expense of other functions. (p.130)

McKeever et al (1976) suggest that certain linguistic milestones (in this case the lateralisation of phonetic discrimination rather than just lateralisation in general as Krashen (1974) suggests) have to be passed at the appropriate time in order to enable further normal development. They found a lack of hemispheric asymmetry for language in non-signing deaf people and only a low level of perceptual asymmetry on tachistoscopic tests in signing ones. They conclude that the normal

development of lateralisation for linguistic and non-linguistic functions may be affected by the absence of phonetic input. However, the fact that laterality for language is found in the signing deaf (Neville 1977) indicates that phonetic input is certainly not the only catalyst, if it is one at all, to normal lateralisation. Furthermore, we may note that in the deaf, two things are failing to occur: phonetic input and the brain functions which would deal with it. It is difficult to see how one could determine whether it is the missing input (an environmental type of factor) or the missing brain activity (a biological factor) which upsets the normal development of functions. The case of Genie (e.g. Fromkin, Krashen, Curtiss, Rigler & Rigler 1974) could also be taken as evidence of the inability of language to lateralise without phonetic input, but the rôle of this environmental deficiency can be extracted neither from the effect of an overall absence of linguistic stimulation, nor, once again, from the biological consequences of failing to initiate linguistic development when the brain is primed to accept it.

4:3 THEORIES FOR BILINGUAL⁴ AND POLYGLOT STORAGE AND ACQUISITION

The involvement of the hemispheres in language has also been addressed in relation to second language acquisition and storage. In the following section theories will be described which have been proposed in this context. Then section 4:4 will examine the inconsistencies in the data which has emanated from testing these accounts.

4. Despite the general use of 'polyglot' to apply to all non-monolinguals (see Notes on Terminology), 'bilingual' is retained where it is a central term in a theory under discussion (e.g. 'compound & coordinate bilingualism', below).

4:3.1 STORAGE

4:3.1.1 COMPOUND & COORDINATE BILINGUALISM

When, after becoming a practical expert in his own, first language, a person starts learning a second language, new sets of decoding and encoding habits are being formed in competition with the old. When the bilingual shifts from language to language, similarly, two systems of decoding and encoding habits come into conflict to a greater or lesser degree. (Ervin & Osgood 1954:139)

Ervin & Osgood (1954) appear to be the first to have used the terms *compound* and *coordinate* in the context of bilingualism. However, Weinreich (1953) explores the same ideas in a slightly less formal way and traces the concepts back as far as the end of the last century (see below).

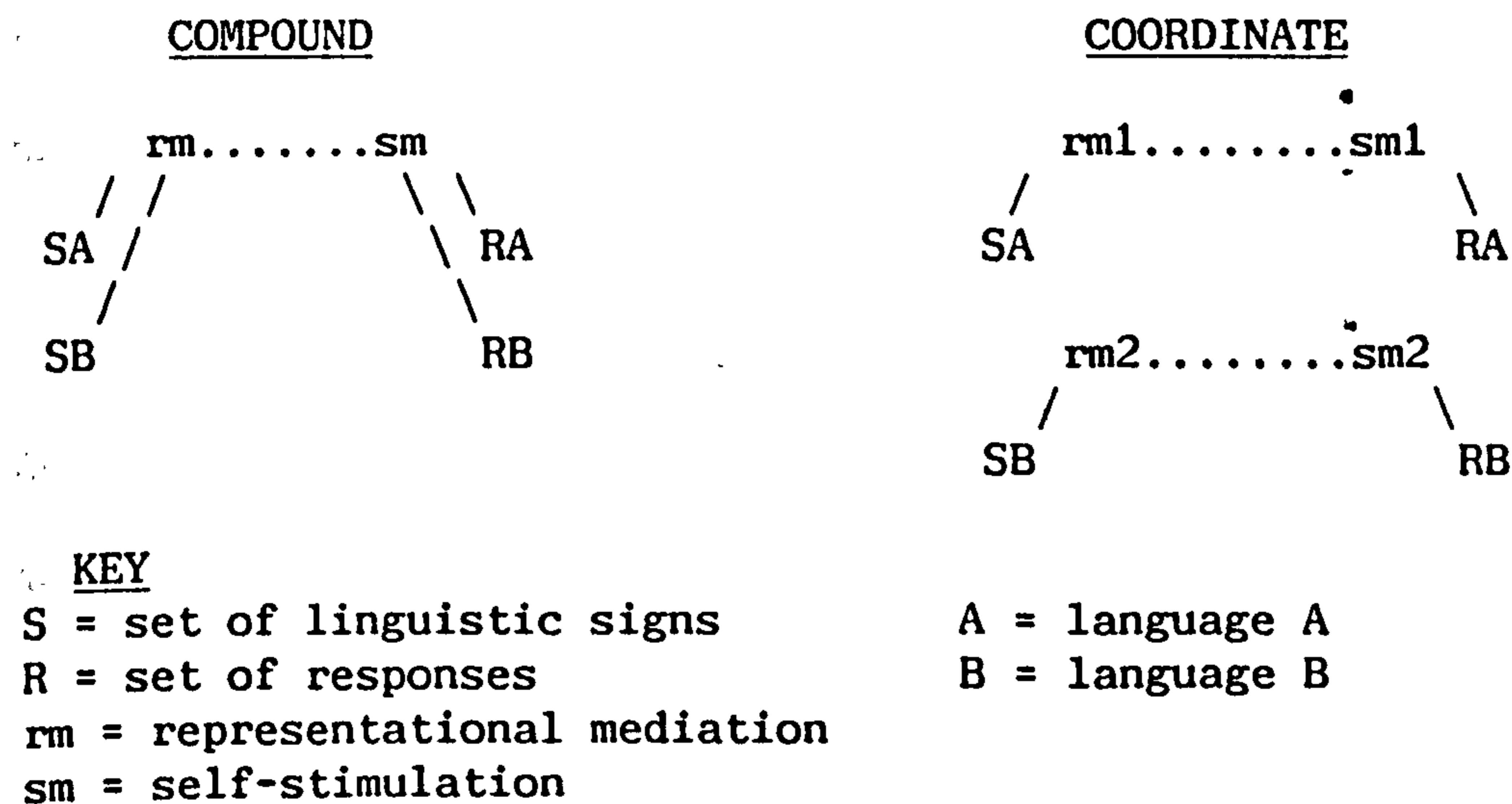


FIGURE 4:I (reproduced from Ervin & Osgood 1954:140)

Figure 4:I depicts the model of compound and coordinate bilingualism used by Ervin & Osgood. The difference between them lies in whether there is (compound) or is not (coordinate) a shared "set of representational mediation processes or meaning" (p.140). The compound structure, they suggest, is typically formed as a result of foreign

language learning in school, where, in particular, vocabulary lists encourage the association of an L2 item with its L1 equivalent rather than directly with the concept. In addition, however, a compound representation may result from an entirely different acquisitional setting:

where interlocutors use both languages interchangeably to refer to the same environmental events. (Lambert & Rawlings 1969:604)

The association of such different methods of language learning/acquisition within one storage category is considered by some to be an avoidable generalisation (see below).

The coordinate bilingual operates two independent systems, each of which may contain some conceptual material not within the other, so that some subjects may be substantially more difficult to discuss in one language than the other:

The total situations, both external and emotional, and the total behaviors occurring when one language is being used will differ from those occurring with the other. (Ervin & Osgood 1954:140)

According to Ervin & Osgood, both types of bilingual will be subject to some problems of cross-language interference, but the difficulties will be more acute for the individual with compound storage. This is because in this case both languages share the same conceptual framework; interference will occur in proportion to the amount of cultural similarity between the two language communities because this will determine the measure of equivalence between a concept-label in one language and its nearest translation in the other.

Weinreich (1953), whose examination of bilingualism resembles and predates that of Ervin & Osgood, attributes the concepts of compounded versus separate systems of storage to earlier writers, such as Ščerba

(1945) and even Loewe (1888). Weinreich's model involves three types of storage, by which means he affords separate status to the two types of compound bilingual treated together by Ervin & Osgood. Weinreich (1953) represents the model as follows (Figure 4:II):

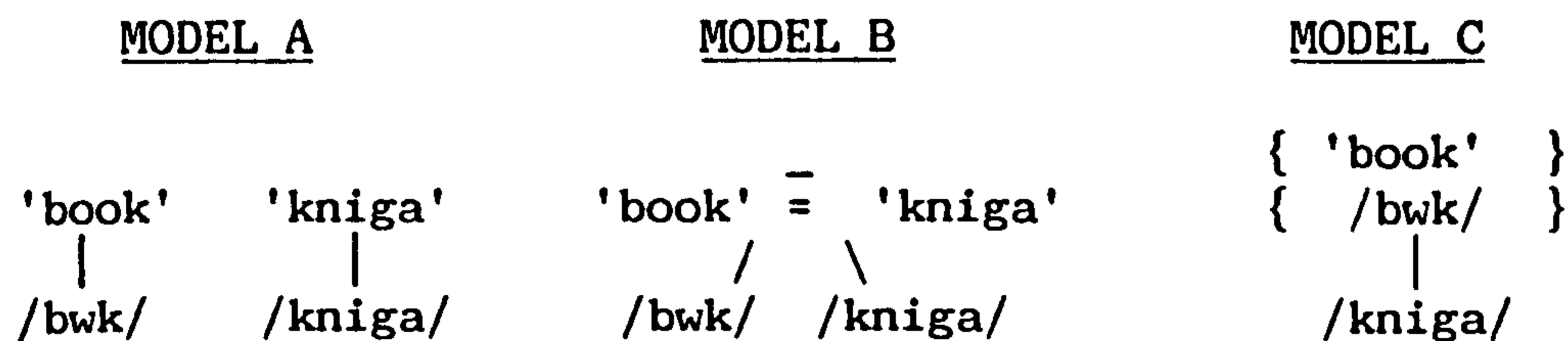


FIGURE 4:II (from Weinreich 1953; see also Paradis 1978)

Model A is equivalent to Ervin & Osgood's coordinate category, where each phonological realisation (/___/) is associated with its own concept ('___'), whatever resemblance there may be between any of those concepts. Model B applies to those individuals termed *compound* by Ervin & Osgood who have acquired two languages within one environment; here the concepts are considered identical (where applicable) and are each directly connected to both words. In Model C, where L2 has been learnt (formally) via the L1 medium, access from a single L1 appropriate concept is mediated by the L1 word, so that L2 production proceeds via some level of *translation*. With reference to the theories of Roberts (1934), Weinreich associates Model C with *subordinative bilingualism* because of this L1 mediation. Further detailed discussion of the compound-coordinate model of linguistic storage can be found in Albert & Obler (1978:227ff).

Whitaker (1978) draws on the evidence from polyglot aphasia (discussed in section 4:5) to challenge the compound-coordinate distinction. Although parallel recovery of languages appears to be indicative

of compound storage, he says, both parallel and differential recovery can be accounted for in terms of coordinate storage:

for the simple reason that it is almost certain that all languages are represented and organized similarly in the same anatomical structures. Therefore, a lesion in one of these structures would affect all languages similarly, regardless of whether there was a single set of linguistic rules or not.... From the evidence at hand, it is not clear that a case can be made for these two types of bilingualism, let alone the third type postulated by Weinreich, the subordinate. (p.28)

The compound-coordinate distinction has proved a useful baseline for research. However, despite the observation that most bilinguals probably fall somewhere on a continuum between totally compounded or totally coordinated storage (Albert & Obler 1978:227; Lambert 1969:301; Kotik 1984:237), much research has failed to really take this into account, relying rather on the assumption that subjects can be considered polarised (Lambert & Rawlings 1969:605). According to Vaid (1984), Lambert's major criterion for the classification of bilinguals as compound or coordinate was the age of onset of the bilingualism (Vaid 1984:176). Some authors employ misleadingly simplified definitions, e.g. Rupp (1980):

A compound bilingual is one who acquired both languages at the same time.... The coordinate bilingual is one who acquired each language in different settings and usually at different times. (p.5)

Rupp's definition is particularly problematic because it predicts a coordinate storage for formal classroom L2 learners.⁵

Despite the implications of modifying a clear two-way distinction into a continuum, Lambert & Rawlings (1969) consider that the studies investigating the "construct validity of compound-coordinate differ-

5. Elsewhere, (e.g. p.23) Rupp (1980) expands on Ervin & Osgood's model in a more representative way.

ences":

promote a good deal of confidence in the psychological significance of the phenomenon. (p.605)

They describe an experiment which required the naming by bilinguals of key words linking a group of semantically associated stimulus words. In alignment with their predictions, compound bilinguals found it easier than coordinates to correctly respond when the stimulus lists contained words in more than one language. Within this condition, coordinates, but not compounds, performed better if the words were grouped according to language and ordered for frequency.⁶

Other studies, however, have not supported the compound-coordinate distinction as it stands. Lambert (1969) himself describes two experiments where compounds were expected to perform less well than coordinates but did not. This leads him to concede that "the matter may be quite complex" and that his "confidence in the compound-coordinate matter is only luke-warm" (p.41, quoted in Diller 1970:259).

Diller (1970) is a little scathing about the simplicity of the compound-coordinate distinction, commenting that the terms are used "as if such phenomena existed in identifiable form" (p.254). He draws attention to the implicit assumptions of a psychological reality for what might otherwise be treated as an abstract sociolinguistic model, remarking that:

the motion seems to be based on the belief that different manners of learning second languages will result in radically different grammars in the brain. (p.254)

He argues against the existence of the two types of bilingual storage

6. That is, frequency as a response in free-association tests on normal monolinguals.

on a number of different grounds.

Firstly, he criticises the inconsistencies between writers (e.g. Brooks 1964, Lambert 1966) in their labelling of subjects as *compound* or *coordinate*. He highlights the problems inherent in Ervin & Osgood's (1954) failure to adequately distinguish between the two types of compound bilingual (as formalised by Weinreich's Models B & C in Figure 4: II above). He also questions the relevance to the model of claims made on the basis of both the *Semantic Differential Test* (Ervin & Osgood 1954:141; Lambert 1961:76) and polyglot aphasic studies. He continues:

If the compound-coordinate distinction has any validity, it should be corroborated by translation tests: the compounds should be better translators. However, in four experiments involving translation, Lambert found negative results in three. As he has pointed out, difficulties in experimental design keep those negative results from being conclusive [Lambert 1961:78]. The same can be said for the experiment that had positive results. (p.259)

On the theoretical level, Diller has two objections. The first concerns the validity of the term *compound* at all, seeing as "no two languages are grammatically similar enough to be compoundable" (p.259). Each language, he claims, has to be functionally autonomous to be usable: neither grammatical constructions nor vocabulary hold any significant level of mapping equivalence across languages. His second objection lies in the implication that any bilingual's languages "are stored so separately in his brain that he cannot speak in one language about things he has learnt in the other" (p.260). (But it may be noted that Blom & Gumperz (1986) found evidence of code-switching in Norwegian students who had left and returned to their home environment; The code was determined by the topic under discussion). Diller concludes that:

the terms are empty. Compound and coordinate systems do not exist in identifiable form in bilinguals who are proficient in their second language. (p.261)

Despite Diller's many objections, Albert & Obler (1978) still consider that:

individual bilinguals do perform differently on many tests, and it would be unwise to discard the notions altogether. (p.227)

Swain (1972), cited in Genesee, Hamers, Lambert, Mononen, Seitz & Starck (1978:2) suggests that infant bilinguals have a shared syntactic system where the rules of L1 and L2 are the same and separate systems for language-specific rules. Some experimental evidence, especially that gathered by Lambert (e.g. Lambert & Rawlings 1969, Lambert 1969) indicates that the bilingual who acquired L2 later is more likely to behave in a way consistent with having two segregated linguistic systems, besides being more likely to avoid deep semantic processing strategies in linguistic tasks like the Stroop Colour Test (Genesee et al 1978:2).

Obler (1984) discusses the possibility that both compound and coordinate storage operates side by side in one individual. Which system is brought into play at any one time will depend on the exact nature of the task undertaken. For example, tests of free association to single word stimuli might activate coordinate relationships, while list recall tasks would tap the compound storage (Obler 1984:197). She continues:

Thus, 'compound' is not a label for an individual, but a statement of the organization of - or, better, the psycholinguistic approach for - specific language tasks. (p.197; see also Kotik 1984:237)

But Kotik (1984) also sees experimental groups as being at a "transitory intermediate stage between coordinative and mixed bilingualism" (p.237), which suggests a change in the relative importance of compound and coordinate organisation in the individual across time (as a func-

tion of increasing linguistic proficiency).

The suggestion that behaviour consistent with a particular type of storage might be dependent upon the task being undertaken has been made by other researchers too. Segalowitz (1977), for instance, suggests the following explanation for the inconsistencies across psycholinguistic and clinical data:

there is one semantic system in the brain subserving all the languages of the multilingual, rather than separate processes for each language... The languages of the bilingual become functionally separate at the speech production end of the language process. (p.131, quoted in Rupp 1980:27; see also Rupp 1980:24)

4:3.1.2 SWITCH MECHANISM & MONITORING MODELS

Not unrelated to the issue of storage, and particularly the relationship between an individual's two languages, is the question of how the bilingual knows which language to process at any given moment. Entirely different mechanisms are clearly to be invoked according to whether we are dealing with production or perception. In the former case, the bilingual makes his own decision, based upon sociolinguistically determined factors: who he is speaking to, where and about what, for instance. Of more interest to psycholinguists is the bilingual's apparent spontaneity in identifying and 'switching into' the language he is hearing.

A procedure of identification might involve a search of the incoming data at phonemic and subsequently lexical and structural level (Obler 1984:198f) to isolate features which belong only to one of the two languages. There is some evidence to suggest that if such a mechanism

exists, however, it is not always fully active, so that the 'scanning'⁷ of incoming information does not occur where a change of language is not expected; output may also sometimes be in the inappropriate language, for instance under the strain of complexity or confusion. With regard to the latter, Gaziel, Obler & Albert (1978) report an experiment in which Hebrew-English bilinguals were administered the Stroop Test. In this test, subjects are required to name the colour of the ink in which a stimulus word is written; the stimulus word, however, is itself the name of a (different) colour. The bilingual subjects had the expected problems in single-language conditions, that is, they tended to read the colour name rather than name the colour of the ink. When they were required to name in one language the ink colour of words written in the other, however:

they would never read the word aloud; rather they pronounced its translation equivalent [implying that] once a subject is set to speak in a certain language, he will continue in that language. (p.159)

Monitoring, the checking of one's own output for grammaticality, forms the third component of the L2 acquisition model presented by Dulay, Burt & Krashen (1982; see section 4:3.2.1). In the first component, information from the language environment is *filtered*, so that only selected parts are subject to the mechanisms of acquisition (p.46f). That information can then be processed by the *organiser* (p.54ff) which operates to build up systems from the L2 input. The *Monitor* (p.58ff)

7. 'Scanning' is also used in the Focusing Hypothesis as a technical term. It is not intended in that sense here, but nevertheless it may be seen that the kind of scanning envisaged by the Focusing Hypothesis to be part of the holistic processing system (chapter 1:2) would, if it exists, be of value in the assessment of the language of input. It might have been clearer, all the same, to have used a separate term. However, 'monitoring', the most acceptable alternative, also has a technical meaning, as described below with reference to Krashen's work.

is a separate information processor, which, unlike the the organiser, is under the conscious control of the learner. Dulay, Burt & Krashen connect the appearance of the Monitor at about puberty with the onset of Piaget's *formal operations* (p.60), which entails the ability to abstract. Because this enables the construction of possible external perceptions of oneself it often leads to hypersensitivity about one's image, and indeed one's importance, in the eyes of others. In the context of second language learning this will mean that the pupil begins to monitor his own production, often to a destructively hypercritical extent. The failure of so many individuals learning a second language after puberty to achieve the same proficiency as those learning it before puberty is therefore considered to be the result of an altered perception of themselves and their ability to succeed, not of some biological alteration affecting the receptivity of the language centres.

Dulay, Burt & Krashen (1982) therefore formally distinguish between the kind of superficial awareness of language which children have, which enables them to enjoy word games and puns, and the metalinguistic insight which the Monitor offers, which includes:

the ability to think abstractly about language, to conceptualize linguistic generalizations, to mentally manipulate abstract linguistic categories, in short to construct or even understand a theory of language, a grammar. (p.61)

Krashen (1978) suggests that the Monitor is applied optionally. He describes how individuals may choose not to employ, in communicational production, rules which they clearly know (p.178) and how, conversely, some people may over-use the Monitor so that they find it virtually impossible to say anything in case it is grammatically inaccurate.

The way in which the concept of the Monitor may relate to the analysis of language-focused-language in the Focusing Hypothesis is exa-

mined in chapter 5.

4:3.2 ACQUISITION

No language is like the native language that one learned at one's mother's knee; no-one is ever perfectly sure in a language afterwards acquired. (Bloomfield 1964:393)

The central interest in L2 acquisitional processes consists of:

whether adult second language learners are able to reinvoke the right hemisphere processes that appear to be active during some stage of child language acquisition. (Carroll 1980:81)

He argues that if right hemisphere mechanisms participate in the early stages of L1 development (see chapter 4:2.2.1),

It would seem unlikely and uneconomical that right hemisphere mechanisms existing for first language acquisition would be dismantled. (p.81)

The theories described below examine the possible mechanisms of L2 acquisition in relation to those believed to underlie the remarkably uniform acquisitional achievements of L1 learners.

4:3.2.1 KRASHEN'S 'ACQUISITION' AND 'LEARNING'

Krashen's formal distinction between 'acquisition' and 'learning'⁸ (e.g. Krashen 1976, Dulay, Burt & Krashen 1982) provides the popular basis for explanations of the variation in L2 competence and in apparent patterns of lateralisation (see section 4:3.2.4.4) as related to the circumstances in which it was acquired.

Children 'acquire' their first language in a way which is unconscious and natural, claims Krashen. The 'acquisition' proceeds independently of any formal tuition, according to an ordering which is ob-

8. For clarity, the words 'acquisition' and 'learning' will be written in inverted commas when referring to Krashen's definitions; the same words without inverted commas are intended in a neutral sense.

servable across individuals (Natural Order Hypothesis, e.g. Krashen & Terrell 1983:28). It requires a naturalistic communicational setting and a situation in which attention is paid primarily to the content, not the form, of utterances (Vaid & Genesee 1980:438). Indeed:

if the child is allowed the necessary input during some critical period, complete competence in the target language (first or second) appears to be inevitable. (Krashen 1976:163)

Krashen claims that this process is still potentially available in adulthood (Krashen & Terrell 1983:26) and that it leads to a linguistic competence which is characterised by a 'feel' for the correctness of structures rather than any awareness of formal rules. 'Learned' language, usually the product of formal classroom instruction via the medium of L1, results in "'knowing about' language" (Krashen & Terrell 1983:28). This formal 'learning' is:

characterized by contexts in which there is an emphasis on the structure of language through, for example, rule isolation and error correction. (Vaid & Genesee 1980:438)

One characteristic of the difference between the two types of process is that the level of ultimate success in a 'learned' language is not uniform and is substantially dependent on the learner's general level of intelligence. Brown (1973a) speaks of qualitative differences between L1 and L2 competence, observing that adult Japanese 'learners' of English failed to master the correct usage of articles, a phenomenon perhaps not unconnected with the fact that these carry only a very low semantic functional load (p.105). English children, however (as opposed to adults), do learn them, he notes, despite the fact that they could clearly get away with getting them wrong, judging from the other mistakes which they make without being considered incomprehensible. In other words, there is little pressure from communicative requirements

to encourage the children to learn the correct forms. Their success, contrasted with the failure of adults, leads Brown to presume that "children operate on language in a way that adults do not" (p.105).

Besides intelligence, motivation is considered to be a crucial variable in language 'learning' (*Affective Filter Hypothesis*, e.g. Krashen & Terrell 1983:37f). It is impossible to avoid the observation that motivation is low in the classroom, where language usage is also not primarily communicative. Krashen's *Great Paradox of Language Teaching* states that:

language is best taught when it is being used to transmit messages, not when it is explicitly taught for conscious learning. (Krashen & Terrell 1983:55)

Indeed, Krashen (1976) goes further, by suggesting that linguistic information imparted in a formal way cannot be adopted into the learner's language store *per se* at all. However, it can help adult learners to "out-perform [their (usually) imperfectly acquired competence] when conditions allow this conscious knowledge to intrude (e.g. when sufficient processing time is available or when not too distracted" (p.163). Rather, all such information relates only to the Monitor (Krashen & Terrell 1983:30f), which checks and edits linguistic output. Thus, adults can 'acquire' language, but in the classroom not only will 'acquisition' occur only very slowly, but it will occur in spite of the formal tuition. He substantiates this claim with the observation that an individual's automatised linguistic system for L2 will increase in accordance with a natural ordering (p.28f).

4:3.2.2 CRITICAL AGE IN L2 ACQUISITION

The critical age hypothesis as relevant to first language acquisi-

tion was discussed in section 4:2.2, so only a very brief summary will be given here for the purpose of contextualising the discussion relating to L2 acquisition. Essentially, the critical age hypothesis states that natural 'acquisition'⁹ is possible only during childhood:

He who learned a language after, say 12 years of age, appears to use much more mental energy when speaking that language than he who acquired it in early childhood.... Indeed, it looks as if linguistic habits formed after puberty never reach the same degree of automaticity as linguistic habits formed early in life. (Lebrun & Paradis 1984b:216)

Echeverria (1974) reviews the appropriateness of L2 teaching methods in the light of the critical age hypothesis, and he proposes that puberty effects some irreversible change to the Language Acquisition Device, so that it is available as such only until that age. Thus, the child handles language by means of a "native speaker coding device" and the adult via a "general coding ability" (p.72). It is because "optimal grammatical coding is available only to children" (p.72) that children are more successful in language acquisition. The adult has lost the capacity to handle an L2 rule independently of the L1 ones:

the child is essentially a 'restructurer', while the adult is basically a 'rule-adder'. (p.72)

Rosansky (1975) presents the Piagetian interpretation of the critical age phenomenon, which points to the cognitive changes associated with the *Formal Operations* stage; the transition from *Concrete Operations* to *Formal Operations* is said to occur during the period from 11-12 to 14-15 (Rosansky 1975:95). Rosansky identifies the relevant questions as:

What in the nature of Formal Operations might be an inhibiting

9. The usage of 'acquisition' and 'learning' continues as before, except with respect to the direct evaluation of Krashen's hypothesis, where the terms are used without inverted commas, as if non-partisan.

factor to further language learning? Does something (operation) compete with language acquisition operations so that the child is no longer able to learn language? Perhaps the problem is not in any single operation but rather in the whole nature of cognitive development. (p.96)

She continues by suggesting that the egocentricity of the child, which accompanies L1 acquisition, may not be incidental to the success of that acquisition, and that the transition to Formal Operations destroys the natural acquisitional ability in involving "progressive decentration":

If decentration is somehow inversely related to the language acquisition ability...and if awareness of contradictions acts as an incentive to decentration, then perhaps what acts as a 'block' to language learning is precisely the awareness of differences. This new consciousness of differences seems to supplant the child's previous limitation of being able to only focus on the underlying similarities. (p.98)

Within this context it can be seen that the critical age hypothesis does not necessarily contradict Krashen's claim that adults can 'acquire' languages, for it may be that it is simply circumstantial that the acquisitional mechanisms are always prevented (if they are) from operating in adulthood.

Ervin-Tripp (1974) on the other hand, does not consider that the use of prior knowledge in L2 acquisition renders it formally different to L1 acquisition:

Now it is certainly the case that the second language learner makes use of prior knowledge, skills, tactics, but it is also true that the first language learner does this. That is, any learning builds on what has happened before.... (p.112)

However, her evidence is drawn from studies of L2 acquisition in young children, not adults; one essential difference between them is the extent of their conscious knowledge of L1 forms. This could be expected to be an important type of *prior knowledge* qualitatively different to anything a young child acquiring L1 or L2 might invoke.

4:3.2.3 LANGUAGE ACQUISITION AS A ONCE-ONLY EVENT

Discussion regarding cognitive changes during the course of biological, psychological and social maturation, and their effect on language learning, are also central to the theories of several other writers. The ideas under discussion in this section have in common the notion of an unavoidable maturational change in cognitive structures, directly attributable to language acquisition itself. In other words, acquiring language (as distinct from a language) involves a mechanism which cannot be reused. This contrasts, then, with the critical age hypothesis, where the change to the Language Acquisition Device is a function of age (e.g. Echeverria 1974, see section 4:3.2.2 above). Thus:

We propose that learning a language after the native one, at whatever age, cannot demand a repetition of all the same steps. In our argument, learning a language is like learning to ride a bicycle; once one has learned the basic principles of riding a bicycle (or using language) one never again has to achieve certain elements of knowledge. (Albert & Obler 1978:230)

But Albert & Obler's hypothesis does not predict any difference in the ability of children and adults to acquire a second language. Others provide a more open-ended account. Lamendella (1977) differentiates primary language acquisition (PLA), secondary language acquisition (SLA) and foreign language learning (FLL):

FLL is basically an intellectual process involving the relational induction of TL [Target Language] rules by cognitive problem solving systems, as well as conscious hypothesis testing.... The FL learner tends to rely on the NL [Native Language] for actual comprehension and formulation of messages, with the TL serving only to mediate between internal NL structures and TL speech schemata. (Lamendella 1977:177f, quoted in Rupp 1980:26)

In Lamendella's FLL we see something equivalent to a post-critical age language learning device, Krashen's 'learning' and Albert & Obler's general L2 device. But he provides a means of accounting for the

child's superiority over the adult in L2 acquisition. However, as SLA is effective between the ages of 6 and 8. (Rupp 1980:68), the hypothesis achieves little more than a shift of the critical age to 8 and a gratuitous amalgamation of an approach similar to Albert & Obler's with a critical age hypothesis.

Although Chomsky (1968) believes it may be possible to use a faculty other than the language one to tackle a language-acquisition type task (p.691), he speaks of this only in relation to the acquisition of a system which contains violations of universal linguistic principles (such as constructing a question by reversing the order of the words in the declarative sentence). This kind of system, which the learner might approach like a puzzle (p.688), would, then, only be used where the language faculty could not cope on account of its strictly limited expectation as to the type of structures it will encounter. He does not imply that a more general analytical faculty MUST be used after L1 has been acquired, nor even that it can be successfully used for L2 acquisition, despite McLaughlin's (1980:60) claim that he does.

Any theory which predicts the inevitability of a different method of acquisition for L2 (thus also the critical age hypothesis), renders the compound-coordinate distinction impossible in its accepted form. For the different underlying structures they predict must imply independent storage, so that only subordinative compound storage, not coordinate or non-subordinative compound storage, could result from adult L2 acquisition.

4:3.2.4 AGE-STAGE-MANNER HYPOTHESIS

4:3.2.4.1 GENERAL

The Age-Stage-Manner hypothesis concerns the amount of right hemisphere involvement believed to occur in L2 acquisition and processing and, for its determining variables, points to the age of that acquisition, the manner in which it occurs (particularly whether it constitutes 'acquisition' or 'learning') and the stage of proficiency reached by the time of testing. Vaid (1983) summarises the hypothesis as follows:

[1]. There will be a greater right hemisphere involvement in the second as compared to the first language of adult bilinguals if the second language is learnt informally. Conversely, there will be greater left hemisphere involvement in the second than in the first language if the former is learnt formally.

[2]. Right hemisphere involvement in second language processing will be more evident in the initial than in the final stages of second language acquisition (Galloway & Krashen 1980; Obler 1977).

[3]. The pattern of hemispheric asymmetry in bilinguals will more closely resemble that of unilinguals the earlier second language acquisition occurs and will differ from that of unilinguals the later the second language is acquired. (p.323-9)

4:3.2.4.2 STAGE

Chronologically speaking, the first of the three factors to be identified as a possible determiner of right hemisphere participation in polyglots appears to have been *stage of acquisition*. Galloway & Krashen (1980) attribute the *stage hypothesis* to Obler's writings of the mid-seventies. In response to experimental data, Galloway & Krashen produce their own *modified stage hypothesis*, which draws a distinction between formal and informal language acquisition. According to the modified stage hypothesis, then, for there to be right hemisphere involvement in L2 processing:

First, the performer MUST be at an early stage in second language acquisition. Second, the use of the conscious grammar, the Monitor, needs to be low or non-existent. (p.78)

This, they suggest, occurs only in informal acquisition, and probably only where the learner is too young to have developed Monitor skills (see section 4:3.1.2).

The reason for the belief that the right hemisphere is more involved in the early stages of L2 is that early-stage learners use strategies which are "compatible with the demonstrated linguistic capabilities of the right hemisphere" (Vaid & Genesee 1980:435). Kotik (1984) names these capabilities as:

dominance of highly contextualized stereotype expressions...using more semantic than functional words, leaning upon more prosodic than phonemic features, more pragmatic than syntactic information. (p.231; see also Genesee 1982:318)

Experimental evidence supports the hypothesis that the right hemisphere is more involved in the processing of L2 in some subjects. Chernigovskaya, Balanov & Deglin (1983:196) refer to the dichotic listening tests conducted by Obler, Albert & Gordon (1975) and Silverberg, Bentin, Gaziel, Obler & Albert (1979), which showed a far less marked right ear advantage when testing the second than the first language. Kotik (1984) considers the stage of acquisition to be crucial to the understanding of such experimental results; without attention to this:

it becomes somewhat nonsensical to discuss neuropsychological problems of bilinguals and especially the rôle of the right hemisphere. (p.237)

But Vaid (1983) observes that studies provide:

little evidence to suggest that right hemisphere involvement is more likely in the beginning than in the advanced stages of second language acquisition. (p.331)

Further results of similar experiments are described in section 4:4.1.2 below).

4:3.2.4.3 AGE

Much of the justification for age as a determiner of right hemisphere participation in L2 processing hinges on the alterations in neural structure which may occur in the course of maturation (see section 4:2.2 above). Both Vaid & Genesee (1980:434) and Kotik (1984:229) agree that:

If the two languages are not learned simultaneously, but successively, it is quite reasonable to expect them to have a different neurological organization since every language is acquired at different stages of brain maturation.... The probability of divergence grows proportionately to the time lag between the acquisition of the different languages. (Kotik 1984:229; see also Genesee 1982:317)

Thus, different processing strategies for L1 and a later acquired L2 are a consequence of the natural characteristics of the human's higher mental processes, viz.:

the instability and inconsistency of their cortical localization, which changes with both development due to age and with successive stages of practice. (Kotik:1984:229)

Carroll (1980:85) suggests that it may be only productive skills which benefit from study at an early age (perhaps this is due to factors relating to social interaction). Nevertheless, he notes that young learners do appear to focus on different things to older ones.

Experimental evidence indicating a greater right ear advantage in late than early bilinguals is described in section 4:4.1.1 below).

4:3.2.4.4 MANNER

The manner hypothesis states that the right hemisphere will be more involved the more informally the L2 has been learnt. Lamendella's (1977) distinction of two types of non-primary acquisition, i.e. secondary language acquisition (SLA) and foreign language learning (FLL) (see section 4:3.2.3 above), is motivated by the belief that the manner

of acquisition plays a vital rôle in the determination of linguistic storage patterns:

There is a difference in the nature and internal organization of the neuro-functional systems responsible, correlated with drastically different types of performance abilities in the target language. (p.176, quoted by Rupp (1980:25))

Part of the justification for the manner hypothesis lies in the observation that L1 acquisition proceeds via informal means (Genesee 1982:19) whereas L2 'learning' in the classroom involves conscious analysis, which is associated with the left hemisphere (Witelson 1977, Genesee 1982:320). Attention is justifiably given to what is missing from the formal classroom environment, viz. "interpersonal interaction (mime, dialogue, affective color, gestures etc.)" (Kotik 1984:232). These are features of language which many believe to be processed by the right hemisphere.

But also to be considered are the features present in 'learning' and absent in 'acquisition'. Vaid & Genesee (1980) observe that adults are more analytic than children, so that:

adults, relative to children, are more likely to use a formal mode of processing language reflecting their more advanced stage of cognitive development. (p.440)

One aspect of this analytical approach may be the increasing use of the Monitor (Krashen 1976) and this forms the basis of a prediction by Gallopy (1981):

The first language should appear more left lateralised than the second language in adults who are acquiring a second language in an informal, natural setting and who are not consciously monitoring their L2 performance with learned L2 grammar rules. (p.51)

4:3.2.4.5 THE INTERACTION OF AGE, STAGE & MANNER

The strength of these hypotheses as an explanation and prediction of experimental and clinical observations lies in their interaction.

Together they state that right hemisphere involvement in L2 processing is more likely the later and more informally it is acquired and the earlier on in acquisition the testing is done (Vaid & Genesee 1980: 439). It is immediately obvious that the first two conditions (age and manner) tend not to coincide in the Western literate nations, where even a move to a new linguistic environment will be characterised by the opportunity of formal tuition in L2 and the presence of other L1 speakers who can comment on the relative nature of L1 and L2 rules in a formal way. The results of all the psycholinguistic experiments described in section 4:4 below must necessarily be accounted for in terms of all three parts of the hypothesis.

4:3.2.5 OTHER FACTORS

The literature review conducted by Albert & Obler (1978:64f) highlights other factors which may have some bearing on the determination of how much right hemisphere involvement there is in language processing. These include the possibility that learning a second language actually alters the cerebral organisational patterns of L1, and that affective and language specific aspects of the languages in question may be relevant.

The affective factors relate to the bilingual's attitude towards his two languages. Obler (1984) reports that:

individuals who are happy where they are and who feel good about the language they are learning are most likely to learn it well.
(p.199)

Affective factors also seem important to the recovery of languages in aphasia (see section 4:5.3 below). Self-consciousness might be another affective factor, Galloway (1981) suggests. Exploring the value to

language acquisition of non-verbal intonational communication (as in L1 acquisition), she suggests that the failure in this respect of right hemisphere capabilities to be fully used by adults acquiring L2 is that "it would be socially embarrassing" (p.21). She cites supportive evidence that success in adult L2 acquisition can be associated with solidifying and intonational imitation. However, the affective factor could be less specific here, and simply relate to the presence or absence of enthusiasm and interest in the learning of the new language.

Language specific factors are of interest because a subset of the general processes associated with the right hemisphere appears to be more central to some languages than others. Vaid (1983) names the following features: the semantic load of vowels as opposed to CV strings, the significance of tones, the direction of scan demanded by the script, and the closeness of phonemic-graphemic correspondence (p.318; see also Silverberg et al 1979:185).

She also highlights the cross-cultural cognitive difference apparent in comparisons between Amerindian (Navajo and Hopi) and English-speaking subjects. The Navajo and Hopi languages reflect (or else "give rise to" (Vaid (1983:319)) an *appositional* as contrasted with our *propositional* mode of thinking, whereby "the Hopi language creates involvement with the perceptual field [but] English orients its users away from the immediate context" (Vaid & Genesee 1980:432). In addition, innumerable other potential bases of variation between individuals or groups might be responsible for the confounding of cross-study comparisons (Vaid 1983:318). It is impossible to itemise all the features of culture, environment, circumstance and maturation which could have some bearing on the results of experiments investigating language

process sharing between the two hemispheres. The nature of the task itself may have an effect (see sections 4:1.2.1.5.3 and 4:1.2.5.2 and also chapter 5:2.1.2), and the subject may have more (unintentional) control over the results than we realise. The existence of unexpected acquisitional phenomena such as Carroll's (1980) discovery that production ability in L2 was actually facilitated by NOT having spend time in the L2 environment (p.85) only serves to remind us how short a distance we can safely go in pronouncing on the subject of processing patterns. As Kotik (1984) observes:

The combination of conditions under which a foreign language is learned is practically unique for every individual subject. The discrepancy in data and opinions may be due to the prevalence of monofactorial hypotheses of interpretation when the process is in fact multifactorial. (p.229)

4:4 INCONSISTENCIES IN THE DATA FROM STUDIES OF NORMAL POLYGLOTS

Experiments investigating L2 acquisition and storage are most often directed towards the testing of the accounts described above, especially aspects of the Age-Stage-Manner hypothesis. Tables A4:iv and v in the Appendix indicate the complications which are inherent in the data.

4:4.1 THE NATURE OF THE INCONSISTENCIES

4:4.1.1 AGE

The prediction to which experimenters are looking with regard to the age variable is that:

the pattern of hemispheric asymmetry in bilinguals will more closely resemble that of unilinguals the earlier second language acquisition occurs, and will differ from that of unilinguals the later the second language is acquired. (Vaid 1983:329)

Literature reviews (e.g. Vaid & Genesee 1980:435, Vaid 1983:331, Genesee 1982) have considered this prediction largely supported. They

cite studies such as Sussman, Franklin & Simon's (1982) finger-tapping (verbal-manual interference) test. In this experiment bilinguals who had acquired L2 before the age of six indicated left hemisphere dominance for both languages (displaying interference to tapping with the right hand more than with the left during verbal tasks). Bilinguals who had acquired L2 after age six, however, displayed greater interference to right hand than left hand tapping only when engaged in L1 verbal tasks. For L2, both hands were equally affected. This is considered to indicate an ambilaterality for L2 processing (Oblert 1984:201).

Tables A4:iv and v (Appendix), however, indicate that even allowing for a separate consideration of *early* and *late* acquirers according to the manner of their acquisition (see below), there are several studies which do not display the pattern of *no difference* in early informal bilinguals or *more right hemisphere for L2* in late informal ones. Soares & Grosjean's (1981) tachistoscopic experiment found no difference between the hemispheres in late bilinguals. Kotik's (1975) experiment (see, for instance, Vaid & Genesee 1980:435) is also cited as counter-evidence to the age hypothesis because a greater REA (indicating left hemisphere laterality) was found in L2 in late bilinguals. But the factor of *manner of acquisition* interacts here and, referring to this and also Gordon's (1980) study, Vaid (1983) suggests that "in certain contexts of language acquisition, age related effects may be superceded" (p.330).

4:4.1.2 STAGE

Right hemisphere involvement in second language processing will be more evident in the initial than in the final stages of second language acquisition. (Vaid 1983:324)

As monolinguals are considered to display little right hemisphere involvement this means that the stage hypothesis predicts *no difference* in comparisons of proficient bilinguals with monolinguals, *more right hemisphere in L2* in comparisons on L1 and L2 in non-proficient bilinguals and *more right hemisphere* in non-proficient bilinguals when compared to proficient bilinguals or monolinguals (Vaid 1983:324).

Support for the stage aspect of the Age-Stage-Manner hypothesis is rather sparse. Kotik's experiment on the acquisition of Russian in Spanish and Vietnamese native speakers provides some limited measure of support, insofar as the Spanish group displayed:

evidence at the very first stage of learning Russian of significant ($p < .01$) right hemisphere rôle in the processing of dichotic verbal stimuli. (Kotik 1984:235)

However, the Vietnamese did not show the same tendency. Bever (1974) attributes to non-proficiency his finding in experiments with six and seven year old Hispanic subjects: they displayed an REA in L1 (Spanish) but not in L2 (English) (Walters & Zatorre 1978:159). By limiting its predictions to 'acquisition' (thus drawing on *manner* as perhaps the most important of the factors under examination), Galloway & Krashen (1980) consider that all experimental data can be viewed as supportive of the *modified stage hypothesis*. Others, however, think differently. Genesee (1978) feels that "the stage hypothesis has been the most extensively examined but the least empirically supported" (p.319).

Vaid & Genesee (1980) point to evidence from six studies that L1 and L2 are equally lateralised in non-proficient bilinguals (p.438; see also Vaid 1983:326). Carroll's (1980) Experiment 1 revealed a greater REA for L2, leading him to believe that adult L2 learners "begin processing the new language in a mode that is highly left lateralized and

continue to do so" (p.82). Rupp (1980) also found a greater REA in L2 than L1 in his Vietnamese-English bilinguals. However, his subjects, with three years of informal and formal exposure to English, may fall into a category defined by Galloway & Krashen (1980), of being "well beyond the stage where the right hemisphere participates" (p.77). Alternatively, Rupp's subjects could have experienced enough formal teaching for the *manner* prediction of greater left hemisphere participation in formal learning (see below) to apply. Galloway (1981), for example, notes that:

in contrast to the stage hypothesis, L2 appears to be more left lateralized than L1 in adult classroom L2 performers. (p.4)

Such a cause for Rupp's results is, however, unlikely, seeing as the greater REA for L2 was uniform across all ages of subjects (range:6-13 years): it seems implausible that children who first came into contact with English by immigration at age 3 and were tested at age 6 could have had much exposure to English of any kind at all comparable to the instruction generally considered formal and equated with adult classroom teaching.

4:4.1.3 MANNER

With reference to Krashen's 'acquisition'-'learning' distinction, Vaid (1983) predicts that:

there will be greater right hemisphere involvement in the second as compared to the first language of adult bilinguals if the second language is learned formally. (p.323)

Elsewhere (p.331) she affirms that the studies in the literature are in keeping with this prediction. Amongst the experiments supporting the manner hypothesis are those of Carroll (1980, Experiment 2) and Kotik

(1975, cited in Vaid 1983), both of which found a greater REA for L2 than L1 associated with formal learning and no difference where L2 was acquired informally.

Genesee (1982), however, notes that while studies do support the hypothesis, there is no common definition between them of *formal* and *informal* learning. Furthermore:

they fail to establish whether it was actually learning or simply teaching that was informal or formal. In fact, they have tended to define manner of learning in terms of the formality/informality of the instructional method to which the learner was exposed. This in no way means, however, that the learning strategies of the learner correspond to the manner of instruction. (p.320)

All in all, there appears to be very little counter-evidence to the manner hypothesis.

The explanation for the observed differences in laterality according to the method of instruction focuses either on *strategies* (see below) or on the nature of the tasks required in different types of teaching/acquisition, as these relate to the right hemisphere's abilities.

Thus, Galloway (1981) says:

language in the L2 performer with only classroom exposure (emphasizing reading skills and grammar) would not appear more bilaterally represented because the context dependent abilities associated with the right hemisphere are not used in L2 performance (let alone acquired). (p.144)

Similarly, an emphasis on the avoidance of 'formal' methods would allow the right hemisphere more involvement in its own capacities:

Certainly, for some learners it might be possible to achieve considerable fluency in certain limited situations with effective use of the Monitor. However, this system may not involve the same processes as those related to primary language acquisition. There is some indication that methodology can affect or influence the learner's strategy. The extremely intensive nature of an immersion program may preclude internal analysis of components and allow or force learners to reactivate earlier language learning strategies. (Carroll 1980:85)

Gordon's (1980) finding that native English speakers learning He-

brew after puberty showed a (non-significant) trend towards less marked left hemisphere dominance (p.261) in comparison to native Hebrew speakers with L2 English was accounted for in terms of acquisitional differences. The native speakers of English learnt Hebrew in intensive courses in Israel, and needed to use it in their every day communication. The native Hebrew speakers had learnt English in school and used it only rarely (p.266).

Approaching it from the other end, Hartnett's (1974) work indicates that those individuals with a greater measure of left lateralisation for language are more successful at deductive (formal) learning in L2, whilst those with some measure of right hemisphere involvement in language processing (as determined by observations of eye movement) are better at inductive (informal) learning (Oblin 1984:199). This ties in with Carroll's (1980:82) suggestion that the lower level L1 laterality in a group who had started L2 learning, as compared to a group of monolinguals, was not due to laterality changes in individuals but rather because L2 classes would be particularly difficult for certain individuals (the most left lateralised) to cope with and so they would drop out, leaving the sample biased.

4:4.1.4 SUMMARY

Although some very bold statements have been made about the blanket equality of monolinguals and bilinguals "regardless of when the second language was learned, how long it had been used or how well it was known" (Soares & Grosjean 1981:603; see also Gordon 1980:265f), still it seems clear that some kind of difference obtains between groups most obviously contrasting in their age, stage and/or manner of acquisition.

If these factors are responsible for the results obtained in experimentation, then the inconsistencies may be due to a failure to appreciate fully the complexity of their interaction.

4:4.2 EXPLANATIONS OF THE INCONSISTENCIES

Potential alternatives to the Age-Stage-Manner hypothesis become most apparent as one examines the accounts and insights which result from the need to explain the inconsistencies in the evidence, as described above. These accounts can be divided into three categories: 1) procedural shortcomings, 2) additions to the current theories and 3) new insights into processing theory.

4:4.2.1 PROCEDURAL SHORTCOMINGS

The most usually invoked defects in experimental design involve a lack of attention to the kind of detail necessary to assure that a group is homogeneous for specific salient variables. The testing procedures may be too unreliable, and be subject to confounding influences (Vaid 1983). Soares & Grosjean (1981:600ff) consider that many of the studies reported in the literature have inadequately controlled for sex, handedness or proficiency in L2. For example, Rupp's (1980) Vietnamese subjects ranged in age from 6-13 years old. All had been in the U.S. for three years. These three years would have involved very different linguistic experiences, according to whether the child was old enough to spend them in an English speaking school or a Vietnamese speaking home. Furthermore, not only their method of L2 acquisition might be affected. There might be important differences between the confidence with which they used L1 and the light in which they saw it,

according to their memories of their previous life and indeed their pre-immigration proficiency in L1.

Some experiments have contained inconsistencies in the quality of test material administered to different subjects, because the bilinguals are tested in two languages, the monolinguals in only one. This may have led to a fatigue factor in Soares & Grosjean's (1981) experiment, thus accounting for the overall slower reaction times of the bilinguals. Alternatively, as they suggest, it could be that the bilinguals' times reflected the added complexity in their task, namely, that they did not know which language the next stimulus would be in. Soares & Grosjean appear to have removed this mono-bilingual difference in scores by presenting the stimuli in blocks of the same language; this indicates that their interpretation is the correct one.

Another criticism levelled at some studies is that they are evaluated using misleading or inadequate statistical analyses, or that analysis overlooks some important features within the results. Rupp (1980) remarks that:

If a non-linear relationship existed in...studies where the data analysis was based on a linear relationship, some developmental trends may not have been discovered. (p.58)

Harshman & Krashen (1972) have presented a new statistical analysis for the dichotic listening test which takes into account changes in accuracy across time; they consider this necessary to gain a correct reflection of performance in this test. Galloway (1981) presents a very revealing graph (reproduced in Figure 4:III), constructed from her own results. She plotted REA scores for her Spanish-English bilinguals cumulatively, thus showing the relative REA patterns for the first 7, first 14, first 21 etc. subjects tested. It can be seen that the re-

lative REA across all subjects (n=39) is not reflected at those points.

In other words:

If, for example, only 7 or 14 subjects had been tested, Figure [4: III] suggests that the L1 would have seemed more left lateralized than the L2, in support of the stage hypothesis. On the other hand, group means from 21 to 28 suggest the opposite. (p.169)

Clearly, it is not enough to take this as a warning against small samples, for it is impossible to predict what the group means would have been if the sample size had been 50 or 60.

RIGHT EAR
ADVANTAGE

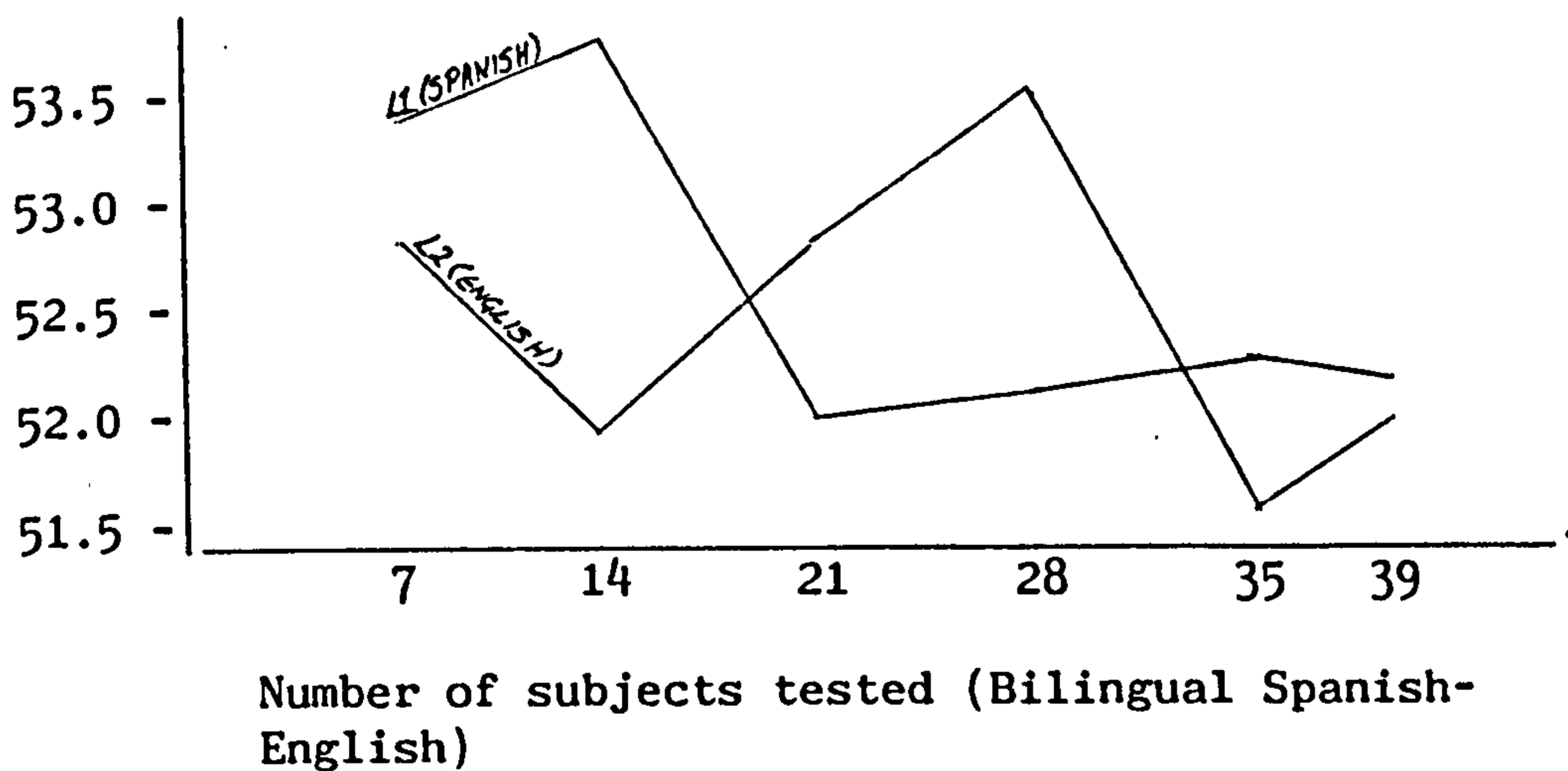


FIGURE 4:III (from Galloway 1981:160)

Finally, some studies may not have provided stimuli which actually tested what they claimed to test. Rupp (1980) says of his own experiment:

The task may be an artificial use of language. While the results of such research give us an indication of how language may be processed, it may be very different in normal discourse and conversation. (p.56)

Galloway (1981) admits this to be a potential shortcoming in her experiment too, where she used only single words, hardly a good way of testing holistic language processing (p.61). Of Genesee et al's (1978) experiment she is equally cautious:

Bilingual subjects...were required to press one button if they had

seen a French word and another button if they had seen an English word. One could question to what extent bilingual language competence is used to perform this task since a monolingual could also perform it easily. (p.154f)

4:4.2.2 ADDITIONS TO CURRENT THEORIES

Other explanations of results include the suggestion that patterns may vary according to the language under examination, the specific task demanded from the subject or the nature of the stimulus used. In addition, there may be influential differences between individual subjects.

4:4.2.2.1 LANGUAGE-SPECIFIC FACTORS

With regard to language-specific variation, Rupp (1980) found a greater REA for L2 English than for L1 Vietnamese. The reason for wondering if this is language-specific as opposed to an indication of differences between L1 and L2 in general is that he also found that the REA scores increased with age for the Vietnamese but not for the English language (p.54).

Kotik (1984) also found differences between REAs in Vietnamese and, in her case, Spanish mother tongue speakers, when both groups were learning L2 Russian. Only the Spanish group displayed a right hemisphere rôle in the initial stages of L2 acquisition (p.235). One feature of Vietnamese which has been associated with differences in lateralisation is the rôle of tone in lexical distinction. Vaid & Genesee (1983) mention work which has indicated that native speakers of tone languages and of non-tone languages process tone differently in a linguistic context (REA for Vietnamese speakers but not for English speakers: Van Lancker & Fromkin 1973, cited in Vaid & Genesee 1983:434). Whether the presence of tone might, conversely, shift language process-

ing into a more ambilateral mode, however, is a different matter.

Tsunoda's (1975) work has led him to claim that Japanese mother tongue speakers process vowels in the left hemisphere, while speakers of European languages process them in the right hemisphere (see also Vaid & Genesee 1983:433). If this is so, then dichotic listening tests might be expected to display language specific differences.

Apparent language specific differences have also been found between Hebrew and English and Yiddish and English (e.g. Gaziel et al 1978). This language specific difference is considered to relate to a greater rôle in input processing (even auditory) where the script is read from right to left (Vaid & Genesee 1980:433).

Silverberg et al's (1979) experiment on Israeli children learning English as L2 also invoked script as a factor determining differences in apparent laterality patterns. All their subjects displayed an RVFA for Hebrew words, but for English words only the most proficient group (six years of tuition) showed one, and then not to the same extent as in L1. The groups who had had only two or four years of tuition in English displayed an LVFA for English words (p.186). Clearly, this is not compatible with the predictions made in connection with the script direction (see above). They suggest that the unfamiliarity of the Roman script may require an increased level of pattern recognition (right hemisphere) for English, and indeed,:

It may be that the verbal nature of the written letters was obscured by their less familiar appearance, demanding a greater pattern recognition process relative to the linguistic one. (p.188)

4:4.2.2.2 TASK-RELATED FACTORS

Hemispheric differences are also determined by the particular linguistic requirements of a given task. (Vaid 1984:176)

Kotik's (1981) experiments (see Vaid 1984 for an account of these) have suggested that the left hemisphere's superiority is most marked in semantic judgements (deciding whether a noun is animate or not; but see Vaid's findings described below), and phonetic and syntactic (parts of speech) comparisons. Gaziel et al's (1978) experiment shows that phoneme discrimination appears to be "primarily a left hemisphere task" (p.197) even though "parts of the two languages [Hebrew & English], may be handled in the right hemisphere" (p.197). The right hemisphere was faster at responding in language recognition tasks in Kotik's (1981) experiment (Vaid 1984:177) and in Vaid's own work:

a significant LVF superiority was found for orthographically based judgements...[but]...no significant visual field differences...for semantic comparisons (Vaid 1983:330).

Work by Vaid using a tachistoscopic test combined with auditory presentation revealed that early bilinguals behaved like monolinguals and differently to late bilinguals in the discrimination of rhyming and semantically related pairs (e.g. NOSE-ROSE vs. NOSE-LEGS). Discriminating synonymous and non-synonymous pairs (e.g. OBLIGATION-DUTY vs. OBLIGATION-TRADE) it was the late bilinguals whose behaviour matched that of the monolinguals. No difference was found between the three groups in the discrimination of rhyming and non-rhyming pairs (e.g. LINT-MINT vs LINT-PINT) (Vaid 1984:190).

Vaid & Genesee (1980; also Vaid 1983) suggest that the LVF preferences found in some non-proficient L2 learners may reflect right hemisphere participation which is limited to reading skills, thus rendering Silverberg et al's (1979) results task specific.

Finally, Obler (1984) draws a distinction between tasks involving perception and those involving production. In the latter, bilinguals

adopt strategies which maximise the differences between the two languages, presenting:

a relatively dual system...[which]...serves to optimally differentiate a distinctive feature dichotomy. (p.207)

Conversely, in the perception task administered by Opler:

the bilinguals present a relatively unified system...[which]...serves to extend flexibility of interpretation. (p.207)

Thus she identifies an adoption by the bilinguals of different strategies for the task, involving:

a system that analyzes and exaggerates differences between the two languages...[and which]...coincides with that of neither monolingual group [but rather] incorporates the extremes from analogous structures in a way that permits the bilingual to pass as a native speaker of each language with greatest functional ease. (p.206-7)

Task accomplishment and general linguistic strategy differences between monolinguals and bilinguals of different types will be discussed below.

Another task-related factor is the influence of the overall difficulty of the experiment. Authors, however, disagree about the direction of this influence. Hardyck (1980, cited in Vaid 1983) interpreted his finding of greater right hemisphere activity in non-proficient bilinguals' L2 (E.E.G. measurements) as indicative of "right hemisphere superiority in tasks requiring perceptual effort" (Vaid 1983:326). Vaid also cites the work of Bentin (1981) as supportive of the notion that:

the right hemisphere is involved when information, whether in the first or second language, is perceptually taxing. (p.327)

Rupp (1980), however, considers his results (greater REA in the more difficult task) to indicate the opposite:

When subjects heard only two stimuli at a time, there was less information to process and store before responding, so that it could be done in a holistic, automatic manner. When the task became more complex, involving more memory storage and analytical processing, the automaticity disappeared and was reflected in the major hemisphere processing. (p.59f)

4:4.2.2.3 INDIVIDUAL VARIATION

The relevance of individual variation in a group is rarely considered important, even though it could lead to results unrepresentative of (what is considered to be) the normal population. Hamers & Lambert (1977), however, do note that to find three out of 15 subjects displaying LVF preference in a task predicted to produce an RVF preference (and doing so in the remaining 12 subjects) casts some doubt on their sample: they quote estimates of 6% (Benton 1965) and 4% (Milner 1973) for the proportion of right-handers expected not to show left cerebral dominance for language, against which their figure "appears very high" (p.61). The same phenomenon invites caution in the interpretation of Gordon's (1980) findings. 20-30% of his right-handed subjects had reversed dominance (p.267).

4:5 THEORIES IN POLYGLOT APHASIA

The study of polyglot¹⁰ aphasia largely centres on two major issues. The first involves a comparison of the incidence of aphasia in monolinguals and polyglots after lesions localised to different parts of the brain and addresses the hypothesis that:

if the right hemisphere were somehow more involved in language in the brain of the bilingual or second language performer, one would expect to find a higher incidence of aphasia due to right-sided lesions in bilinguals as opposed to monolinguals. (Galloway & Kra-shen 1980:75)

10. See Notes on Terminology for details of the use of this term.

The second issue in polyglot aphasic studies is language dissociation, that is, differential recovery in the two (or more) languages. Exploration of this phenomenon is given first.

4:5.1 LANGUAGE DISSOCIATION

It sometimes happens that an individual who has known more than one language experiences more aphasic symptoms in one than the other, either by virtue of one being initially less affected than the other, or one recovering to a greater extent than the other. Parallel affliction and recovery has been viewed by some as an indication of storage of both languages in the same place while dissociation indicates separate storage, either within the left hemisphere (e.g. Scoresby-Jackson 1867) or in different hemispheres (e.g. Galloway 1978,1981).

L'Hermitte et al's (1966) cases all corresponded to a pattern of parallel loss and recovery, which leads him to say:

According to an examination given in only one language it is possible to predict the type of disorganization in the other languages. (L'Hermitte et al 1966:742-3)

This statement is paramount to a claim that dissociation does not exist at all; otherwise it is a truism, for it will not be possible to decide if a given patient has parallel or dissociative aphasia except by observing the state of the languages. Their prediction can, therefore, only be post hoc. The existence of dissociation as a phenomenon is strongly affirmed by others (e.g. Chernigovskaya et al 1983:195).

Freud (1891) believed only one type of differential loss and recovery of languages to be possible, viz. L2 more retarded than L1. In his opinion, all acquired linguistic abilities, including literacy skills, shorthand and second languages, were localised to the same

place as L1. This contrasts with Scoresby-Jackson (1867) who saw each skill as occupying a new section of cortex in the third temporal convolution (p.704). Thus L2 could be lost and L1 remain, but not vice versa:

It never happens that an organic lesion causes an impairment affecting the mother tongue and not a later acquired language. If in the case of a German who understands French the word sounds of the latter language had a different localization from the German word sounds, it ought to happen occasionally that following a cerebral softening such a patient would cease to understand German while still understanding French. In fact, the opposite is invariably the case, and this applies to all functions of speech.(p.24)

Some subsequently reported evidence appears to indicate that L1 can in fact suffer heavier loss than L2. For example, Bychowski (1919, cited in Galloway 1981:30f) had a patient who recovered productional ability in Russian (learnt in adulthood by formal methods) before Polish (his mother tongue). His German (informally acquired) never recovered. According to Galloway,

Bychowski suggests that the two most fluent languages, Polish (L1) and German (L2) were entrenched in the left hemisphere and therefore most impaired by damage to the left hemisphere and that the right hemisphere was used to process L2. (p.29)

It may, however, be relevant that the patient recovered in a Russian hospital.

It is cases of this type that make Pitres' rule more convincing than Ribot's rule for many writers (both rules are described below). What is open to question is whether language dissociation is attributable to separate storage. Lambert & Fillenbaum (1959) believe it is:

aphasia would be likely to affect all languages of the compound bilingual, but should lead to more selective disturbances for coordinate bilinguals. (p.626)

If different storage or processing areas are invoked for each language, this might relate to whether the script is ideographic or alpha-

betic (Vaid & Genesee 1980:420). Vaid (1983) identifies the likely areas of localisation as the parieto-occipital (visual) areas for the former and the temporal (auditory) area for the latter (p.320). Evidence from studies of *deep dyslexia* in Japanese patients supports the hypothesis that a syllabic script and a logographic script can be differentially affected (see Coltheart, Patterson & Marshall 1980).

Any explanation of language dissociation invoking language-specific factors make predictions which need to be investigated. It has been suggested that a polyglot loses the ability to read in one language and not the other because reading is operated from a different area in each, either on account of the type of script each uses or the relative closeness of phonemic-graphemic correspondence in each language. For example, Luria had a patient who could write Russian but not French after an inferior parietal lesion disrupting the "visual analysis and synthesis" required for his "non-phonemically" written French (L'Hermitte et al 1966:730)). If the location of graphemic representations is language specific in this way, then the reading abilities of monolingual patients ought also to be differently affected after damage to a given area, according to the specific characteristics of their L1. Nevertheless, L'Hermitte et al (1966) believe that language specific factors have only limited explanatory power:

independently of each particular linguistic system there exists a specific character in the disorganization of language [*per se*].
(p.735)

The association of parallel aphasia with a common storage for L1 and L2, and of dissociation with separate storage is a little problematic. For judgements to be reliably made on the basis of loss and recovery patterns, there may not really be any extraneous influences on

those patterns. Thus, while affective factors, for example, cannot be proved to account for all the characteristics of differential or parallel recovery, it is a different matter entirely to discount their influence altogether. So, if it were to be the case that affective factors prevented the entirely parallel recovery of languages with common storage and processing mechanisms, the resultant pattern would be judged as differential, implying separate storage.

As a major concern in polyglot aphasia is the relative accessibility of the two languages, attention must also be given to the patient's ability to translate. Obler (1984) cites cases reported by Paradis, Goldblum & Abidi (1982) where patients could access their L2 only via translation strategies from L1 (p.198). Poetzl (1925) even believed that the translation function could be traced to a specific part of the left hemisphere, the inferior parietal region. It was damage to this area that led to a preference for one language over the other in aphasia. L'Hermitte et al (1966) do not believe there to be any anatomical support for this claim (p.730).

Vaid & Genesee (1980:418) have suggested that a false impression may prevail regarding the frequency with which dissociation as opposed to parallel loss and recovery occurs. This is because only the most interesting cases tend to be reported in the literature. The exact purpose of a study seems to be a salient consideration: they contrast the high percentage occurrence claimed by Albert & Obler (1978): 58%, and by Paradis: 45%, with the much lower figures found in unselected samples, e.g. Charlton (1964): 22%, L'Hermitte et al (1966): 0%, and Nair & Virmani (1973): 6% (Vaid & Genesee 1980:419). Genesee (1982) observes that selective studies are more likely to find evidence of se-

parate processing areas for each language than are unselected ones (p.315f; see also Obler 1984:195, Charlton 1964:307;310).

Affective factors have been discussed so far only in relation to the ease of acquiring a second language (section 4:3.2.5). When it comes to the recovery of the second or first language after aphasia, they may be entirely responsible for non-parallel patterns, or at least have some influence. The kind of affective factors which might influence recovery are (a) the association of a language with unhappy experiences, e.g. a difficult childhood, wartime traumas (cf. Galloway 1981: 32), an unsuccessful relationship etc., or (b) with positive emotions, e.g. a case reported by Bychowski (1919), where the language recovered first was the one spoken by the nursing staff, which was neither his L1 nor the language of his speech therapy; (c) the need to recover one language more than the rest: Vaid & Genesee (1980) refer to a case described by Halpern (1949) where a patient recovered the language he needed to finish a scholarly treatise he was writing.

4:5.2 TWO RULES FOR RECOVERY

Ribot's and Pitres' rules form a central focus in much of the discussion of language dissociation in polyglot aphasia. They make certain predictions about the order of recovery of languages and much effort has been put into the formulation of plausible accounts for exceptions to Pitres' rule in particular. By virtue of their not invoking affective factors as they address dissociation, neither Ribot nor Pitres can accommodate the possibility of compound storage (Minkowsky 1928, cited in Charlton 1964:307).

4:5.2.1 RIBOT'S RULE

Ribot's rule dates from 1881 and was not intended to be specific to linguistic restitution after polyglot aphasia. It states the following:

the new dies earlier than the old. (Chernigovskaya et al 1983:195)

in cases of overall loss of memory, the loss occurs following a pattern of starting with the most recent requisitions and spreading to the oldest ones. (Veyrac 1931:333)

Pick (1921) associated adherence to Ribot's rule with the first language being the most *automized* (p.162), but believed that the return of lucidity to a patient could enable the operation of volition, so that some other language could be preferentially nurtured if required (p.157f). Pitres (1895) cited a substantial number of cases which require some explanation other than Ribot's rule and which form the basis for his own rule (see below). These mostly concern the failure of the mother tongue to recover to the same extent as some second language which had been much more frequently used by the patient before the injury.

Such exceptions to Ribot's rule appear to relate to speech recovery only, with comprehension in the mother tongue remaining possible (Pick 1921:157).

Not least problematic in the evaluation of Ribot's rule is the paucity of cases suitable to test it. As Vaid & Genesee (1980) point out, in almost every polyglot the oldest language (L1) is also the best known and the most useful and valuable to him (p.421).

4:5.2.2 PITRES' RULE

The most familiar language reappears first because it is the one that uses the most solidly fixed associations. The patient understands this language when it is spoken before he is able to speak

it because the verbal hearing centre has the earliest and closest links to the language function. (Pitres 1895:47)

Pitres believed the total aphasia often observed immediately after a trauma to be a type of verbal amnesia, temporary in nature. He cited a case where a language could be restituted under hypnosis (p.49,fn.8). Only by invoking a shock-induced "general functional interia" which "shatter[s] but do[es] not destroy the cortical language centres" (p.46f) could one account for the gradual restitution of linguistic functions. Thus his more detailed accounts of patterns of recovery hinge on the disinhibiting of functions previously bound by this *inertia*. He specifies the following steps:

- 1) Total loss of the ability to understand and speak any of the languages.
- 2) Gradual return of the ability to understand the most familiar language.
- 3) Return of the ability to speak this language.
- 4) Return of the ability to understand the other language or languages known to the patient.
- 5) Return of the ability to speak this or these languages. (p.35).

Pitres reported that even when patients were unable to understand the words, they were able to identify which language was being spoken (p.43).

Table A4:vi (Appendix) presents details of some of the cases referred to by Pitres (1895); those omitted are the ones where the mother tongue is not identifiable. It can be seen that it is mostly, but not always, the mother tongue which recovers best; this is predicted by Pitres' rule, so long as in those cases where a second language fares better than L1 it can be genuinely considered the most used language. It is hard to ascertain this from the minimal details given by Pitres, but in at least one case (Proust's) recovery was most successful in the language spoken in the patient's long term place of residence. Pitres

indeed names five of the cases reported (Proust, Trousseau, Grasset, Bernard and Pitres (Case I)), as examples of the most used (non-mother tongue) being the best restored (p.34f).

The heptalingual patient reported by Galloway (1978) also adheres to Pitres' pattern. The linguistic history of this patient, M.B., is particularly interesting. Born in 1926 as a Hungarian Jew, he learnt Hungarian as his mother tongue. From age 4-6 he was resident in Poland, becoming fluent in Polish and losing his Hungarian. After again living in Hungary from age 6 to 10, from 10-12 he lived in Rumania in a multilingual environment of Rumanian, Hungarian, Yiddish and German. He spent the years from 12-17 in Hungary, speaking Hungarian and receiving formal tuition in English and German. In addition, between the ages of 3 and 17 he received regular instruction in biblical Hebrew. At 18 he was sent to an Austrian concentration camp for a year, where he spoke German. Then he spent six years in Germany obtaining a university degree, during which time he received some formal instruction in German. From 25 till the time of the CVA (at age 47) he lived in the United States where he acquired English via newspapers and radio, through his work and social interaction. He was married to a Hungarian but spoke English with her. He occasionally used German and Yiddish, rarely Hebrew.

The particularly rich linguistic experience of this individual makes him unrepresentative of the population at large, but a good test case for theories of polyglot storage. However, caution is required in any generalisation even within this context, by virtue of his being left-handed or ambidextrous.

At the age of 47 he suffered a massive left-sided cardio-vascular

accident, leaving him with a "large cystic space in the left parietal lobe" (p.141). His "severe expressive aphasia with some receptive disturbances" (p.141) left him with the following features of linguistic dissociation. In production his English was:

fluent, syntactically complex and marked with some word substitutions and word finding difficulties. (p.141)

The other six languages were "limited to the occasional recall of isolated words" (p.141). With regard to comprehension, he had no apparent problems with English or German (though replies were in English); he said he could understand Hungarian and Yiddish but not Hebrew, Rumanian or Polish. Experiments revealed some comprehension in these last three, but the relative levels of ability were fairly well in line with his own assessment.

Galloway evaluates the details of this case as largely in line with Pitres' rule; slight departures from the predictions of the rule are explained in terms of the nature and longevity of contact the patient had with one language (Yiddish) versus the method of acquisition and lack of interactional experience he had in another (Hebrew) (Galloway 1978:143f). This case is re-explored in chapter 5:5.3.

Despite its substantial explanatory advantages over Ribot's rule, Pitres' rule also has its limitations. Both affective and sociolinguistic factors related to usage remain outside of its domain of prediction. It may be expected that an individual with fluency in more than one language does not use the languages interchangeably but rather employs a specific language in a specific social environment, e.g. with particular interlocutors. If the whole range of linguistic environments is not available after the onset of aphasia, then the recovery of

languages no longer appropriate for day to day usage may be retarded (see Veyrac 1931:334).

For some, Pitres' rule has simply not proved valid in the cases they report (e.g. L'Hermitte et al 1966:742). Lambert & Fillenbaum (1959, cited in L'Hermitte et al 1966) produced evidence which suggested that Pitres' rule did not apply to compound bilinguals. This concurs with Chernigovskaya et al's (1983) own reservations (p.196). Lambert & Fillenbaum's work involved the comparison of French-Canadian and European bilinguals. Of this study's results L'Hermitte et al say:

among European aphasics the recovered language is not necessarily the first learned language, nor is it the most practised language before insult. On the contrary, in Montreal aphasics, Pitres' rule was found most often valid. The affective factors which according to Minkowsky (1963) often come into play during recovery only occurred in exceptional circumstances in Montreal aphasics. (p.729)

Lambert & Fillenbaum attributed this to early acquisition and compound storage in the Montrealers as opposed to late acquisition and coordinate storage in the Europeans. Furthermore, their motivation for recovery was different: a European expatriot has a greater communicative need for L2, which ought to speed its recovery. The Montrealer can survive more easily without L2 because of the widespread bilingualism around him (L'Hermitte et al 1966:729).

4:5.3 OTHER PERTINENT FACTORS & COMMENTS

A number of other observations need mentioning within the context of the present discussion. Firstly, it is easy to gain too simplistic a picture of the clarity of compatibility between patients. It must often be the case that the diagnosis is open to question and is reviewed in the light of subsequent developments. Furthermore, a patient may

not be known to be a polyglot; another may choose not to use a language in which he is still able to communicate (e.g. section 4:2.2.1, point c).

A second point to be borne in mind relates to the methodology behind the data collection. Galloway (1981) points out that tests are far from uniform and reports are often composed from evidence which is "anecdotal, impressionistic, scantily documented and not infrequently based on hearsay" (p.36). Vaid & Genesee (1980) agree that there is a need for standardised tests and longitudinal studies (p.419). Furthermore:

there is almost always no unique explanation for linguistic deficits in any of the polyglot aphasia cases. Degrees of impairment and patterns of recovery may be due to several factors (e.g. age of acquisition, frequency of use pre-morbidly, fluency, social and affective value of the languages, literacy, different orthographies, language of recovery environment, the language rehabilitated in speech therapy, function of the language, lateralization, structural similarities between languages, dead languages vs. vernaculars etc. (p.36)

Other factors possibly determining recovery patterns are the handedness and sex of the patients (see section 4:1.2.4.3), all too often not even mentioned in the case studies. Vaid & Genesee (1980) suggest that a water-tight analysis of polyglot aphasia after right hemisphere, to give one example, should work from a knowledge of the frequency of right hemisphere damage initiated aphasia in monolinguals, and systematically rule out possible alternative explanations to that right hemisphere processed L2. Such alternatives might be unreported early damage to the left hemisphere causing a shift of function to the right hemisphere in that individual, or the onset of right hemisphere processing after the lesion (p.422).

Observations of polyglot aphasia may have a wider range of rele-

vance too, than just the domain of L2 storage. They may indicate potential chronic symptoms present but undetected in monolinguals. As already noted elsewhere, one of Veyrac's (1931) patients recovered L1 completely but not L2, such that:

if she had never spoken any other language but French, it could have been concluded that the aphasia had completely regressed.
(p.326)

CHAPTER FIVE

DISCUSSION OF THE CLAIMS AND PREDICTIONS OF THE FOCUSING HYPOTHESIS AND ITS EVALUATION IN TERMS OF OTHERS' FINDINGS

5:1 EMPIRICAL & NON-EMPIRICAL SUPPORT FOR COMPONENTS OF THE FOCUSING HYPOTHESIS

5:1.1 INTRODUCTION

As chapter 3 has illustrated, the backdrop against which the Focusing Hypothesis argues for a central right hemisphere rôle in language processing is one of firm adherence, even in the face of some inconsistencies in the evidence (chapter 4), to the principle that language is a left hemisphere lateralised function. Furthermore, various individual components of the Focusing Hypothesis are separately challenged. For example, the notion of clausal level decoding faces assertions such as the following:

during a clause, listeners accumulate information and hypotheses concerning its potential underlying structure(s): the end of the clause is the point at which a particular complete underlying structure is determined. (Bever, Garrett & Hurtig 1973:278, referring to work by Abrams & Bever 1969)

The justification for clausal processing and its relationship to the *clausal processing hypothesis* is examined in section 5:1.6 below.

But it is also possible to draw much support for the Focusing Hypothesis by noting that many of the features of language processing which it combines into one account have been observed or proposed by others.

5:1.2 DUAL SYSTEMS

A number of writers have envisaged a duality in linguistic processing. Wundt's (1897) account is briefly described in section 5:1.6 below. MacKay (1973) proposes that a short term memory (M1) deals with

all input but that, in addition, a long term memory (M2) operates specifically on attended input. Thus he suggests, and substantiates experimentally, that:

The fact that subjects are not fully aware of or cannot recall the signal to the unattended ear is not evidence that the signal was not processed. (p.30)¹

A processing account provided by Shiffrin & Schneider (1977, described by Tanenhaus, Leiman & Seidenberg 1979) also shares some characteristics of the Focusing Hypothesis' dual systems model. They envisage two levels of processing, referred to as *veiled* and *conscious*. Veiled processes:

are opaque to conscious introspection, faster than conscious controlled processes, and make fewer demands on limited processing resources. (Tanenhaus et al 1979:436)

In both these accounts, then, we are offered an unattended, economical processor able to at least scan input material (see section 5:1.6 for a parallel account from the Focusing Hypothesis), but not equipped to find 'deep structure' relationships between items or structures (MacKay 1973:36).

Nor is this support for dual systems limited to abstract accounts of processing models. The characteristics of the two hemispheres are considered to underlie not only different approaches to tasks (Levy, Trevarthen & Sperry 1972, cited in Ten Houten 1982) but also to be the basis of an antagonism which, during the evolutionary history of *homo loquens*, may have instigated the necessity for an 'armed truce' between the hemispheres, with a sharing of functions and, consequently, lateralisation (Levy 1969). This idea is intimately associated with the notion of optimal processing strategies which are preferred because they

1. For a report of MacKay's experiments see section 5:2 below.

are economical but which are also subject to deposition because they are not programmed in as the only way of operating. The separate and distinctive approaches of each hemisphere to tasks have been investigated by Calderon (1976, cited in Hécaen & Albert 1978). She played verbal material into one ear and musical material into the other in a dichotic listening test. Her conclusion was that:

the two hemispheres may independently process the components of complex stimuli, selecting that component for which each is dominant. (Hécaen & Albert 1978:413).

The example of Calderon's (1976) work above is an exception to the general corollary of the Focusing Hypothesis, that dichotic listening tests are not a suitable means of observing optimal processing strategies (see 5:2 below), because she did not use exclusively verbal stimuli in the test. In section 5:2 it is suggested that the only way to find out how normal processing works is to observe precisely that, and not performance in some artificial test situation. If such observation is possible, it is predicted to yield indications of differences between the strategies operating in proposition- and language-focused language. This appears to be precisely what Van Lancker (1972) reports, with respect to hesitation phenomena, which, she says:

indicate quite different processing for newly created, propositional use of language as compared with overlearned, read and repeated speech. (p.23)

There is no conflict between this observation and the proposal made in Chapter 2:2.3.3 that some *automatic language* is processed in precisely the same way as proposition-focused language, because, when it comes to hesitation, it is clear that both the cause of it and the relief of it will be quite differently motivated for the two kinds of production: in novel language is it the proposition, not the form which must be

consistent to some internal model, while in overlearned, read and repeated speech, the form is set².

5:1.3 OPTIMAL PROCESSING

Optimal processing has been defined (chapter 1) as the most economical use of resources to achieve the desired result. This presupposes that conscious analysis, i.e. attention, makes more demands upon those resources than holistic processing does. Kintsch & Van Dijk (1978) say something rather similar:

Resources seem to be required only as attention, consciousness, decisions and memory become involved; it is here that the well-known capacity limitations of the human system seem to be localised rather than in the actual processing. (p.364)

They use this principle as a basis for their own processing model. Guyton (1981) links the notion of a finite capacity for attention to the reinforcement, during development, of the more advanced (left hemisphere) areas by directing the attentional processes into the best developed regions, all of which increases the asymmetry (p.196).

The Focusing Hypothesis proposes that the strategies most appropriate to L1 acquisition (unconscious analysis with formula construction and application), while remaining part of the strategy option range, do not offer the most economical (optimal) processing route in adulthood except where new items are encountered or the input is partially masked

2. Many solo singers have remarked that the potential for a 'hesitation phenomenon' associated with performing music from memory is such that it can become impossible to remove one's attention from the level of form (i.e. "What is the next word/phrase?"). In order to relieve this 'focus', which can seriously interfere with attention to the interpretation of the song and the communication of ideas to the audience, some prefer, where possible, to perform with the score in front of them.

by extraneous noise (see chapter 1:8). Rather, a holistic decoding up to clausal level, employing the recognition of formulae rather than the operation of a rule, is more economical. Vennemann (1974) also suggests that, with regard to morphophonology at any rate, their decoding and encoding may not be generative in nature, except "when new words are adapted, constructed and analysed" (p.346). However, Vennemann does not believe that syntax also operates non-generatively.

5:1.4 HOLISTIC PROCESSING

Mitchell & Holmes (1985) review a number of studies which have supported a non-generative approach to linguistic processing. Fodor et al's (1974) lexical analysis model suggests that:

readers and listeners use the properties of individual words to help them make decisions about the structure. (Mitchell & Holmes 1985:543)

In 'lexical analysis' of this kind, the verb is considered to play the central rôle, because it specifies a finite number of possible structures (or, as the Focusing Hypothesis would say, formulae). This leads easily to the proposal (see chapter 1:1.3) that a formula might be a skeleton in which the verb is lexicalised, the function words (a closed class) are specified and the other slots are filled from a paradigm of content words. Others whom Mitchell & Holmes (1985) cite in relation to 'lexical analysis' are Ford, Bresnan & Kaplan (1982) and Riesbeck & Schank (1978). The latter have proposed that:

parsing consists largely of executing routines that are recovered from the dictionary. (Mitchell & Holmes 1985:544)

5:1.5 STRATEGIES

Most support of all for the approach taken in the Focusing Hypothe-

sis is found in respect of the notion of strategies, which determine the amount of each type of processing to be used for accomplishing the task.

The amount of effort a subject makes and the extent to which his strategy is specifically verbal, will determine how much the left hemisphere is activated, as compared to the right, and thus the degree of any asymmetry in processing ability. The relative activation of the two hemispheres will vary with task difficulty, motivation, cognitive strategy, and more conscious attentional shift to compensate for known or inferred shortcomings in processing one of the inputs. (Kinsbourne & Hiscock 1977:182)

Individual variation in strategy preferences or options is associated with cognitive development (Bryden & Allard 1976, cited in O'Leary 1982:61) and class, sex and culture (Kinsbourne & Hiscock 1977:182f) not because of some intrinsic differences in brain organisation but because of differences in experience, such as familiarity and confidence in dealing with the sounds or letters used as stimuli (Bryden & Allard 1976) and the effects this may have on strategy preferences. With reference to Geffner & Hochberg's (1971) failure to find an REA for dichotically presented verbal material in children of a low socio-economic status, Kinsbourne & Hiscock (1977) suggest that such a child:

might not be adopting a verbal strategy or any strategy at all when the experimenter shoves earphones over his head. (p.182)

Code (1983) and Heny (1985) both note how easy it is to deliberately or unintentionally prime subjects into a specific strategy for a task by what they are given to do first. Heny considers this to cast serious doubt on the reliability of many experiments (p.170). Code, addressing the treatment of Wernicke's aphasia, is acknowledging the fact that apparent improvements in performance on standard psycholinguistic tests administered as a type of therapy for the express purpose

of training the patient into new strategies for dealing with language, may not reveal anything other than an increasing familiarity with the test procedures themselves (p.58). Further support for the effect of strategy selection, as determined by precisely what is demanded of the individual, comes from Gazzaniga (1977):

slight variations in the design of classic experiments change the previous unequivocal notions concerning the unique organization of the human brain and show how dubious interpretations can be perpetuated in the literature. (p.421)

Similarly, Brown (1983) considers that:

it is not the material but the operation applied to this material which determines laterality. (p.49)

5:1.6 CLAUSAL PROCESSING: CHALLENGE AND SUPPORT

As will become clear in section 5:2 below, psycholinguistic experiments which provide evidence of clausal processing are not necessarily compatible with the Focusing Hypothesis. While the Focusing Hypothesis abstains from detailed comment on the internal workings of the analytic system which may, or may not, include the mechanisms required to set up (in some people, if needed) a clausal decoding procedure, it certainly does not predict systematic access in experimental conditions to the holistic clausal processing mechanisms. The strongest case in support of the Focusing Hypothesis would be to find that clausal processing appeared to be operating when normal communicational language was informally examined, but that closer, controlled testing failed to observe it in any consistent way.

However, some experimental evidence, e.g. Mackay (1966), Bever et al (1973) has indicated that even in test conditions the clause can be the pivot about which processing operates (see Garnham 1985:184ff and

Bever et al 1973:277 for reviews). Bever et al's (1973) findings are discussed in the context of ambiguity in section 5:2.4 below. In addition, Garnham (1985) raises the following point, which challenges the non-experimental aspect of the account given by the Focusing Hypothesis:

Many people would claim that introspective evidence refutes the idea that syntactic and semantic processing are delayed to clause boundaries. In neither reading nor listening does it seem that understanding comes only at the end of clauses.... However, introspection is an unreliable source of information about language processing and, as noted above, the feeling of comprehension in the middle of the clause may simply come from the recognition of familiar words. (p.185)

Garnham is right, in one sense, to say that introspection is unreliable, because it cannot be subjected to the same rigorous control as experimental testing. If, however, the act of testing itself alters the operations under investigation, so that controlled observation is monitoring something quite different, then introspection and informal observation will be a crucial part of the quest for a full picture of the language mechanisms (and techniques can be developed to access this, as Conversation Analysis shows³).

Garnham's point about thinking you understand something because you recognise the words is important here. It raises the question: what is *comprehension*? The Focusing Hypothesis has differentiated stages in decoding, beginning with the *scanning* of input to check that only items and structures within the capabilities of the holistic system are present (see chapter 1:2). But it has presented comprehension as the successful evaluation of a proposition in relation to other propositions, i.e. it is the result of juxtaposition. This, then, is very different

3. See Levinson (1983) chapter 6 for an examination of the Conversation Analysis approach to linguistic study.

to the earlier stages of semantic decoding. It could, of course, be argued that comprehension occurs when, say, the idea is produced by the holistic mechanisms, rather than only when that idea is evaluated. The stance taken by the Focusing Hypothesis rests on the assumption that there is something qualitatively different about seeing the significance of a proposition and simply decoding a message. This is forcibly borne out in the symptoms of right hemisphere damage (see section 5:3.2). In other words, it sees comprehension as an active, conscious achievement. The questions which arise from this are tantalising⁴. What does it make of that stage where semantic decoding has taken place but the propositions have not been (and perhaps will not be) evaluated? This may occur in many psycholinguistic tests (see section 5:2) and, as already mentioned, it appears to characterise some localised right hemisphere damage (see discussion in section 5:3.2). This would be a stage at which 'comprehension' questions could be successfully answered (e.g. "*Was it a man who ate the hamburger?*") because these require only recourse to the structure and content of the single sentence ("*No, it was a dog that ate the hamburger.*"). But questions requiring opinion, or the relating of one sentence to others, for a contextual assessment, would only be possible after propositional evaluation had been completed. Thus it might be that in the routine reading of continuous prose that was not particularly interesting, full semantic decoding took place, but the propositions were not evaluated. Such reading would be characterised by having no retention of the propositional content of

4. Indeed, in the context of the Focusing Hypothesis, literally so! (Tantalus was cast into a pool of water, which receded from him whenever he tried to drink. The fruit tree above him moved out of his reach whenever he tried to grasp the fruit).

the text and, in the case of reaching a sentence which was evaluated propositionally, probably having insufficient information to do so adequately without re-reading the previous text. In this case, the 'comprehension' that had occurred would be useless and would, as Garnham suggests, amount to little more than a recognition of the words and the syntactic structures, leading to an assurance that the text 'made sense' and, thereby, a feeling of having 'understood' it, even though only passively and inconsequentially. This *recognition of words and structures* is very much in keeping with the picture which the Focusing Hypothesis paints of the holistic part of language processing, beginning with *scanning*, and it draws the divide between decoding and comprehension in exactly the place at which attention is required for the successful completion of the comprehension process.

If the above account is valid, then psycholinguistic experiments which required attention to the language itself at some level would not result in comprehension in the sense of propositional evaluation. But that is self-evident, for most do not require it and so it would be a gratuitous exercise in any case. For further discussion of this, see section 5:2 below.

The division of 'comprehension' into the successful evaluation of propositions on the one hand and the recognition of words and structures on the other provides an explanation for the two conflicting sets of experimental findings regarding clausal processing (see Garnham 1985:184ff). This is because the Focusing Hypothesis' account, as expounded so far, neatly complies with the proposal that it is this *recognition* type of 'comprehension' which can be swapped between the two systems, but not the *evaluation* type. In other words, the holistic

system can and will recognise and prepare for evaluation items up to the clause level, but the analytic system may cut in at any point and take over, with the result that that level becomes the focus of attention. Now, in addition, as described above, we have the possibility of the analytic system never cutting in, not even at the propositional stage, such that only recognition comprehension occurs and propositional evaluation never does. In this case, the hearer/reader will know that what was decoded made sense, but will have no recollection of it or have drawn any conclusions about it which contribute to their picture of the world.

A similar two-level processing scenario to the one just discussed was proposed nearly a century ago by Wundt (1897). MacKay (1973) summarises Wundt's hypothesis as follows:

The first level of processing provides a preliminary analysis, a superficial or 'surface' description of phrases as they appear in the sentence. Attention plays no rôle in this preliminary or surface analysis, but is essential for the second level of analysis - the level producing perception of the relations among words and phrases in the sentences, relations such as 'subject' and 'object'. (p.22)

In the remainder of this chapter, an assessment of the Focusing Hypothesis will be made by examining the predictions it makes with regard to psycholinguistic experimentation, brain damage (left and right) and other types of hemispheric monitoring in monolinguals and polyglots.

5:2 PREDICTION: LANGUAGE FOCUS IN EXPERIMENTS

THE INTRINSIC NATURE OF EXPERIMENTAL CONDITIONS WILL INDUCE STRESS AND THIS WILL LEAD TO STRATEGY SELECTIONS DIFFERENT TO THOSE OPERATING IN NORMAL COMMUNICATION.

5:2.1 DISCUSSION

It is not intended to use the term *stress* in any technical sense,

but only to refer to alterations in the levels of self-monitoring, concentration and self-confidence which may be associated with a new and difficult task⁵. The level of stress, and indeed, the effect of that level of stress, will vary from experiment to experiment and from person to person. If strategy choice is determined by stress and its effects, then, insofar as different strategies involve the two hemispheres to different extents, patterns of ear and visual field advantage will fluctuate across, and even within, subjects, and from study to study.

The range of strategies available for a task will depend on:

1. The nature of the task
2. The nature of the stimulus
3. The test environment
4. The type of subject

Of these, it is (1) and (2) that establish the actual range of strategies appropriate for achieving the desired result. In the case of a metalinguistic task or a stimulus which cannot (or need not) be treated as a semantic unit, the holistic processing of information up to the focal level may be impossible or disadvantageous⁶. (3) and (4) will cross-sect (1) and (2) to delimit the strategy option range by making one point of it more attractive or more efficient than the rest.

5. I am grateful to Dr. Sidney Gottlieb for pointing out that it is legitimate to identify stress as a potential major determiner of strategy selection in psycholinguistic experiments. However, his suggestion that subjects could be screened for high anxiety levels would, even if practical, only serve to reduce the pool from which subjects were drawn even more. Furthermore, some might argue that those remaining in it would, by definition, be rather unrepresentative of the general population of university students!

6. For example, Mitchell & Holmes 1985: "...the segmentation procedure [of the task presentation] must have had some effect on the subject's overall approach to the task" (p.551)

5:2.1.1 THE NATURE OF THE TASK

Tyler & Marslen-Wilson (1977) issued the following instructions to subjects:

First, please continue each sentence fragment with an appropriate verb. You should only use verbs which have both singular and plural forms and you may use the same verb as often as you wish. Second, please rate each sentence fragment for its naturalness, using a scale of 1-5, where 1 is very natural and 5 is unnatural. (p.685)

This specifies the task as linguistic, encouraging attention to the language at a level lower than the proposition. In addition, the terminology is of a nature closely associated with grammatical analysis. The tone of the instructions is rather like that of an exam, where great concentration and detailed attention is required.

By instructing subjects to react as fast as possible to stimuli and measuring those reaction times (e.g. Tyler & Marslen-Wilson 1982) the exercise becomes one of precision, high stress and even implicitly competitive, because success and failure are determined by concentration and quick reactions.

5:2.1.2 THE NATURE OF THE STIMULUS

Instructions may inform subjects that propositional content evaluation is unnecessary even if it is possible. For example:

The subjects were told that they would be hearing some words on the earphones and that they would be hearing different words in each ear at the same time. They were asked to listen very carefully and during the pause of the tape, they were to repeat in any order everything they thought they had heard. (Rupp 1980:39)

In dichotic listening tests the stimuli are often single words, most often digits (e.g. Inglis & Sykes 1967, Kimura 1963; for a review of many such experiments see Bryden & Allard 1978:392ff), or else nonsense syllables (e.g. Studdert-Kennedy & Shankweiler 1969, Berlin,

Lowe-Bell et al 1973, Haggard & Parkinson 1971). Such stimuli, used in a simple discrimination task, have very little in common with the input which the Focusing Hypothesis associates with *proposition-focused* linguistic processing⁷.

Where continuous prose is used, this is still not for the purposes of eliciting propositional evaluations. For example, Tyler & Marslen-Wilson (1977), whose experimental instructions are quoted above, required the appropriate selection of an item suitable to complete a sentence fragment. This is still very much a metalinguistic task, despite the need for semantic decoding. Similarly, Tyler & Marslen-Wilson (1982) required subjects to recognise a prespecified target word when it was presented in a sentential (or anomalous or scrambled) context. MacKay (1973) required subjects to shadow the stimulus sentences and restricted his analysis to those cases where the shadowing latency was short.

Even Sachs (1974), whose experiment disclosed that, in continuous prose, semantic (propositional) information was more accurately retained than details of the original linguistic form, required subjects to pay attention to the stimulus material in preparation for a test (which may involve different strategies to those used for reading it/listening to it for the sake of sheer interest).

5:2.1.3 TEST ENVIRONMENT

7. Where some complication has been added to a dichotic presentation (e.g. white noise (Weiss & House 1973), variations in voice pitch (Darwin 1971) or speaker (Haggard 1971), all cited in Code 1987:27), REAs have been found for vowels, in contrast to standard d.l.t.s (see chapter 3:4.2). It seems plausible that the strategy selected for vowel perception might be different where intense concentration (focus) is required.

Measurements of hemispheric involvement and prowess in tasks require the use of equipment (e.g. headphones, tape recorder, timer, tachistoscope, response buttons or keys, computer display units and keyboards) and the establishment of controlled experimental conditions. These may contribute to a test 'set', quite different to the frame of mind in which linguistic interaction is approached. The stress levels induced by the test environment would presumably depend to a large extent on the individual subject's experience, attitude and vulnerability. Gur, Gur & Harris (1975) found that lateral eye movement was only predictable from the test stimuli when the subject was not facing the experimenter:

We suggest that, when E [Experimenter] is behind S [Subject], the problem itself is the most salient stimulus, and S, more nearly free to attend exclusively to it, can use that cerebral hemisphere that more nearly serves the cognitive strategies needed for solving the problem. When E faces S, however, S is confronted with a new set of stimuli, and thereby the problem's saliency is decreased. Because the face-to-face situations, being more personal, may be more threatening and anxiety-provoking..., S falls back on characteristic and preferred modes of response. Thus, when questioned, S tends to rely on the preferred hemisphere even though it might be the 'wrong' hemisphere for a particular kind of problem. (p.41)

5:2.1.4 TYPE OF SUBJECT

The subjects used in experiments tend to be of two main types: (i) university students, often studying linguistics or psychology (e.g. Foss 1970, Hogaboam & Perfetti 1975, Holmes 1979)⁸, and (ii) children. Results from the latter tend to be inconsistent (see section 5:2.2 below). The former tend to be tested because they are available and willing to participate. However, they are rather unrepresentative of the

8. Mehler et al (1978) expressly state that their subjects "had no particular sophistication in experimental psychology or linguistics"(p.33). Nevertheless, they were university students.

general population, and, moreover, in a way which it is rather convenient to overlook because it renders them more rather than less efficient and predictable performers. They are all members of the small section of the population who have been suited to or have adapted to the specifically analytic requirements of school and of state examinations (see chapter 1:9). It is highly plausible that one feature of their educational adeptness is an ability to examine a problem and select the most appropriate strategy to tackle it, so that they reach the answer intended by the teacher or examiner. The instructions quoted in 5:2.1.1 above from Tyler & Marslen-Wilson (1977) exemplify the kind of language and task which a university student would be at home with but which might be unfamiliar or threatening to other individuals. The psycholinguist who did dare to use other types of subject would face a dilemma, if he recognised it, when some of his subjects failed to complete the test properly. It would be too easy to simply write them off as 'careless' if they failed to read the instructions properly, or as 'uncooperative' if they gave up before the end, and exclude them from the analysis. It would be undermining of many premises inherent in experimental design to see in this the possible manifestation of different strategy choices, whereby what seemed to be an appropriate strategy for a successful subject, who has used it to his advantage in 'similar' school test conditions, did not seem to be appropriate or easy to another subject, who was 'unsuccessful' (see further discussion in chapter 1:9).

5:2.1.5 THE SCOPE FOR CONTROLLING FOCUSING IN EXPERIMENTS

The Focusing Hypothesis ultimately predicts that no amount of con-

trol of stimuli, subject type, environment or administration will reliably remove the tendency to make language (or the task itself) focal (see chapter 6). The only possibilities which remain would be to alter the whole emphasis of the test (see section 5:4) or to create a genuine interactive situation (including spontaneous input and output). The latter would be hard to achieve without sacrificing the rigours of experimental design which are required for testing across samples, making direct measurements of efficiency and controlling extraneous factors.

Therefore, in tests of hemispheric superiority for language, variation in the balance of these variables across and within studies might manifest itself in inconsistencies in the side or extent of that superiority; in other psycholinguistic experiments, differences in processing patterns might be observable. As all four of the variables described in 5:2.1 could interact, the picture could easily be primarily one of confusion.

5:2.2 SUBJECT TYPE AS THE PRIMARY VARIABLE

It was suggested in section 5:2.1 above that the subject holds the key to the range of strategy options and the choice made between them in the attempt to complete a task successfully. Chapter 4:1.2 described experiments where the subject variable can be associated with contrasting results. In the following discussion the decisive features differentiating subject groups are examined in the light of the Focusing Hypothesis' *strategy option range* account (see chapter 1:9). However, it must first be noted that there are plausible ways of accounting for these inter-group contrasts which do not invoke the increased activity of some holistic processing mechanism. These may involve the-

ories of strategy, but do not, even in that, necessarily provide any direct support for the Focusing Hypothesis.

In chapter 4:1.2.2 some observations of Heny (1985) were noted, namely, that the same subject may show different patterns of superiority when tested twice on the same task (Heny 1985:169f) and that by *priming* one hemisphere with an initial task, a subsequent task can be biased into showing the same (unexpected) pattern of hemispheric superiority. This leads her to state that:

obviously, the reliability of tests like these depends on the ability to control such outside factors on choice of processing strategy, and that is no simple matter. (p.170)

The Focusing Hypothesis proposes that the inventory of strategies open to an individual in a given situation and also his flexibility in switching between them is governed by a number of environmental factors, (and possibly some physiological ones too, related to sex and handedness; see Geschwind 1983 and the discussion in chapter 4:2). Experimental findings have indicated general relationships which indirectly associate subjects of a lower socioeconomic class (Geffner & Hochberg 1971), an oppositional cognitive viewpoint (Scott et al 1979) or who are not Western-aculturated (Hynd et al 1980), under a common heading of *less left-lateralised for language*. Other factors include language-specific differences (Tsunoda 1975; Gaziel, Obler & Albert 1978), which are of a different type and so not discussed here, sex differences (e.g. Buffery 1971) and age (see below). These last two present a more complex picture.

As Bryden & Allard (1978) report in their review, an REA can be elicited in children as young as four (e.g. Kimura 1967) but not all experiments have succeeded in doing so (e.g. Zurif & Carson 1970, Witel-

son 1962). Harris (1978) proposes that sex and age interact to produce earlier signs of laterality in females than males but by the time maturation rates equal out, more extreme ones in males (p.460; see chapter 4:1.2.4.3).

Ultimately, an account such as the Focusing Hypothesis needs not only to simply cite strategy options as the single, unifying factor which produces all these cross-group differences in experiments, but to suggest why the patterns should be as they are; that is, why an analytic strategy in experimental tasks should be preferred by younger girls, older boys, middle class children, and educated and Western-aculturated subjects.

Several possible contributors to this may be proposed. Sex, like handedness, has been the object of many interesting psychological studies (see Harris 1978 for a review) in which differences have been found and, in most cases, attributed to physiological rather than environmental differences. One exception to this is Berry's (1966) study of visuo-spatial skills in the Temne tribe (Sierra Leone) and Eskimos (Baffin Island). Here, marked sex differences were found in the Temne but not the Eskimos and the Eskimos also performed much better overall. This was attributed to the different demands put upon the two groups by their respective environments and the difference in the status afforded to women by them. Such findings could indicate that the demands of the environment with regard to survival are stronger than any biologically (or culturally) instigated sex differences in strategy preferences. As Segalowitz & Bryden (1983) point out, if male and female subjects were to have different preferred strategies for tasks, it would be hard to differentiate this in the results from the effects predicted for dif-

ferent measures of lateralisation (p.363, cited in Code 1987:14).

In regard to age, it could be suggested that the range of strategies available for a task increases, decreases or otherwise alters during the process of maturation; and any rôle for maturation will provide some specific pointers to expected patterns. One is that girls will, in general, display characteristics before boys, given their advanced maturity. As already noted, Harris (1978) supports this view:

Girls, because of their earlier linguistic development, may begin a course of intellectual development in which, compared with boys, language plays the larger rôle. (p.474f)

Another is that changes might be expected to be apparent where samples span some traditional maturational watersheds, most notably puberty and the age of 7.

Puberty is the greater of these two dividers. Krashen (e.g. Dulay, Burt & Krashen 1982:61) associates it with the development of self-consciousness (an aspect of what Piaget termed *Formal Operations*) and with *Monitoring* and a new kind of linguistic consciousness. The Formal Operations stage is considered, as Krashen suggests, to mark the onset of special sensitivity to oneself in relation to not only what one says but everything that one does, with an increased sensitivity to how others perceive one (e.g. Piaget 1962a,b,1964). This, then, would seem an obvious, stress-related, factor associable with a tendency to focus on performance in any test condition. This change at puberty might account for the greater reliability of adult over child subjects to produce a left hemisphere superiority for language in psycholinguistic tests. However, it does not account for the still over-riding tendency in the same direction of those children. Kinsbourne & Hiscock (1977) attribute child-language differences in dichotic listening performance

to "an attentional bias to the right when children adopt a verbal set" (p.181). This is less marked in adults, they suggest, because of increasing sophistication in behavioural control (p.182).

The age of seven appears to have its own significance too. In the educational methods inspired by Rudolf Steiner seven marks the end of the first phase of development and the onset of the second (Harwood 1940:100, Edmunds 1975:38): children are not introduced to literacy skills until certain physical milestones associated with that age have been passed (notably the "change of teeth" (Harwood 194):100), because they are considered not to be equipped to deal with them⁹. Piaget (e.g. 1972) considered seven to mark the end of the *pre-operational* period, during which "thought processes are *perceptually bound* and *ego-centric*" (O'Leary 1982:65). An analytic approach to the world has not been fully developed and "the transition to predominantly verbal processing occurs at about age seven" (O'Leary 1982:65). In chapter 6, Experiment 2 attempts to replicate O'Leary's (1982) finding of an alteration at that age in hemispheric superiority from right to left in making judgements about tachistoscopically presented pictures, and it re-examines his suggestion that this marks the adoption of a verbal labelling strategy.

Also mentioned and experimentally investigated in chapter 6 is the question of educational experience and its possible relationship to the tendency to adopt analytic strategies. This is important as a potential influencing factor because it has implications beyond just the age

9. The years from seven to fourteen are termed the "'uncritical' years (that is to say, the years before the critical faculty of intellect is freed)" (Edmunds 1975:47). In other words, children of that age are still not considered to be able to take a consciously 'analytic' approach to life.

dimension. If, as seems highly plausible, learning to read, write, do arithmetical and mathematical calculations and to manipulate facts in relation to each other in an ordered way develops the analytic capabilities of the child, then it stands to reason that those most confident and most successful in the school environment will either be by definition or else become by practice those most able to adopt an analytic approach to a task. Furthermore, and importantly, *all-rounders*, who succeed in the widest range of subjects on the curriculum, will be those who know when not to be analytic as well. These are, perhaps, akin to what Krashen terms, in the second language acquisition context, *optimal monitor users* (Krashen & Terrell 1983) as opposed to overusers or underusers. The latter two could be considered to demonstrate least freedom in strategy choice.

This leads to the the suggestion that subsections of the community who are educationally successful and/or favoured in one way or another might be most consistent in displaying analytic strategies where they are appropriate (and also not displaying them where they are not appropriate). These would be individuals who were able to meet specific stress with analytic attention, as in exam conditions. We might predict, then, (and this is borne out in the data, as described above and in chapter 4) that groups of experimental subjects would display differences along the parameters of class (where this is related to education motivation and attitudes and home support for learning), race (where ethnic minorities experience poverty, educational (including linguistic) disadvantage, prejudice-related stress and feelings of inferiority), culture (where different emphases are placed on analytic approaches to the environment), age (as discussed above) and sex (where

females, or males, are treated differently or require different treatment than they receive). The description of field dependency (chapter 4:1.2.4.2) examines the possible inter-relationship of population subgroups to an analytic cognitive approach and implicitly indicates how, in Western society, field independence is considered 'better' than field dependence; the latter happens also to be associated with women, left-handers¹⁰ and some non-Western cultures (Ten Houten 1982:24).

In accord with the above we find that Kimura (1969) has suggested that males have a greater tendency than females to select the strategy most appropriate to the task (see also Harris 1978:476 and chapter 4:1.2.4.2). Obler (1984), amongst others, proposes that positive attitudes increase second language learning ability (p.199; see chapter 4:3.2.5); these may be easily associated with reduced stress levels. On the other hand, the desire to do well, which is also associated with greater attainment, may act to positively harness stress and to enable focusing onto the precise level required in the specific exercise, i.e. linguistic form in a grammar lesson but propositions in a conversation lesson.

To summarise, it has been suggested in the above discussion, that optimal strategy selection is related to a range of factors, including sex, handedness and age differences, but also task-related ones, and that these latter may reinforce and exacerbate the differences initiated by the former, or in other circumstances may reduce them to insignificant levels.

10. The issue of left handedness raises questions of physiological as well as environmental influences; it now also seems more fashionable again to invoke the same to account for at least some sex differences (Geschwind 1983).

5:2.3 THE VALUE OF PSYCHOLINGUISTIC DATA IN EVALUATING THE FOCUSING HYPOTHESIS

The above discussion has illustrated how the Focusing Hypothesis predicts a confused picture from the psycholinguistic data. Furthermore, it predicts that experiments which consistently preclude holistic involvement (e.g. dichotic listening tests or high-stress tasks conducted using University students) have little to say about the existence of two processing systems, for they tap only one of them. This is, inevitably, a partisan view, emanating exclusively from internal reasoning. The general consensus in psycholinguistic research is that even the most artificial experiments (in terms of how closely they resemble what happens in normal communication) contribute in a direct way to our knowledge about general mechanisms of linguistic processing. Assertions such as "our research indicates that all speech processing involves..." (Tyler & Marslen-Wilson 1982:180) bear witness to this. Elsewhere, Tyler & Marslen-Wilson (1982) are even more explicit:

The aim of the research reported here is to characterize the basic properties of human spoken language understanding; of the mental events that take place as the listener hears an utterance. The research is carried out within the framework of the claim that speech understanding is mediated by a set of central on-line processes, and that the primary goal of psychological research into speech understanding is to determine the properties of these processes. (p.169; see also Tyler & Marslen-Wilson 1977:684 and MacKay 1973:26).

From their point of view, then, their experimental results are clear refutations of the notion of non-analytic (i.e. holistic) approaches to (at least) input processing. Such initial premises are irreconcilable with those of the Focusing Hypothesis, which designates the kinds of questions which Tyler and Marslen-Wilson ask (e.g. 1977, 1982,

Tyler 1984), regarding the nature of the processing they initiate experimentally, irrelevant to the central issue of the dual systems aspect of the Focusing Hypothesis. Indeed, it remains ambivalent to the issues raised in this, and many other, areas of linguistic investigation which are, in its terms, concerned with the internal organisation of just one, the analytic one, of these two systems.

To test the Focusing Hypothesis in its own terms, then, requires investigatory methods which do not by virtue of their intrinsic nature, simply debilitate the holistic system and then, in not finding it operational, permit the conclusion that it does not exist.

5:2.4 TEST CASE: AMBIGUITY

This single area of psycholinguistic research has been selected for closer examination. It contributes particularly to the discussion because it is not as limited as, say, the dichotic listening research, in the range of investigatory methods which it can employ. To facilitate a full discussion, the aims and findings of research in this area are first of all examined in some detail, before they are evaluated in terms of the Focusing Hypothesis.

5:2.4.1 FINDINGS IN AMBIGUITY RESEARCH

At least two aims may be identified as motivating the research into ambiguity. The first concerns whether more than one reading of an ambiguous word or expression is available at a given moment during or immediately after processing. This has been tested by comparing reaction times to stimuli containing ambiguous and unambiguous items. Reactions to the former are predicted to be slower if different readings

are competing in the interpretation of the stimulus. Amongst the studies finding such an effect are MacKay (1966, cited in Bever et al 1973:278 and Lackner & Garrett 1972:360), Mistler-Lachman (1972, cited in Hogaboam & Perfetti 1975:273), Bever et al (1973, experiment II), Foss (1970), Foss & Jenkins (1973, cited in Hogaboam & Perfetti 1975:273) and Conrad (1974, cited in Hogaboam & Perfetti 1975:266). For a general review of 'ambiguity' see Garnham (1985).

However, there is a large measure of variation in the experimental designs and the exact findings (see Table 5:i in section 5:2.4.4 below). MacKay (1966) used a sentence fragment completion task. The fragments contained lexical, surface structure or underlying structure ambiguities or matched unambiguous controls. (Examples of such constructions can be found in the Appendix, A5:1). He found ambiguous stimuli more slowly reacted to than unambiguous ones in the cases of underlying structure only, not in lexical or surface structure ambiguities. Bever et al (1973) were able, retrospectively, to narrow down the scope of this ambiguity effect from all underlying structure stimuli to only those where the fragment left a clause incomplete. There was no effect where the fragment ended with a clause boundary. Bever et al (1973, Expt.II) replicated this finding.

Mistler-Lachman's (1972) experiment, on the other hand, found an ambiguity effect for stimuli which were all complete sentences. Subjects had to provide an appropriate sequential sentence. But Bever et al (1973) hypothesise that the positive encouragement given to subjects to respond quickly would have led them to start formulating, even uttering, their response before the sentence was finished. In this case, the stimuli would be being treated as fragments which were not clausal-

ly complete. However, Mistler-Lachman's experiment dealt only with lexical ambiguity (Hogaboam & Perfetti 1975:273), which did not show an ambiguity effect in the other experiments.

Mitchell & Holmes (1985) had subjects responding to simple comprehension *yes-no* questions immediately after sentences carrying an ambiguous or an unambiguous sentence. The verb in the sentence biased for one reading, without excluding the other. The sentence was then disambiguated with an *indicator* segment after the verb. This was predicted to cause a *garden path* effect where the verb biased the reader towards the inappropriate interpretation. They did indeed find that it took longer to react to *garden-path* sentences. They managed to replicate these results when, instead of splitting the presentation of the stimulus into segments (Expt.I), they presented it as a single unit (Expt. II). However, whether they in fact captured in this the opposition which others have observed between sentence fragments and complete sentences (see above) is open to question: the subjects in the segment-presentation condition knew that they would ultimately see the whole sentence and they were not required to provide the ending for the stimulus sentence.

Other experiments have found no difference between reaction times to ambiguous and unambiguous stimuli. Foss, Bever & Silver (1968, cited in Foss 1970:700) required subjects to recognise pictures as compatible with a previous sentence. As a picture could only depict one meaning of an ambiguous stimulus, those decisions might be expected to take longer than the ones relating to unambiguous stimuli. But no difference was found. However, there was a frequency effect, with responses to pictures matching the less frequent interpretation taking

longer than those matching the more frequent one. Bever et al (1973, Expt.I) required the construction of a plausible following sentence to sentences which contained a lexical, surface structure or underlying structure ambiguity. Not only was no difference found in general across stimulus types, but in the case of underlying structure ambiguities, responses were made more quickly to ambiguous than unambiguous stimuli. They explained this in terms of the task permitting the choice of either reading, so that in each case the first to be found (probably the more frequent, see below) was the one which was computed. Mehler et al (1978) found no difference in response times to target phonemes immediately following an ambiguous or unambiguous stimulus, once they had controlled for word length over the two conditions. Foss (1970), using a similar design, but not controlling for word length, had found an ambiguity effect. Mitchell & Holmes (1985) also claimed to find no effect of *garden pathing* in their Expt.III. But this is hardly surprising since, in their effort to test whether the effect was caused by syntactic or pragmatic factors, they employed stimuli which were no longer able to cause garden pathing. Their conclusions, then, rest on the assumption that there was no difference in the strategies adopted by the subjects involved in this condition and those used in the other experiments, who were presented with a task requiring complex (and unnatural) ambiguity decisions.

Tanenhaus, Leiman & Seidenberg (1979) suggest that the contradictory findings regarding whether one or more than one reading is available might be dependent upon the time lag between the stimulus and the response; unrequired readings from a multiply accessed pool might be discarded in this time, or, conversely, a singly accessed reading might

be found unsuitable and replaced by another. They attribute the contrast in findings of Conrad (1974) and Oden & Spira (1978) (discussed below) to the immediate onset of response in the former and the 500msec delay in the latter:

If, for example, multiple access is followed by a rapid selection process based on context, then the 500-msec interval may have provided enough time for the contextually appropriate reading to be accessed. (p.429)

They claim support for this stance from Neely (1977) and also from their own experimental work. In the latter, presenting a single word for naming immediately after the sentence containing the ambiguous word resulted in no difference in response times whether the word was semantically related to the primed or to the unprimed reading of the ambiguous word. This suggested that, at that specific stage, more than one reading was available, regardless of context. But when there was a 200 msec or 600msec gap before the presentation of the word to be named (and therefore before a response could be made) the response time was faster only for the primed reading. This suggested that by 200msec after the stimulus presentation, all but the chosen appropriate (primed) reading had been discarded.

The second area of interest in ambiguity studies has been the process by which one reading is selected. Experiments have tested hypotheses including (a) multiple access, with parallel processing of all possibilities until one can be selected from context and (b) the selection of one reading only, with its subsequent abandonment if necessary and the search for a second reading (the *order hypothesis*). For a general review of studies, see Garnham (1985:63ff). Lackner & Garrett (1972) conducted an experiment to test the predictions of these two hy-

potheses. They used a dichotic listening procedure to present ambiguous sentences of various kinds to the attended ear and the disambiguating ones, more quietly, to the unattended ear. In each of three groups of 15 subjects, seven received the ambiguous (attended) stimulus in the right ear and the disambiguating sentence in the left. The remaining eight had the reverse presentation. The subjects had to paraphrase the attended sentence. A biasing effect for each condition was calculated from its frequency of occurrence in the primed condition and in a neutral, unprimed condition. The effect of priming was significant for all the types of ambiguity, despite the fact that no subjects realised that the stimulus sentences were ambiguous, nor had any knowledge of what had been played to the unattended ear. Lackner & Garrett reason that for simultaneous priming to have such an effect, either both readings must have been simultaneously available through some parallel processing or else processing must have been delayed until enough contextual information was available. That the subjects were encouraged to begin their paraphrase even before the stimulus was finished is one fact called in support of the former account, i.e. simultaneous multiple access and parallel processing. For a brief review of these hypotheses, see Hogaboam & Perfetti 1975:265).

But the *frequency hypothesis*, which is an elaboration of the order hypothesis, receives most attention. This proposes that the accessing of readings for ambiguous items & structures proceeds via a fixed order, determined by frequency. Several studies claim to support this.

Hogaboam & Perfetti (1975, Expt.I) presented sentences ending with an ambiguous or an unambiguous (control) word. The sentence itself biased the meaning to either the high or the low frequency reading. The

subject had to decide whether the last word in the sentence was ambiguous or not. They found that decision times on the low frequency readings were quicker than on the high frequency ones. They explained this by suggesting that it took longer to find a second, infrequent meaning once the frequent meaning had been accessed and found to fit the context, than it did to find a frequent meaning after the infrequent one had been found to fit. It is hard to see why this should be so: the same number of processes ought to be involved either way. Even their later attempt to elucidate does not help much:

the secondary sense...cannot be accessed unless the primary sense has been accessed. (p.272)

While it would be true that both readings were available by the end of the sentence processing itself in the low frequency but not the high frequency cases, it ought, presumably, to take less time to complete the sentence processing in the high frequency cases, because the first reading accessed would have been acceptable. This would leave time in hand for the search for a second meaning. However, their account could work if the contextual information were of more value in locating a low than a high frequency meaning, as might be the case if, as they suggest, the word in isolation or in a neutral context was attributed, by default, the more frequent reading.

Holmes (1979) proposed another account. The faster reaction times for low frequency readings might not be because the high frequency reading was accessed first, as described above, but rather because context accesses the correct reading, whether high or low frequency; but in the subsequent search for a second reading, the higher frequency reading is found faster (p.576). Holmes (1979) replicated Hogaboam & Perfetti's experiment with the same result. In his subsequent experi-

ments, subjects made judgements about whether stimulus sentences were meaningful or anomalous, without being alerted by the experimenter to the presence of ambiguity. The more frequent readings elicited faster response times (Expts.II-IV), even with a context clearly restricting the ambiguous item to one reading. When a pre-stimulus sentence contextualised (often semantically restating) the stimulus sentence and its ambiguous reading (Expt.V) the frequency effect almost completely disappeared. This was considered to be because there was sufficient contextual information to prevent the irrelevant reading from surfacing at all. Support for this interpretation could perhaps be drawn from Carey et al (1970, cited in Bever et al 1973:278). Here, using surface structure ambiguity only, subjects were primed for one or other reading and then had to decide whether a picture was relevant to the ambiguous stimulus. Where the picture related to the reading which had not been primed, reactions took longer, so long as the subject had noticed that there was ambiguity present.

Priming (or *biasing*) has been used in a number of experiments (see Table 5:i below) and effects found. Mackay (1973) used a dichotic listening presentation similar to Lackner & Garrett's (1972) described above. He tested a number of hypotheses relating to a general model envisaging only surface level analysis of unattended material (see earlier discussion). He tested this by requiring subjects to attend to a sentence in one ear well enough to shadow it with short latency and without error. A single lexical item (or two items) were played into the other ear, to which the subjects were instructed not to listen. He found that when that word disambiguated lexical or surface structure ambiguity a biasing effect occurred. But there was no effect in the

case of underlying structural ambiguity, that is, where the underlying structure of the unattended sentence was the same as one of the readings of the ambiguous sequence.

5:2.4.2 THE FOCUSING HYPOTHESIS ON AMBIGUITY

The Focusing Hypothesis predicts two kinds of conflict in observations about language processing. One is variation within the corpus of experimental data. The other is contrasts between what happens under experimental and non-experimental conditions. Thus, one welcome observation from others is that:

Many sentences could mean more than one thing, but in a normal context we usually notice only one meaning." (Bever et al 1973: 277)

It is clear...that many everyday sentences which in (linguistic) theory are ambiguous are not taken to be ambiguous by those who hear them." (Foss 1970:699)

This observation might be defined as 'informal evidence' because it addresses a phenomenon (the oversight of ambiguity in normal language processing) which cannot, by definition, be experimentally examined, quantified or controlled without altering its 'everyday' nature. It has served as a starting point for others to ask, and to seek to find out experimentally, why it is that we fail to see ambiguity. However, they soon discover that, in test conditions, we can, after all, detect ambiguity, more or less rapidly, according to various factors. Yet they see little significance in the fact that of the several glaring differences in the circumstances in which the two (experimental and informal) observations are made (see above), one is whether or not the subject or informal hearer/reader is looking for ambiguity, either directly or indirectly. For the Focusing Hypothesis the difference is

paramount, for it is proposed there that entirely different strategies are in operation for dealing with the information in each case, which may, if those strategies differ in relevant ways, completely alter the patterns which are observed.

There are some who in fact do note this variable but they lack a uniform account to contextualise it and to give it significance:

...reconciling the present results with our everyday experience of ambiguity is needed. (Foss 1970:705)

Within the context of experimental investigations, the Focusing Hypothesis predicts conflicting findings because of uncontrolled effects on strategy choice from the experimental design, including stimulus type, experimental environment and subject type. Any of these might play some rôle in enabling or disabling a temporary contribution from the holistic mechanisms. According to the Focusing Hypothesis, in normal processing ambiguity would be overlooked whenever the previous context or the information contained in any part of the current clause clarified the meaning. This is because the whole clause would be decoded at once¹¹. On the other hand it could be argued that at the *scanning* stage (see chapter 1:1.2) there would be a 'multiple access' in the sense of the highlighting of more than one formula/lexical area as possibly relevant for the later clausal decoding. It has been proposed, however, that this aspect of the *recognition* process (see section 5:1.6) could not be accessed experimentally, as the attempt of the experimenter to observe it would alter the strategy adopted by the sub-

11. This contrasts with the more common belief that language is processed as it is received, e.g.: "it seems safe to assume that the structural analysis of a sentence is begun by a listener during its reception" (Lackner & Garrett 1972:236).

ject. Where there was not enough contextual information one of two things might happen. Firstly, pragmatic knowledge and imagination, used to extend the context beyond the explicit, might provide the 'more likely' meaning as the only reading. This process would resemble, and might be mistaken for, a frequency-based selection procedure (see below) but would be bound by the dynamic processes of context and common sense, not by some immutable internal frequency hierarchy as suggested by others¹². In this case the ambiguity would be entirely missed whenever the assumptions were correct, but would become apparent if the subsequent context indicated a mistake.

Alternatively, there might be a failure to satisfactorily decode the clause, and a 'homing in' (i.e. focus) on the dubious item. In this case, as in the case of a selectional mistake being detected (as described above), the holistic processing mechanisms would be unable to cope with the problems (see chapter 1:3) and would hand over the processing to the analytic mechanisms. The word in question would become temporarily focal and some or all of its various readings accessed. The analytic mechanisms would be able to deal with different readings and their context by means of juxtaposition, and might adhere to any of the patterns of internal organisation which are discussed in the psycholinguistic literature (but which are there considered to apply to normal processing situations as well).

It is important to note, however, that the analytic mechanisms are

12. In the light of Pawley & Syder's (1983) stronger hypothesis (see section 5:6 below) it could alternatively be postulated that lexically stored interpretations would be preferred to novel ones. In this case, again, the results would resemble some kind of frequency ordering, but in fact the subset of 'natural' lexicalised or part-lexicalised constructs would underlie the preferences.

not envisaged to go beyond simply identifying the ambiguity. There would, namely, be no value in simply choosing a reading if the context had not defined one. In normal communication, only one meaning has been intended by the speaker and it is the hearer's job to find out which, by seeking clarification from the speaker. He may not usefully exercise free choice, unless he deliberately wishes to risk misunderstanding the propositions expressed by the speaker. This observation seems a fairly obvious one, yet it appears to be ignored by many psycholinguists. That this is so is evident from the rather different selectional criteria which are permitted to operate in experimental conditions (see below). In addition, general comments by experimenters about the nature of the processes involved in decoding ambiguity in normal communication fail to acknowledge the point. For example, Lackner & Garrett (1972) present three possible scenarios for ambiguity decoding and then state:

It is presumed that in all three cases only one reading is finally selected. (p.361)

It is contended here that where ambiguity is noticed and the context does not disambiguate, the listener holds the two readings side by side until clarification is forthcoming, and does not just choose whichever reading he likes better.

5:2.4.3 CHALLENGES TO THE FOCUSING HYPOTHESIS

There are some serious challenges to be faced by the Focusing Hypothesis in respect of some of the ambiguity data. Although there are clear indications that stimulus type, at least, does affect experimental findings (see below), the Focusing Hypothesis cannot account for the

apparently clear-cut nature of the contrasts anything like as succinctly as some other hypotheses. As exemplified above and also in Table 5: ii, some experiments have revealed a delay in processing ambiguous words and structures, as compared to unambiguous ones, while other experiments have found no such contrast. Bever et al (1973) attribute this to whether the stimulus is a sentence (clause¹³) fragment or a complete one:

Those experiments which show an effect of ambiguity used tasks initiated during the processing of the sentence, while those showing no effect used tasks initiated after processing of the sentence was presumably complete. (p.279)

This observation is fuel for their argument that all the readings of ambiguous words, surface structures or underlying structures are potentially available until the clausal boundary and then the inappropriate ones are discarded, so that:

tasks that occur before such boundaries are complicated by the presence of both interpretations of ambiguities, while subsequent tasks are not. (p.279)

If the pattern is as they describe (this is examined below), then the arguments presented so far in this chapter are compromised, though the Hypothesis itself is not challenged. The reason for this is as follows.

The Focusing Hypothesis proposes that holistic and analytic mechanisms are both capable of linguistic processing. A consistent contrast in subjects' efficiency in processing ambiguous items, according to whether they are dealt with before or after the end of the clause could be indicative of one of two things:

13. Although they speak here in terms of sentences, they are primarily concerned with clauses as basic units of processing. So references from now on are to the clause.

a) Ambiguities processed before the end of the clause involve analytic processing, and those processed after it involve holistic processing. In other words, the experiments which use clause fragments do not give us any insight into the processes by which the single reading of an ambiguous item is selected in the experiments which use whole clauses; the processing procedures are entirely separated and the former does not reflect a stage part-way through the latter.

This account is unsatisfactory because it makes no allowance for the inhibition of the holistic mechanisms as a result of the other variables outlined in section 5:2.1, viz. stress levels as a function of the experimental environment, subject type etc.

b) Both the clause-fragment and the whole-clause observations relate to stages of analytic processing, just as Bever et al (1973) and others suggest. The Focusing Hypothesis' account is then different because it holds that neither condition is representative of real language processing, which it considers to be holistic. The whole question of ambiguity is, in this case, only of secondary interest, since it sheds light on the operation of the analytic system but does not relate to its relationship with the holistic system.

This account is also unsatisfactory because up until now the possibility has remained that some experimental designs might permit some limited and sporadic involvement by the holistic mechanisms. If this is denied, so that all psycholinguistic experiments discussed here are considered wholly unsuitable for even indirect indications of the existence of dual systems, there is an unfortunate consequence. The Focusing Hypothesis is forced to fail to predict confusion in the data unless it does so with reference to some factors internal to the analy-

tic system. It cannot account, then, in terms of strategy options, for conflicting evidence in the ambiguity data, nor, more importantly, for the inconsistencies in other data, such as those outlined above.

The Focusing Hypothesis does predict conflict in the data, but it must be of a type that would appear, to the experimenter, unprincipled, because it will be caused by small fluctuations in numerous variables. What we must search for, then, is greater within- and cross-study variation than Bever et al (1973) depict in their clear-cut account. As it turns out, there is some indication of this when the data is re-examined in this light.

5:2.4.4 REASSESSMENT OF THE AMBIGUITY DATA

An examination of the experiments described above, in terms of the criteria outlined in section 5:2.1, reveals variation of precisely the kind predicted to lead to conflicting results. And, as already demonstrated, they do conflict. Bever et al's (1973) and Lackner & Garrett's (1972) work supports the multiple access hypothesis, with the parallel processing of different readings and the discarding of all but one at the clausal boundary. Hogaboam & Perfetti (1975) and Holmes (1979) support the frequency order hypothesis, which states that a second reading will only be accessed if the first (the more frequent one) is found to be unsuitable.

The Focusing Hypothesis treats both sets of evidence with some caution and it considers other parameters more pertinent to the subcategorisation of experiments. The following oppositions of features are observable in the experimental designs referred to above:

- a) type of ambiguity: lexical, surface structure or underlying structure

- b) stimulus type: isolated item, clause (or sentence) fragment, whole clause (or sentence)
- c) task requirements: direct search for ambiguity, some other linguistic search, propositional decision without knowledge of implanted ambiguity
- d) 'correct answer': subject must select the appropriate reading, subject may select any reading
- e) stress-factors: subjects aware of timing or encouraged to react quickly etc.

This list is very similar to the more generalised one in 5:2.1 above.

As already described, some of these variables have been acknowledged by experimenters as pertinent to their findings. But others have not been. Bever et al (1973) perceive a combined effect of (a) and (b): the experiments of MacKay (1966) and Bever et al (1973, Expt.II) revealed an ambiguity effect only for sentences varying in underlying structure but not for the other two types of ambiguity; but this effect was only found where the stimulus (a sentence fragment) ended with an incomplete clause.

The Focusing Hypothesis, as it has been presented here, does not directly address the question of ambiguity types (a) as a variable, as this relates to the internal organisation of a single system, not to inter-system differences. However, as already expounded, variable (b) is potentially important because sentence completion tasks and tasks dealing with stimuli out of a propositional context would be predicted to rule out holistic processing; stimuli which were complete sentences might enable some (sporadic) holistic involvement, if other variables permitted this. Holmes' (1979) comment serves as indirect support for this view:

...entirely different processing strategies may be involved depending on whether words are presented individually or in sentential context. (p.586)

Mitchell & Holmes (1985) checked the results which they had obtained

using sentences which were displayed in segmental units (Expt.I) by presenting the whole sentence at once on the screen (Expt.II). The results produced the same patterns but there was clear evidence that:

the segmentation procedure must have had some effect on the subject's overall approach to the task. (p.551)

The nature of the task (variable c) is less consistently registered as a potential influence on results. Two main observations can be made: that most tasks are at variance with our real-life experience of language processing procedures, and that some tasks are far more explicitly metalinguistic than others.

The first observation also incorporates variable (d). It is clearly 'unnatural' to require subjects to (repeatedly) encounter unresolved ambiguity and make decisions about it (e.g. Mitchell & Holmes 1985). Similarly, it is an 'unnatural' question which experimenters are posing when they ask "*How do people deal with ambiguity when they're listening out for the letter 'p'?*" (e.g. Foss 1970, Mehler et al 1978). As described in section 5:2.4.2 above, in the course of normal communication two things may happen in the face of contextually unresolved ambiguity. It may go unnoticed and thereby possibly lead to misunderstandings, or it may be noticed as ambiguous. What is different here to the test situation (e.g. Mitchell & Holmes 1985) is that experimental subjects may be required to make decisions about the meaning of sentences despite a lack of adequate evidence to lead them to a firm conclusion. This is, then, a free choice: either reading is correct. In normal interaction there is no choice. The speaker never (except consciously, for effect) intends to be ambiguous - it happens by accident. As the hearer is not a mind reader, ambiguity is a hazard which must ultimately be overcome by the speaker, even if at the hearer's request. In experimental con-

ditions, the ambiguity is intentional and it is left to the hearer to resolve it, either using contextual information or by, practically speaking, guessing.

The priming of subjects to expect something other than normal linguistic interaction is inevitable. In some cases instructions are particularly explicit. Hogaboam & Perfetti (1975) set up, by means of their instructions, an awareness in the subjects that ambiguity was the major point of interest, which removes any semblance of normality from the task:

The subjects...were informed that the experiment involved ambiguous words, defined as words of one spelling and two or more unrelated meanings. The instructions emphasised that the two meanings had to be unrelated in order to be considered ambiguous. It was pointed out that even though the word plow had two usages, it was not to be considered ambiguous because the usages were related. They were also told not to consider metaphorical usage, or homophones that were not homographs.

The subjects were told that their task was to listen carefully to each sentence and decide whether the last word was ambiguous (p.269)

Furthermore, the task itself was highly artificial according to the criteria of naturalness outlined above. Subjects were required to decide whether the last word in sentences like (1) & (2) below was ambiguous:

- 1) The tired hiker rested his feet.
- 2) The building's dimensions were measured in feet.

Regarding the second observation made above about variables (c) and (d), viz. that some tasks require more metalinguistic attention than others, this question has not gone entirely unnoticed:

...the difference between the two studies could be due to the differing task demands made upon the [subjects]. That is, the kind or depth of comprehension required of a sentence is, perhaps, a function of what [subjects] are asked to do. (Foss 1970:704)

Holmes (1979) also notes that results from a task using isolated lexical decision do not necessarily tell us much about the procedures involved in processing words in a "meaningful sentential context" (p.570; Mitchell & Holmes 1985:544 make a similar observation). The importance of this is clearly illustrated in Holmes' (1979) experiments. His Expt.I required the detection of ambiguity. The remainder required judgements of 'meaningfulness' (i.e. whether a stimulus sentence "*describes events that are quite possible in our everyday world*" or "*describes events that cannot really happen in our everyday real-life world*" (p.577) and subjects were not told that ambiguous words were in use. The results of his Expt.I and Expts.II-IV were contradictory, which indicates that the test design variable needs to be seriously considered.

No attention was drawn to the fact that the test sentences would contain ambiguous words. (p.577)

The experimental tasks employed by Foss & Jenkins (1973, cited in Hogaboam & Perfetti 1975:271) and by Foss (1970) were even more metalinguistic, requiring the detection of a target phoneme. Conrad (1974, cited in Tanenhaus et al 1979:428) conducted a Stroop-like task, whereby subjects had to name the colour of a stimulus word presented after a sentence containing an ambiguous word which was contextually constrained to one reading. The variable was whether the stimulus word was semantically related to the primed reading or the unprimed one. Conrad found that colour naming was slower to stimulus words related to either the primed or the unprimed reading, which supports a multiple access hypothesis (Tanenhaus et al 1979:428f). Oden & Spira (1978, cited in Tanenhaus et al 1979:429) conducted a similar, but more tightly con-

trolled, experiment and found a priming effect.

In both the phoneme detection and the colour naming experiments referred to above, the subject had to focus on something other than the meaning of the sentence (though Foss had three conditions: phoneme detection, ambiguity detection and both). In the case of Conrad's (1974) experiment, it is hard to see how one could control the amount of notice subjects took of the semantic context at all (though the Stroop test itself illustrates that it is hard to ignore the semantic content entirely), particularly as, unlike in the Stroop test, the semantic context was not related to the colour name.

So far, we have examined variables (a)-(d). Variable (e), the level of stress induced, would inevitably manifest itself to different extents in different experiments. In some cases subjects appear to have been aware that reaction times were being measured (e.g. Mehler et al 1978). In others, the timing was done afterwards, off tapes (e.g. Bever et al 1973). In some cases, subjects were encouraged to respond as fast as possible (e.g. Mistler-Lachman 1972, cited in Hogaboam & Perfetti 1975:273, Foss et al 1968, cited in Foss 1970:700). In others, they were permitted to take as long as necessary to set up in their own minds the context in which a stimulus was to be seen (e.g. Bever et al 1973).

Amongst the experiments on ambiguity, one design, using dichotically presented stimuli, raises some questions of particular relevance to the Focusing Hypothesis. Dichotic listening tests have shown that the right ear is better at dealing with linguistic stimuli than the left (see chapter 3:4.2) though, as mentioned in section 5:2.1.2 above, the stimuli have usually been single words or nonsense syllables and the

right ear advantage has not been consistent across populations (chapter 4:1.2). In Lackner & Garrett's (1972) experiment, however, the task was not a simple report (i.e. repetition) of what had been heard, but to paraphrase the message in one (the attended) ear, which required the extraction of the proposition underlying the sentence played to that ear. In addition, as Lackner & Garrett report, the proposition contained in the sentence played to the unattended ear appears to have been extracted and utilised too. (MacKay's 1973 experimental design was similar, but for clarity it is not discussed here).

Leaving aside for the moment the effect, discussed above, of experimental design and environment, and of subject type, all of which might preclude anything but analytic processing, it is clear that the simultaneous handling of an attended and an unattended message for the purposes of extracting propositions would be predicted to operate better when the right ear was attended to than when the left one was. In other words, to have attention focused upon the ambiguous stimulus (though at what level this might be is debatable) would permit, as always, successful decoding with, at the same time, unhindered holistic handling of the unattended message by the right hemisphere. A proposition could then be fed to the analytic mechanisms where it might influence the reading given to the ambiguity, perhaps by being juxtaposed with some of the smaller semantic units (indeed, being taken to be one of them) which the analytic mechanisms routinely juxtaposed as part of their decoding procedure.

But when the attended message was presented to the left ear and the unattended one to the right, the subject ought to find the task more difficult. Unfortunately, it is impossible to tell if this was the

case. Lackner & Garrett (1972) monitored only the effect of biasing for each ear and used different subjects for each side of presentation.

EXPERIMENTER	TIMING ASPECT STRESSED?	SENTENTIAL STIMULI?	CONTEXT-RELATED TASK?	AMBIGUITY(AE)/FREQ.(FE)/PRIMING EFFECT(PE)?
Bever et al 1973 (Expt.I)	NO	YES	YES	lex.& ss:No AE us:AE:RTs faster to AMBIG.stimuli.
Bever et al 1973 (Expt.II)	NO	NO	YES	lex.& ss:No AE us:AE for incomplete clauses
Carey et al 1970	?	YES	YES	ss:RTs faster for primed readings
Conrad 1974	?	YES	NO	lex:AE; No PE.
Foss 1970	YES	YES	NO	lex.& us:AE
Foss et al 1968	YES	YES	YES	No AE;FE:RTs faster for HIGH freq
Foss & Jenkins '73	?	YES	NO	lex:AE
Hogaboam & Perfetti 1975	YES	YES	NO	lex:FE:RTs faster for LOW freq
Holmes 1979 (Expt.I)	YES	YES	NO	lex:FE:RTs faster for LOW freq
Holmes 1979 (Expts.II-IV)	?	YES	YES	lex:FE:RTs faster for HIGH freq
Holmes 1979(Expt.V)	?	YES	YES	lex: No FE
Lackner & Garrett 1972	YES	YES	YES	lex,ss,us:PE from unattended ear
MacKay 1966	NO	NO	YES	lex & ss: no AE us:AE for incomplete clauses
MacKay 1973	(NO)	YES	NO	lex & ss:PE from unattended ear
Mehler et al 1978	YES	YES	NO	lex:No AE in phoneme detection
Mistler-Lachman'72	YES	(YES)	YES	lex:AE with pre-stimulus contextualiser only
Mitchell & Holmes 1985 (I)	?	NO	YES	ss: AE
ibid (II)	?	YES	YES	ss: AE
ibid (III)	?	YES	YES	ss: No AE
Oden & Spira 1978	?	YES	NO	various types:AE
Tanenhaus et al'79	?	YES	NO	lex:PE with delay

TABLE 5:i

KEY

lex = lexical ambiguity
 ss = surface structure ambiguity
 us = underlying structure ambiguity
 RT = response time
 PE = Priming Effect (previously context biases choice of reading)

AE = ambiguity effect (RTs longer for ambiguous than unambiguous items)
 FE = frequency effect (may operate in either direction)

They found no differences, but this could simply mean that the two groups had to concentrate to a different degree in order to achieve satisfactory responses.

To summarise, many criteria may be at work besides those normally highlighted in experimental reports. Table 5:i displays the less than uniform picture which results from highlighting certain features of experimental design which the Focusing Hypothesis considers important.

When these studies are roughly rearranged according to the effect that the three criteria shown are predicted to have on the findings, they fall into three groups (Table 5:ii).

Group A contains those which are predicted to be most likely to enable some holistic involvement. These have or approach the configuration NO YES YES. In other words, they involved lower stress in regard to the timing aspect of the experiment (e.g. manual control of stimulus presentation, screen between them and experimenter with timer etc.), stimuli that were sentential and a task requiring meaningfulness (pragmatic) judgements or equivalent. Bever et al (1973, Expt.II) and Mackay (1966) have been added to two groups (A & C) because of Bever et al's proposal that sentence fragments were treated like sentences when they ended in a complete clause. Foss et al (1968) has been added to Group A because the level of the subjects' awareness of the timing aspect is difficult to ascertain, and in all other respects this study meets the criteria of Group A membership.

Group B contains the studies predicted to be least likely to permit holistic involvement. The configurations are (or approximate) YES NO NO and (as this has no members) YES YES NO.

Group C contains the remainder, with predictions dependent upon the

presumed relative strength of the three variables.

GROUP A

SUMMARY OF FINDINGS				
Bever et al (I)	NO	YES	YES	No AE (Ambig. faster in us)
Carey et al	?	YES	YES	Context aided speed
Holmes (II-IV)	?	YES	YES	FE:RTs faster for HIGH freq
Holmes (V)	?	YES	YES	No FE
Mitchell & Holmes II	?	YES	YES	AE
" " III	?	YES	YES	No AE (but stimuli <u>NOT</u> ambiguous!!)
Bever et al (II)	NO (YES)	YES		No AE (complete clauses)
MacKay	NO (YES)	YES		No AE (complete clauses)
Foss et al	(YES)	YES	YES	No AE; FE:RTs faster for HIGH freq.

GROUP B

Foss	YES	YES	NO	AE
Hogaboam & Perfetti	YES	YES	NO	FE:RTs faster for LOW freq
Holmes (I)	YES	YES	NO	FE:RTs faster for LOW freq
Mehler et al	YES	YES	NO	No AE
Foss & Jenkins	?	YES	NO	AE
Conrad	?	YES	NO	No AE
Oden & Spira	?	YES	NO	AE; PE
Tanenhaus et al	?	YES	NO	PE at 200 & 600msec, not 0msec

GROUP C

Bever et al (II)	NO	NO	YES	AE (incomplete clauses)
MacKay	NO	NO	YES	AE (incomplete clauses)
Lackner & Garrett	YES	YES	NO	PE from unattended ear (simultaneous)
MacKay	(NO)	YES	NO	PE from unattended ear (simultaneous)
Mistler-Lachman	YES	?	YES	AE in pre-stimulus context only
Mitchell & Holmes III	?	NO	YES	AE

TABLE 5:ii (Key as in Table 5:i)

Although this arrangement incorporates many generalisations over what is a complex network of interacting variables, clear patterns can be seen. General group characteristics appear to include:

Group A: no Ambiguity Effect; Frequency Effect: faster for HIGH fre-

quency readings.

Group B: No Ambiguity Effect¹⁴; Frequency Effect: faster for LOW frequency readings.

The pattern revealed above is both supportive and undermining of the Focusing Hypothesis. The support lies in the indication that something may be going on which is related to the parameters which the Focusing Hypothesis considers important. But the picture is almost too clear, given the claim that numerous uncontrolled variables might well be interacting to confound the findings. So it remains questionable whether it is advantageous or not for the Focusing Hypothesis to seek and claim support from these studies, or whether it should prefer to stand at the sidelines and attribute all the findings to patterns in the internal organisation of only one (the analytic) system.

5:3 PREDICTION: DISRUPTION TO THE MECHANISMS IN LEFT AND RIGHT HEMISPHERE DAMAGED PATIENTS

5:3.1 LEFT HEMISPHERE DAMAGE

AS LANGUAGE-FOCUS TRANSFERS ROUTINE LANGUAGE PROCESSING FROM THE RIGHT HEMISPHERE TO THE LEFT HEMISPHERE¹⁵ IT WILL BE FORCED INTO THE DAMAGED AREAS OF AN APHASIC IF HE FOCUSES ON HIS OUTPUT.

In this case, the intact right hemisphere mechanisms would be potentially capable of handling processing in the normal way, but would be deactivated whenever the left hemisphere damaged patient paid attention to his processing.

14. Mehler et al's 1978 study not only contradicts the findings of Foss 1970 and Foss & Jenkins 1973 but also provides a plausible alternative account for their so-called Ambiguity Effect.

15. A direct connection is assumed here between holistic processing and the right hemisphere and between analytic processing and the left; cf. chapter 1:10

5:3.1.1 DISCUSSION

It is important to begin by noting that alterations in focusing are not considered to account for the aphasic symptoms themselves, only for circumstantial variations in their severity. Even though left hemisphere damage is characterised by an awareness of the problems (Geschwind 1979:165), to observe that left hemisphere damage is accompanied by language loss is hardly a source of unique support for the Focusing Hypothesis! However, another prediction is entailed in the above, namely, that language processing should be less affected when the aphasic is not focusing on the language itself but on something else¹⁶. In comprehension, this might occur when the patient was not trying to juxtapose the propositions in the input, as, for example, when he was present during a conversation between others, or when the television was on. In production, there would have to be a formulation of the propositions in preparation for an utterance, followed by a failure, for some reason to pay the customary attention to the intelligibility of the output. This might occur when the proposition retained the focus, e.g. in an emergency or some other emotive situation (see also section 5:3.2.1 below), or when the patient was distracted or caught off guard. Linguistic output beyond the characteristic (language-focused) post-aphasic capabilities of the patient might be produced, but, as the patient would be as surprised as anyone to witness this, language focus would immediately ensue, with the consequent loss of those temporarily reinstated abilities.

16. Discussion here is restricted to the symptoms characteristic of Broca's aphasia only. The question of accounting for the different symptoms of different aphasias is addressed later in this section.

Support for these phenomena tends to be anecdotal, as much of it does not reach the literature. Amongst the incidents which have been recounted are the following:

1) In clinical tests of aphasia, a patient may be unable to pick out a named object from three placed in front of him. But when the test is over, an off-hand request for him to pass that object to the tester so that it can be packed away may be successfully understood and responded to¹⁷.

2) Family may insist that a patient understands much more of their conversation and of television programmes than symptom diagnosis indicates to be possible¹⁸.

3) A patient may indicate unexpected levels of comprehension, including vehement disagreement, during a conversation between the speech therapist and a member of his family who has accompanied him¹⁹. It is possible that some apparent signs of following a conversation (e.g. head-nodding & shaking etc.) are not motivated by comprehension but by other automatic social cueing²⁰. However, signs of strong disagreement, as attested, probably could not be motivated in this way.

4) An aphasic woman, unable to speak, witnessed a conversation between her two sons, who were trying to establish some fact about their childhood, but were not acknowledging her in the exchange, even though she was the only one who could answer their query. She suddenly uttered the key word they needed to know. She was amazed to have spoken and was immediately unable to do so again²¹.

Two other common symptoms of left hemisphere damage can be interpreted in the light of the Focusing Hypothesis. Firstly, the tendency for automatic language (idioms, swearwords, paradigms and memorised sequences) to be better retained. As discussed in chapter 2:2.2.3, there is no reason for disagreeing with Hughlings Jackson's (1874) proposal that automatic language is right hemisphere processed; the Focusing Hypothesis only proposes that other, novel language is also dealt with

17. Andrew Spencer, Central School of Speech & Drama, London, personal communication.

18. Ruth Vinson, Speech Therapist, Lincolnshire Health Authority, personal communication.

19. *ibid.*

20. Andrew Spencer, personal communication, has suggested this.

21. Dick Hudson, University College, London, personal communication.

there. The familiarity of automatic phrases, their storage in prefabricated form and the total lack of experience of the left hemisphere for constructing them, even in focused situations, might all enable them to be more easily accessed.

Secondly, a symptom of milder forms of aphasia is word-finding difficulties. This is a phenomenon also found in normal production from time to time and thus it is fitting that the Focusing Hypothesis can account for its occurrence in aphasia in terms of the continued functioning of the normal task-sharing mechanisms. As word-finding difficulties would be a feature of, or at least exacerbated by, language focus, the least productive response to them would be to try harder. Word-finding problems in normals are renownedly persistent, despite the availability of certain kinds of phonological information while the word is on the *tip-of-the-tongue*, until the search is discontinued; the word often becomes available when it is no longer being sought.

It is plausible that individuals might differ in the frequency of these right hemisphere deactivations according to their previous tendency to focus on language. Apart from differences according to personality, which might correspond to the subcategorisations which Krashen points to with regard to Monitor use in L2 learning (over-users, under-users and optimal users, Krashen & Terrell 1983:44), cross-cultural ones might also obtain. These could relate to the status of language in a community, with those valuing rhetorical skills more likely to be associated with a relative rarity of reactivation of the right hemisphere language centres. Literacy would also be salient, with illiterate individuals less analytically aware of their language, and therefore less primed for that deactivation.

Furthermore, if literacy is one powerful determiner of a tendency to focus on language (see also the discussion in section 5:5), then preliterate individuals (i.e. children under, say, five years old) would be less likely to deactivate the right hemisphere mechanisms. This would mean that, all in all, left hemisphere damage would appear to affect their language less severely, or perhaps less uniformly from occasion to occasion. As described in chapter 4, there are indications that children under five are affected differently to adults by localised brain damage. But as the development of analytic ability in general, as well as the acquisition of strategies for the easy accomplishment of many every day tasks is not yet complete in children of that age, any further attempt to draw support for the Focusing Hypothesis from this particular type of data would be speculative.

In Japanese brain damaged patients, differences in the ability to read the *kana* and *kanji* scripts have attracted much attention. Much of the discussion centres around the symptoms of *deep dyslexia* (Coltheart et al 1980) which is not an area explored in any depth here²². The indications from clinical studies (e.g. Sasamuma 1980) and from psycholinguistic ones (e.g. Shimada 1981) are that the processing of the syllabic *kana* script is more left lateralised than that of the logographic *kanji* script. Code (1987) cites studies which have found normal subjects to more accurately report *kanji* words presented to the left visual field and *kana* words presented to the right visual field (p.55). As *kanji* characters cannot be segmentally analysed for the purpose of gaining phonological information, it is generally supposed that they are processed holistically and that is why the right hemisphere re-

22. See the Concluding Remarks.

sponds to them so well. As many of the articles in Coltheart et al (1980) observe, speakers of languages with a non-logographic script also appear to process words holistically, rather than by phonological segmentalisation; but for them it is a convenient option, not a necessity.

The *kana-kanji* phenomenon provides some valuable support for the Focusing Hypothesis, because it illustrates what could be the results of the enforced adoption of certain strategies by one literate community, while a wider range of strategies is available in another. Specifically, to focus on the written form of a word and to analyse it segmentally would have no value where it was represented by a logogram, so the only time such a strategy would be adopted would be when the character was first learnt. Conversely, alphabetic or syllabic scripts could be read either way, and so the strategy options would remain open. Furthermore, for Japanese speakers there might be little advantage to a holistic approach to *kana* words, as they tend to be used mostly for grammatical 'function words' etc. The preferred strategies in Japanese would operate by default. Thus, after left hemisphere damage, *kanji* reading would be less affected than *kana*, because even the tendency to focus on language as a response to the disabilities would mostly fail to force such a shift in processing. Where it did, *kanji* would be disrupted. The Focusing Hypothesis predicts that the left hemisphere would only have access to the original mnemonics associated with learning the character up to the point where it became automatised. However, this might be enough to enable some level of reading ability, subject to the disruption initiated by the localised damage. The possible effect of right hemisphere damage on Japanese patients is dis-

cussed in section 5:3.2.1 below.

It might seem timely and necessary to examine now the way the Focusing Hypothesis accounts for different types of aphasia (e.g. Wernicke's, Broca's, conduction and even dynamic aphasia (as described by Luria & Tsvetkova 1970) etc.). However, no account will be offered here for two reasons. Firstly, the symptoms of aphasia which can be most reliably observed and quantified relate to production. This is not to deny, of course, that comprehension difficulties are also associated with many forms of aphasia. As no attempt has been made here to systematically explore the output aspect of the Focusing Hypothesis, it would be impossible to contribute in any useful way to the discussion. Secondly, aphasia is generally defined, because of its specific association with left hemisphere damage, as a problem exclusively pertaining to the left hemisphere and its malfunction; in addition, the Focusing Hypothesis holds that in the characteristic language-focus condition of the aphasic, there is little or no right hemisphere involvement.

5:3.2 RIGHT HEMISPHERE DAMAGE

IF THERE IS DAMAGE TO THE RIGHT HEMISPHERE LANGUAGE CENTRES, THE LEFT HEMISPHERE WILL SIMPLY TAKE OVER, AT THE EXPENSE OF THE JUXTAPOSITION OF PROPOSITIONS.

This prediction addresses the obvious question of why, if the right hemisphere is normally involved in language processing, right hemisphere damage is not usually associated with language disability. The answer, then, lies in the recognition that, as the right hemisphere does not know anything that the left hemisphere didn't 'teach' it (see chapter 1:8), the left hemisphere is equipped to adopt all processing, and to exclude the right hemisphere from any contribution. But the ad-

option by the left hemisphere of this task distracts it from focusing on other levels, including the propositional, so that, while language processing remains intact, those other levels are disrupted.

5:3.2.1 DISCUSSION

Just as, in normal individuals, left hemisphere low-level linguistic processing, initiated by language focus, would make it more difficult to understand the relation of propositions to each other, and therefore to follow and evaluate an argument, so the general adoption by the left hemisphere of language processing after right hemisphere damage would lead to the same failure in propositional juxtaposition. Right hemisphere damage, then, would be characterised by apparently normal comprehension and production but a failure to appreciate the relationship which an utterance had to its context. It could be speculated, then, that a right hemisphere damaged patient might hear, understand and be able to repeat and paraphrase a sentence like "*its time for us to go to the shops now*", but would still not get up and put his coat on. Such problems, rather than being associated with language deficits *per se* might be considered a sign of absent-mindedness, loss of alertness, confusion etc. Gainotti et al (1983) make reference to an association of "subtle language disturbances", by which they mean phonological errors in repetition, perseverations in speech and writing, some semantic-lexical errors, etc. (p.150f), and "widespread mental deterioration" in right hemisphere damaged patients (p.151).

Support for the prediction is found in Gardner et al (1983), and, to a limited extent, in Van Lancker (1987)²³. Gardner et al (1983) ex-

23. See the Appendix, A5:3 for examples from Van Lancker (1987).

amined the abilities of right and left hemisphere damaged patients, normals and ageing normals in a series of linguistic tests requiring the ability to understand and recount narratives, to recognise contextual incongruities and, for a range of humorous items and foils, to assess 'funniness'. The results of their study confirmed their hypothesis, that right hemisphere damaged patients:

lack a full understanding of the context of an utterance, the pre-suppositions entailed, the affective tone, or the point of a conversational exchange...[and] appear to have difficulties in processing abstract sentences, in reasoning logically, and in maintaining a coherent stream of thought. (p.172)

Their appreciation of stories and jokes appeared to be disrupted because "the basic scaffolding...has not been apprehended" so that the patients were "unable to judge which details matter and what overarching points they yield" (p.187). In humorous items they could recognise types (e.g. puns are funnier than foils (p.184)) but could not rate how funny different items were.

An obvious explanation for all these observations, and the one which Gardner et al (1983) implicitly adhere to, is that the left hemisphere processes language as it always has done and the deficits indicate what the right hemisphere would have been doing if it hadn't been damaged. They appear to relate their observations to the known characteristics of right hemisphere processing in two particular ways. Firstly, by observing that:

such patients exhibit clear and recurring difficulties relating to the abilities to conceptualize the unit as a whole. (p.187)

In this way they seem to make a connection between the appreciation of propositions in context and a holistic approach to semantic input. Secondly, they observe side by side the deficits already mentioned and

the loss of intonational features (p.172,178) and of emotional congruity (p.178f,185), which right hemisphere damaged patients display in dealing with the input presented to them.

These two assumptions can be challenged. With regard to the first, it is open to question whether the appreciation of propositions in relation to each other and to the real world is a holistic or an analytic process. The argument presented in relation to the Focusing Hypothesis has been that it is the latter, because it involves the juxtaposition of one idea with others. As for the second, there does not appear to be any reason to directly associate the two phenomena of a deficit in the *plausibility metric* (Gardner et al 1983:186) and a loss of the ability to produce and interpret intonational contours and emotive force in utterances. While, as already discussed, the former would be considered, in terms of the Focusing Hypothesis, a result of overloading on the left hemisphere, detrimentally affecting an intrinsically left hemisphere process, the Focusing Hypothesis would attribute the latter directly to the damage to the right hemisphere, that is, as a loss associated with the total abandonment of the right hemisphere language processing mechanisms.

If, as suggested here, the intonational and emotive parameters of an utterance are directly linked to right hemisphere language processing, three things could be expected to occur. Firstly, focus on language by normals would detract from the ability to correctly interpret or, in production, incorporate, these cues. This might explain why a beginner in reading, when reading aloud, i.e. via non-automated left hemisphere mechanisms, is unable to intone naturally. Hand in hand with this would be the failure on the part of that beginner to fully

take in and evaluate the propositions contained in the text, because language focus distracted him from this. Secondly, in left hemisphere damage, unexpected utterances, associated here with a freeing of the right hemisphere mechanisms for production (see above), would be associated with the expression of extreme emotions. Thirdly, in right hemisphere damage there would not be any mis-functioning, only a failure to function, of the intonational and emotional parameters, so that utterances would be devoid of intonational patterns and colour, not assigned inappropriate patterns of it, as might be expected if the right hemisphere areas were permitted to still partially operate. All three predictions appear to be generally supported.

The failure of right hemisphere damaged patients to appreciate humour even though they knew it was there (Gardner et al 1983:184) can be explained by recalling that the activity of the left hemisphere in language decoding would detract not only from propositional evaluation (disrupting the comprehension of situational humour and stories) but also other levels of potential focus (disrupting the juxtaposition of words in their environment to appreciate puns etc.).

A Japanese right hemisphere damaged patient, who had been accustomed to process *kanji* characters in the right hemisphere only, there being no value in focusing onto form (see section 5:3.1.1 above), would be predicted to lose his ability to read *kanji*²⁴, but only temporarily. This is because the left hemisphere is the learner, the innovator, and it would be equipped to work out once again the information which the

24. Once again, it is to be noted that this discussion of a reading deficit is, strictly speaking, beyond the scope of this work, and the remarks made here have only very limited value outside of a full discussion of the acquired dyslexias.

right hemisphere had been operating with, and to use that to recognise forms. It would do this in the same way as it was able to focus on the word or phrase level in preference to the alphabetic level in other languages.

5:3.3 OTHER CLINICAL ISSUES

5:3.3.1 PREDICTION: THE TOKEN TEST

IN THE TOKEN TEST, THE CLAUSAL STRUCTURE OF THE TEST ITEMS DETERMINES THE PATTERNS OF SUCCESS FOR DIFFERENT TYPES OF SUBJECT

The right hemisphere, working alone, could deal with single clauses. Commands containing more than one clause could be dealt with only by a separate decoding and execution of each part, so that success would be more likely where the temporal sequence in the command matched that of the required actions (e.g. *After picking up the green rectangle touch the white circle*) than where it did not (e.g. *Before touching the yellow circle, pick up the red rectangle*). It would be unable to deal with interacting clauses like *if...then* or *Instead of x do y*²⁵. As coordinations of the kind used in parts III & IV (e.g. *Touch the (small) red circle and the (large) blue rectangle*; see chapter 4:1.1.3) have only one verb they are counted by the Focusing Hypothesis as single clauses (see chapter 2: 3.1.1). However, if they exceeded the general or acquired limitations of the short term memory, then they might be treated as separate clauses. In this case, success in the second clause would depend on the individual's ability to reconstitute the gapped verb. This would be aided by the exclusivity of the one verb 'touch' in parts I-IV (see below) and the reinforcement achieved through physi-

25. For a list of the commands in part V see A5:4 in the Appendix.

cal response on previous trials.²⁶

The left hemisphere could decode and juxtapose the content of clauses provided it was not prevented from doing so by damage. Language-focus, brought on by stress, might lead to some difficulty with prepositions and temporal adverbs, if they were decoded in isolation, as such words have a meaning which is directly dependent upon the context in which they appear. The limitations on short term memory would depend on the size of the item stored (cf. the Papçun et al 1974 experiment, described in chapter 4:1.2.5.1.2).

Because of the likelihood of variation in the involvement of the right and left hemispheres during language in different kinds of patient, it may be seen that slightly different predictions are made for each.

Assuming an increased left hemisphere activity under stress (section 5:3.1 above), aphasics and commissurotomed patients would be most affected by stress with the former employing the damaged mechanisms and the latter, in right hemisphere presentation, perhaps unable to respond at all unless via external cueing (assuming that no strategy had been learnt for preventing this 'migration' of functions). It is predicted that stress would have no effect on performance during a left hemisphere presentation to commissurotomed or hemispherectomised patients. In children, the lack of an adult-type strategy option range, and particularly, a reduced ability to approach tasks analytically, might mean that stress had to be greater to have an effect, but that that effect would be strong, as the left hemisphere easily became overburdened. As no groups at all would be using what might be termed an

26. For a description of parts I-IV see chapter 4:1.1.3.

optimal processing route, all would be subject to restrictions in the short term memory. Of most interest is the observation that some items in part V would be easier than those in parts III and IV, but others would be very much more difficult. Thus, the average performance on part V might be unexpectedly high.

5:3.3.1.1 DISCUSSION

Neither of the studies to be discussed here (Whitaker & Noll 1972 & Zaidel 1977) takes any account of a possible change in performance as a function of stress. This inevitably means that there is no way of telling whether or not the observations made relate to a strategy in which the right hemisphere is as active as it could be. All the same, some points of interest can be highlighted from the accounts.

Zaidel (1977) reports that an analysis of error patterns revealed "a consistent difference between the structure of the linguistic competence of 4 year old children and that of the disconnected right hemisphere²⁷" (p.8). He takes this as an indication that increased right hemisphere language processing is not a feature of child language. The Focusing Hypothesis, on the other hand, sees it as a sign of a wider, though imperfectly formed, strategy option range in children, who use left hemisphere processing with some, though limited, success.

Zaidel (1977) also found that the right hemisphere of hemispherectomised and commissurotomised patients was generally less able to cope with the test than the combined right hemisphere and damaged left hemisphere of aphasics. The difference was most marked in parts II and IV, where the instructions were longest and the choice of tokens on the ta-

27. i.e. in commissurotomised patients.

ble was largest. It was less marked in part V (p.8). This pattern is predicted by the Focusing Hypothesis if it is considered to be the case that the right hemisphere, encountering sequences of more than a certain length, has to break them down into parts and process each part separately in sequence. Some items in part V would be easier than others for the right hemisphere (see below), increasing the mean score. This is further borne out by Zaidel's observation that the right hemisphere users scored higher on part V than they did in parts II and IV (p.8). The heterogeneity of the stimuli in part V is noted by Zaidel:

the right hemisphere and many aphasics may be selectively hampered by different linguistic structures in part V. (p.9)

One source of difference between the hemispherectomised and commissurotomised patients using only their right hemisphere and those with a damaged left hemisphere appeared to be in the difficulty of processing grammatical particles. The former group had little problem with verbs relative to other parts of speech, some problem with particles, but most with colour and shape adjectives. The left hemisphere damaged patients made more particle errors than anything else (Zaidel 1977:10). This corresponds to the predictions of the Focusing Hypothesis, whereby the right hemisphere would cope with particles because they were stipulated within a formula, as long as their semantic scope was confined to one clause. It would be able to assign formulae by referring to the verbs. But colour and shape would be problematic because there was choice and no redundancy of information, so that the separate defining features of the tokens described in the command would have to be extracted and assessed relative to the array of tokens on the table. Conversely, the damaged left hemisphere would be able to manage such jux-

taposition (assuming that there was no damage specifically to the mechanisms for that function), but in the sequential analysis of the linguistic structure itself, the particles, strongly bound to their context, would be found to have limited semantic autonomy, and focusing upon them would make them even harder to assign meaning to.

Particularly interesting is Zaidel's (1977) remark that:

The right hemisphere [in commissurotomed and hemispherectomized patients] is superior to the average aphasic on the syntactic dimensions of the test but inferior with respect to memory. (p.12)

It does not seem unreasonable to rephrase this in the terminology of the Focusing Hypothesis, and thus to say that the right hemisphere is fine on the decoding of linguistic packaging (formulae) but cannot deal with the longer, more complex sequences.

Whitaker & Noll (1972) pay more direct attention to the linguistic structures involved in part V. They note both that at that point "for the first time in the Token Test the subject is required to process two verbs" (p.402) and that, on the other hand, "not all [items in part V are] more difficult or complex than those of the other parts" (p.398). They list the eight most problematic commands for the children in their study:

- 3) 43. Touch the blue circle with the red square. (168 errors)
 44. Touch, with the blue circle, the red square. (122)
 45. Touch the blue circle and the red square. (101)
 51. Touch the white circle without using your right hand. (77)
 54. Touch the squares slowly and the circles quickly. (77)
 59. Together with the yellow circle, take the blue circle. (81)
 60. After picking up the green square, touch the white circle. (99)
 62. Before touching the yellow circle, pick up the red square. (121)
- (p.398)

All of these sentences except (45), discussed below, are complex in some way. (44), (51), (59), (60) & (62) are multicausal; (43) & (62) are not sequenced according to the actions required; (54) arguably requires

treatment as two clauses because of the restricted scope of each of the adverbs. Regarding (45), it is actually no different to a part III stimulus and so it is surprising that it should cause particular difficulty. Whitaker & Noll (1972) address this with the observation that their subjects, who were normal children aged 5;5 to 11;11, performed well on parts I-IV, having no difficulty with the command 'touch' but that in part V, it "suddenly [became] difficult to process" (p.399). In part V, 'touch' is one of a selection of verbs appearing in the commands. For the first time, perhaps, the verb had to be decoded on each trial, rather than being taken for granted. They note that 'touch' did not appear to have a clear semantic identity for some of the children, and this may have made it difficult to understand relative to the other verbs ('pick up' and 'take'). They hypothesise that the complexity of 'touch' might be to do with the implicit, rather than explicit, instrumental and locative entailments that it has (p.400).

The examples given in (3) above are representative of the list administered by Zaidel (1977) even though Whitaker & Noll used the Boller & Vignolo (1966) version and Zaidel used De Renzi & Vignolo's (1962) and Spreen & Benton's (1969) versions. What is clear from Zaidel's full list of part V items (see Appendix, A5:4) is that not all of the unsequenced multiple clauses in the test caused as many errors as the ones listed above. But as the subjects used in the two studies were different, it makes little sense to compare them beyond this point.

The quotes from Zaidel (1977) given in chapter 4:1.1.3 correspond well with the predictions of the Focusing Hypothesis, particularly relating to the apparent inability of the right hemisphere to form "stable internal representations...in response to sequential bits of se-

mantically unrelated information" (p.11).

5:3.3.2 THE OBSERVED ABILITIES OF THE RIGHT HEMISPHERE

The discussion above has dealt implicitly with many of the observations which have been made regarding some limited linguistic ability in the right hemisphere. Nebes (1978) throws his own light onto the abilities of commissurotomed patients. Referring to a case reported by Gordon (1973), where the patient performed with his left hand an action the command for which had been presented to his right ear in a dichotic presentation, he says:

This successful execution of a command took place while the left hemisphere was occupied by its own instruction and thus unable to obstruct minor hemisphere output. (p.111f).

This, then, is support for the Focusing Hypothesis, which sees right hemisphere participation as the normal consequence of focus elsewhere by the left hemisphere.

One observation which has been made about the right hemisphere in regard to language is that language handicap following right hemisphere damage is reported to be more common in children under five (10-35%) than in adults (less than 1%) (Moscovitch 1977:22; but see the contradictory observations of Satz & Bullard-Bates 1981, quoted in Code 1987: 15f). This could be seen to reflect two aspects of the processing model defined by the Focusing Hypothesis. Firstly, that language acquisition occurs by processing the known structures holistically so that the analytic mechanisms are free to deal with the unknown by means of a simultaneous employment of unconscious analysis and propositional focus. Thus, the right hemisphere is particularly crucial during acquisition. Once the mechanisms of unconscious analysis are less active,

there is more scope for language-focused decoding to occur without an overload of the analytic system. Secondly, the child has not yet learnt to be analytic and to operate strategies which select the left hemisphere and use it to advantage.

Moscovitch (1983) is quite explicit in expressing his belief that the right hemisphere has substantial, but masked, linguistic ability:

Whatever the reason, the right hemisphere's inherent abilities are not reflected in normal performance, and the functions therefore appear to be localised to the left. (p.64)

The rôle of the right hemisphere in reading is explored by Coltheart (1980). Given the various indications that normal reading involves the recognition of words as wholes (in parallel to *kanji* processing in Japanese, see section 5:3.1.1 above), which the right hemisphere is better at (Code 1987:54), and that the left hemisphere's parallel phonological processing route is slower, the implication is that the right hemisphere is largely responsible for routine reading processes.

Finally, Code (1987) explores the possible rôle of the right hemisphere in real-word recurrent utterances (RWRUs) (p.66f). These are short phrases repeated involuntarily by some aphasics. The association of these lexicalised strings, produced holistically, with the intact right hemisphere is pertinent to the discussion in chapter 2:2.2 regarding *automatic language* and also to the exploration, in section 5:6 below, of Pawley & Syder's (1983) output model.

5:3.4 SUMMARY AND COMMENTS

There is no shortage of plausible accounts for the effects of left and right hemisphere damage upon language and other functions. The Focusing Hypothesis is not the simplest, but it has the advantage of in-

voking for pre- and post-damage linguistic ability the same general mechanism, viz. the sharing of functions by the two hemispheres in the way most advantageous for, or otherwise preferred by, the individual in his specific pre-aphasic situation.

Two accounts of the symptoms of right hemisphere damage have been presented. One is that the left hemisphere processes language, the right hemisphere propositions. The other, provided by the Focusing Hypothesis, is that the right hemisphere normally processes language, the left hemisphere propositions, and that right hemisphere damage leads to a transfer of the former functions to the left hemisphere, at the expense of the efficiency with which the latter can operate. Undoubtedly, the first account has the edge in terms of the Occam's Razor Principle. On the other hand, that is only the case insofar as no other evidence, external to the examination of the symptoms of right hemisphere damage alone, contributes to the complexity of the picture. Previous sections in this chapter and also chapter 4 have indicated that they do indeed present data of such a kind that the accounts normally provided may fall short in some crucial ways.

5:4 PREDICTION: NEUROPHYSIOLOGICAL EVIDENCE

IF THERE WERE SOME WAY OF MEASURING HEMISPHERIC ACTIVITY DURING LANGUAGE PROCESSING WITHOUT DRAWING THE SUBJECT OR PATIENT'S ATTENTION (FOCUS) ONTO THAT LANGUAGE, THEN A GREATER MEASURE OF RIGHT HEMISPHERE INVOLVEMENT MIGHT BE DETECTED THAN IS FOUND IN THE PSYCHOLINGUISTIC LABORATORY OR IS IMPLIED FROM CLINICAL STUDIES.

Apart from experiments using the tympanic thermometer, a new means of measuring hemispheric bloodflow, but not yet widely used in experimental linguistics (see chapter 6:4), the method of examination which most closely (but not perfectly) answers this description is the *in vi-*

vo dynamic testing of metabolic exchange or electrical emission, described below. The Focusing Hypothesis predicts that in propositional focus the two hemispheres would be found to both be active: the right hemisphere would be dealing with the language, the left hemisphere with the evaluation of the propositions. It is important to note that a greater measure of activity in the right than the left hemisphere is not predicted, as the right hemisphere only becomes active (in language processing at least) where the left hemisphere is operational as well.

5:4.1 INTRODUCTION

A considerable challenge to the theory of left lateralisation comes from medical investigations of brain cell activity in live subjects. Much of this research has revealed virtually equal activity in both hemispheres during linguistic processing:

[none of our research has] yet found any striking difference in cortical activation between right and left hemisphere during complex behavioural processes which involve speech. Our conclusion so far is that in normal brain both hemispheres are highly active. (Larsen, Skinhøj & Lassen 1979:37)

the most parsimonious interpretation is that both hemispheres are involved in some manner in the processing of linguistic information. This is not to say that the processing need be altogether similar in the two hemispheres. (Roemer & Teyler 1977:58)

These two quotations are from reports referring to two distinct methods of measuring cellular activity in the brain during language, and neither have found significant differences between the hemispheres in this respect. Some of the most common techniques of brain activity measurement are briefly described below, along with the results obtained from them. Details of some other methods not mentioned here (e.g. positron emission tomography) can be found in McAlister (1979), Larsen, Skinhøj & Lassen (1978:193f) and Code (1987:20). All the experimental

procedures described below refer to dynamic studies, not to steady state ones. That is, they measure changes in patterns of cell activity as the subject performs different tasks, rather than mapping physiological structures (as, for instance, in Fazio, Fieschi, Nardini, Collice & Possa 1979). In all these tests subjects tend to be patients who have had strokes, tumours or epilepsy (Lassen, Ingvar & Skinhøj 1978: 53). Controls are neurological outpatients with minor, unrelated damage. For example, Lassen et al (1978) believe that 80 or so of their 500 subjects were representative of the normal population. They were individuals who were being examined on account of bad headaches or epileptic fits which were found not to relate to any (detectable) brain damage (p.53; see also Larsen et al 1978:194f).

The first two methods described here use computerised imaging to provide detailed profile coloured grid representations of the brain from the monitored information. The equipment is briefly described by Larsen et al (1978:195). Different concentrations of the detected emissions are represented by different colours. The information is gathered by means of sensors attached to the scalp. In Lassen and Larsen's laboratories 254 detectors are used, each covering approximately one square centimetre.

5:4.2 RADIOACTIVE TRACING

Dynamic studies require the ability to trace some element intimately linked with cellular activity, such that alterations in its distribution as determined by the rate of metabolic exchange under different conditions can be monitored. In the two techniques described here, sensors measure relative levels of gamma ray emission after the intra-

venous introduction of a radioactive substance. As bloodflow levels are a response to the cells' need for oxygen, tracing the amount of blood directed to each area of the brain provides a clear picture of the cellular activity.

Images depict only the surface of the brain (but see Fazio et al 1979 for attempts at tomography). They are constructed by computer from a baseline comparison with the brain 'at rest'; this is necessary because even at rest there is an unequal distribution of cellular activity across the brain (Lassen et al 1978:53).

5:4.2.1 XENON-133

Xenon-133 is a radioactive isotope which is dissolved in a sterile salt solution and injected into the internal carotid artery or the femoral artery. Alterations in the regional cerebral bloodflow (rCBF) can then be monitored.

Larsen et al (1978) measured rCBF changes from rest in 18 right-handed subjects reciting the days of the week or counting to twenty. The most striking finding was that there was no increase in the mean hemispheric bloodflow to the left hemisphere (though there was also not the 3% decrease associated with a second reading²⁸). But there was a 10% increase in mean bloodflow to the right hemisphere, despite second readings being associated with a 10% decrease. Larsen et al (1978) suggest various reasons for this finding. For instance, the left hemisphere areas involved in that type of speech function might be activated for only a fraction of the 45 seconds across which the measurements are pooled, such that no effect would be observable (p.203). Alterna-

28. The first reading was the 'at rest' one.

tively, they might already be active during rest, in which no change would be seen. Whatever the explanation, they are clear that:

the performance of the rather simple task of spoken speech involves activation of both hemispheres (p.206)

Lassen et al (1978) report the following results:

- a) Listening to simple words increased the bloodflow to both hemispheres' auditory and auditory association centres and, in the left hemisphere, to Wernicke's area. If the patient's eyes were closed, there was some activation of the frontal eye region too.
- b) Listening to complex verbal sequences also revealed asymmetrical activity, this time in Broca's area.
- c) When the patient spoke, activity increased symmetrically, to the auditory centres, articulatory motor areas, to Broca's area and its right hemisphere equivalent. Of this finding Lassen et al say:

Studies of the effects of brain damage on speech have revealed that destruction of Broca's area in the left hemisphere results in motor aphasia, that is, the loss of the ability to speak more than simple words but not the loss of the ability to understand spoken or written language. Destruction of the corresponding area in the right hemisphere, however, has no discernible effect on speech. We were therefore surprised to observe that this part of the right hemisphere was active during vocalization, suggesting that it makes some contribution (albeit a nonessential one) to the final synthesis and mobilization of speech. (p.57-8)

Larsen et al (1978) failed to find any increased activity in Broca's area during their automatic speech task.

Lassen et al (1978) go on to suggest that the right hemisphere may play some rôle in the construction and articulation of speech. They also report an increase in bloodflow to the whole hemisphere (as opposed to localised regions) when a complex task was undertaken (p.58). Bloodflow increase has also been associated with anxiety, which "provokes a dramatic increase in one's awareness of self and the environment" (p.59). Task demands and stress levels have been named in the

course of the discussion of the Focusing Hypothesis as possible influences on strategy selection. Just what, if any, relationship these two observations may have is not a question that can be tackled here.

Larsen et al's (1979) results include the following findings. Reading aloud and visual naming tasks both led to a mean increase in bloodflow of 5% to both hemispheres (p.6). There was a greater mean increase to Broca's area (8%) than to the right hemisphere equivalent area (3%). They conclude by noting similar results in other studies, viz., that counting aloud and listening to language activate both hemispheres, so that:

our results thus confirm that many cortical areas of both hemispheres are co-operating in performing a complex task. (p.7)

Gur, Packer, Reivich et al (1979) found that during a verbal task on 36 male right-handed subjects the bloodflow to the left hemisphere grey matter increased significantly ($p < .01$). Not all of the subjects showed any similar increase during a spatial task, but those who did also performed better on it. These results support the proposal that there is individual difference in the tendency to employ the hemisphere which is best suited to a task. This is pertinent to considerations of strategy choice in processing (see chapter 1:9).

5:4.2.2 18-F-FLUORODEOXYGLUCOSE

Reivich et al (1979) have used 18-F-2-fluoro-2-deoxyglucose (FDG) to monitor the metabolic rate of the brain during different functions. The emission sensors detect the concentrations of glucose exchange between the blood plasma and the brain cells, and computerised images can be constructed (p.198). Using 17 normal male subjects, they admini-

stered visual, tactile and auditory stimuli. The last, using six subjects only, involved linguistic input:

The subject listened to connected discourse consisting of a factual story read by a male talker.... In three subjects the stimulus was delivered to the right ear and in the other three to the left ear. Attentiveness to the story was assessed by testing the subject's recall at the end of the study. In all six subjects the local cerebral metabolic rate for glucose increased 20-25% in the right temporal lobe. The stimulus caused an increase in the metabolic rate not only of the primary auditory region but of the entire temporal lobe. (p.199)

This finding is highly unexpected in the context of the theory of left lateralisation for language.

5:4.3 ELECTRICAL IMPULSE MONITORING

By attaching electrodes to the scalp it is possible to create electroencephalograms (EEGs) which trace the natural electrical impulses of the neurons. The emissions are in wave form and four are identifiable, according to the wave frequency: alpha (8-13 cycles per second), beta (14-15 cps), theta (4-7 cps) and delta (<3.5 cps). The brain states associated with each wave type are described by Guyton (1981:183f).

5:4.3.1 ALPHA WAVE MEASUREMENT

Alpha waves proliferate when an individual is conscious but in a state of rest. They are present neither during sleep nor during attention-focusing activity. In the latter case they are replaced by beta waves, which are higher in frequency but lower in voltage.

Alpha waves therefore decrease proportionately to an increase in mental activity. The emission of alpha waves from a specific area of the brain during a given task is an indication of that area's non-participation. Alpha wave measurements are valuable because they have:

the distinctive quality of occurring in well-defined bursts and

[standing] out from other activity in high amplitude, rhythmical waves. (Marsh 1978:293)

Cole & Cummings (1977) measured alpha wave emission in 3-6 year old children during the presentation of a sequence of two stories (auditory input) and, before the second story, a silent film (visual input). The children were encouraged to talk and ask questions during the stories but were told to remain silent during the film.

The results showed a trend towards low alpha wave levels in the left hemisphere and high levels in the right hemisphere during the linguistic task and the reverse during the visual task. Thus the results were:

consistent with the notion that the left hemisphere temporal lobe is more involved in ongoing verbal activity than in on-going visual activity in young children. (p.43)

However, they continue with this comment:

it is interesting to note that the pattern of results observed in the left hemisphere was reflected to a lesser extent in the right hemisphere during different tasks. In general there was an increase in alpha activity from story one to the cartoon...as found in the left hemisphere, but there was no corresponding decrease in alpha rhythm during story two. (p.43f)

This finding is interesting on three counts. Firstly it does not comply with general predictions that during a visual task the right hemisphere will be more active than (a) the left hemisphere during the same task and (b) the right hemisphere during a linguistic task (e.g. Morgan, McDonald & MacDonald 1971, cited in Cole & Cummings 1977:37). Secondly, it may indicate unpredicted right hemisphere participation in the functions associated with the processing of story one. Thirdly, it indicates some kind of variation in right hemisphere participation from story one to story two, which suggests that the brain has more than one way of dealing with a linguistic task: one which shows up as left hemi-

sphere with right hemisphere, and one which indicates left hemisphere only. As the right hemisphere was less involved in the second story, one potential explanation is that the children adopted a new strategy (using only the left hemisphere) on the basis of their experience in the earlier parts of the test. If this were to be the case, then it could explain why similar tasks done by adults produce the pattern found in the children's second story (cf. Cole & Cummings 1977:41). In other words, adults already know which strategy to adopt for such tasks, or else learn more quickly (i.e. near the very beginning of the test).

Scott et al (1979) briefly describe the findings of a study by Rogers et al (1976) in which EEG ratios were compared for Hopi Indians and Anglo-Americans. The finding was of:

a significant right cerebral hemisphere specialization for language processing in Hopi Indian children. (p.89)

Psycholinguistic experiments too have found differences between Amerindian and white American children (see chapter 4:1.2.4.1).

5:4.3.2 AUDITORY EVOKED POTENTIALS

AEP tests also monitor the differences in electrical activity under different conditions. Marsh (1978) defines Evoked Potentials as:

generally of smaller magnitude than the on-going EEG activity, ... extracted from the scalp-recorded EEG by summing together several short portions (e.g. 500msec.) of the EEG record following several stimulus presentations.... When...the portions of the EEG time-locked to the repeated presentation of a stimulus are summed, the electrophysiological responses elicited by the stimulus are accumulated, and the electrical events not tied to the stimulus tend to cancel towards zero. (p.300f)

In this way a reading is obtained which contrasts the electrical acti-

vity elicited by the stimuli (Evoked Potential) with the general background electrical activity.

Roemer & Teyler (1977) presented normal adults with linguistic stimuli which were ambiguous across lexical categories, e.g. *rock* (= a rock or to rock), *fire*, *blow* etc. While the EP patterns were different according to a noun or verb interpretation, the two hemispheres were equally involved at all times. Thus:

the observation of similar waveforms in both hemisphere suggests caution in the interpretation of the asymmetric rôle of the hemispheres in dealing with linguistic information. (p.58)

Molfese (1977), on the other hand, found marked AEP asymmetries in infants of less than 12 months old. He notes that the degree of asymmetry was, indeed, actually greater in the infants than in adults for linguistic stimuli, while non-linguistic stimuli elicited a response of equal or greater magnitude in the right hemisphere (p.195). Given the young age of these subjects, the stimuli cannot have been being reacted to on any complex semantic level, but rather, presumably, more generally, as human phonetic speech patterns (p.198).

Further tests revealed that babies responded with left hemisphere activity to both vowels and consonants. This contrasts with other, adult, studies (e.g. Studdert-Kennedy & Shankweiler 1969), which found a contrast between strong left lateralisation for consonant-distinguished minimal pairs, but weak or no left lateralisation for vowel-distinguished ones.

5:4.4 SUMMARY

The following Table (5:iii) affords a general representation of the findings of the physiological studies:

	AUDITORY	SPEECH
left & right hemispheres equally active:	Roemer & Teyler '77	Larsen et al '78 Larsen et al '79 Lassen et al '78 Endo et al '79
both hemispheres active, but left more so:	Cole & Cummings '77	
right hemisphere more active:	Reivich et al '79 Rogers et al '76 (Amerindians)	
left hemisphere active, right inactive:	Lassen et al '78 (simple words & complex sequences) Molfese '77 (babies)	

TABLE 5:iii

It is clear from the above that there is considerable variation across studies. Some of them have found levels of right hemisphere activity entirely unpredicted by the theories of left hemisphere dominance for language. Of course, the detection of neural activity *per se* does not tell us anything about the brain mechanisms directly responsible for language. But, on the other hand, no other method of measurement does either, and indeed this one permits considerably more direct association between structures and functions than most others.

5:4.5 DISCUSSION

The techniques described above have certain limitations. With regard to the monitoring of electrical activity, Larsen et al (1978) comment that:

they afford only a rough localization and one furthermore influenced by artifacts, especially when recorded from the scalp....
(p.193)

Larsen et al (1978) and Lassen et al (1978) are equally cognisant of the problems with their own technique, however. Firstly, tests are only of very short duration, due to the speed with which the tracer is

dissipated (Lassen et al 1978:59). Secondly, only one hemisphere is examined in any one patient. This means that the left-right contrasts could be due to individual differences in the hemispheric localisation of functions (Lassen et al 1978:204). Thirdly, some areas of interest to the general picture of hemispheric activity are not supplied by the carotid artery (e.g. the primary visual cortex and the hippocampus, which are supplied by the vertebral artery (Lassen et al 1978:55)). These cannot be monitored, as their blood supply does not contain the isotope. Fourthly:

these results mainly reflect events in the superficial layers of the cortex and leave out deeper structures. (Lassen et al 1978:59)

Equipment is, however, now in existence for taking three-dimensional readings (p.59).

The level of support which these results offer the Focusing Hypothesis is not entirely clear, even though there is such strong evidence of right hemisphere participation in what have been generally considered left hemisphere functions. The reasons for holding reservations are as follows. Firstly, some of the measurements are of output; the Focusing Hypothesis as expounded here has dealt almost exclusively with input. This is probably not a point of any great consequence, however, as there is no clear indication that it is only input (as in Larsen et al 1978) that shows signs of right hemisphere participation; the other studies described bear this out. Secondly, the nature of the input or output is not particularly representative of normal proposition-focused language. Larsen et al (1978) explicitly restrict the generality of their remarks to precisely the kind of automatic language which they elicited from their subjects; this was a linguistic activity "not re-

quiring any mental effort, verbal commands or emotional involvement" (p.195). It could well be asked just how representative observations of such language processing could be expected to be of the operations involved in normal language, which certainly does entail mental effort, reaction to verbal input and emotional involvement.

Other studies, observing two-way conversation, would be of greater value for the evaluation of the Focusing Hypothesis, but though such work is mentioned by Larsen et al (1978:206) they do not reference it. On the other hand, as outlined in chapter 2:2.3.3, *automatic language* need not be set so far apart from the material dealt with in proposition-focused processing. The automaticity with which lists and paradigms can be produced may simply be a less transient operation than its sister procedure of novel language processing, the latter being peculiarly prone to strategy changes initiated by alterations in focus level.

One issue remains to be addressed: what is different about these studies, to set them apart from those which find no evidence of right hemisphere involvement in language processing? Lassen et al (1978) observe that:

the right hemisphere is much more active during speech than the tissue-damaged approach has suggested. (p.50)

Larsen et al (1978) note that while the patterns of localised CBF increase correspond to the ones identified by Penfield & Rasmussen (1949) using electrical stimulation to instigate aphasic symptoms in specific regions of the cortex, their findings are at odds with Wada test results (see chapter 3:2.2.4). One possible explanation for this is that to debilitate one hemisphere leads to compensatory action by the other where this is possible. In this way, the left hemisphere

might achieve all functions usually shared with the right hemisphere during right hemisphere anaesthetisation, while, during left hemisphere anaesthetisation, the right hemisphere was unable to reciprocate, if only because of a language-focused strategy. The techniques described in this section are unique in not selectively debilitating one hemisphere or else setting the two hemispheres into some kind of enforced competition. This is a major consideration if it is held to be plausible that it may be exceedingly easy to upset the balance of some hemispheric job-sharing which characterises normal processing. In the same vein, it is much easier to explain why there are differences in the measures of right hemisphere activity evidenced through these and other less direct methods of measurement such as psycholinguistic tests. Despite the measure of unnaturalness which is inevitable where a subject is chanting the days of the week at one second intervals, lying flat with his eyes covered and ears plugged, surrounded by equipment and wired up with 254 sensors on the scalp, nevertheless there is not the same pressure to perform well, to concentrate on complex stimuli or to get better at speaking and comprehending (as with aphasics), which characterise the investigative circumstances of other study methods.

5:5 POLYGLOTS²⁹

5:5.1 INTRODUCTION

Despite the considerable attention which has been paid in both psycholinguistic and clinical research to the question of brain function in relation to the processing of more than one language (see chapter

29. The use of 'polyglot' where others would use 'bilingual' rather jars in some places, but it has been retained for the sake of consistency (see Notes on Terminology).

4), not very much more can be said about the Focusing Hypothesis in this context than has already been expressed elsewhere. Indeed it is this very fact that is perhaps the most striking feature of the Focusing Hypothesis in this area of study. Just as many facets of language acquisition and processing in general have been, so to speak, streamlined into one account by, for instance, (1) projecting the operation of the same interaction of processing mechanisms into both the formulation of hypotheses by the child and the tackling of new or problematic structures in adulthood (see chapter 1:9) and (2) accounting for the problems associated with aphasia in terms of an extension of processes already operational in the pre-aphasic (i.e. normal) condition (section 5:3), so here also, the operations of the second language 'acquisition', 'learning' and/or processing devices are viewed as precisely the same as those which deal with L1, such that the whole field of psycholinguistic and clinical study into L2 is, essentially, demystified rather than separately and minutely explained in terms of some specialised and perhaps unprecedented principles.

The applicability of the Focusing Hypothesis' general account across so many different aspects of linguistic investigation is possible because of the nature of the processing operations it describes. As chapter 4:3, 4:4 illustrates, there is no shortage of acquisition and storage hypotheses in the L2 related literature. However, such specific and exclusive language storage arrangements, if they are indeed environmentally determined (e.g. by age, stage and manner of acquisition), are presumably potentially available to all and thus, in their embryonic form, redundant in the monolingual majority. This separation of L2-specific mechanisms from general processing ones is shown to be

gratuitous from the perspective of the Focusing Hypothesis.

The manner and environment in which the second language is acquired is considered the central influence upon the strategies preferred for operating in it. The contrast of formal and informal acquisition has been well explored by others (see chapter 4) but most notably by Krashen, who envisages a different level of consciousness in informal 'acquisition' and formal 'learning', which correspond well with the Focusing Hypothesis' proposals regarding the rôle of the analysis of structures and focus.

As Western education is so strongly biased towards analysis, in that it encourages a mathematical or scientific approach, characterised by the expectation of cause and effect as the salient operators in the relationship of items and ideas, it is not surprising that L2 learning in the classroom should be presented and received as if it were a code, not a language that was being learnt (cf. here also Chomsky 1968). Two particular characteristics of L2 'learning' can be particularly considered. Firstly, that the L2 is presented as a regular system with separately itemised exceptions (e.g. irregular verbs). This is clearly a legitimate way of presenting the information to people who have been taught to formally identify linguistic order, and it does, of course, encapsulate in some way a process which operates automatically in the child, viz. the identification of patterns and the forming of hypotheses which may overgenerate. But this conscious attention to form out of its communicational environment is not 'natural', as is witnessed by the fact that individuals cannot always easily identify irregularities in their language if they have not been taught them.

Secondly, vocabulary is presented and/or received in equation form,

e.g. avion = aeroplane, Blumentopf = flower pot. This ensures that the points at which two languages do not overlap will be problematic, whether these reflect major cultural differences (e.g. paniir (Hindi) = a kind of curd cheese a bit like quark...) or not (e.g. Wald (German) = forest and wood (group of trees), Holz = wood (material)).

It clearly is not impossible to transfer from the strategies associated with analytic processing to ones permitting propositional focus and holistic decoding. This might be characterised by the feeling that it is now possible to 'think' in the language. Just how easily this transfer occurred would, however, depend upon the strategy range available. If the language has never been used for interaction, then propositional focus may not be an option. It would depend too upon the flexibility of the individual to choose (or develop) a different strategy to the customary one. As the use of a language for fluent communication does entail, for the non-native speaker, 'throwing caution to the wind' and permitting mistakes in the grammar and pronunciation, the personality of the individual would be expected to play an important rôle. This again conforms with Krashen's *Monitor* model, with the most successful polyglots being those who are in control of their Monitor use (Krashen & Terrell 1983, Dulay, Burt & Krashen 1982, Krashen 1976, 1978).

5:5.2 PSYCHOLINGUISTIC EXPERIMENTS

Beginning, then, from the standpoint that the systems and processes available for L1 are the same and the only ones available for L2, the assumption will be that polyglot behaviour in the psycholinguistic laboratory will reflect the same limitations and biases as those argued

to dominate monolingual studies (see section 5:2). These will include a high level of inconsistency in the findings, caused by the interaction of mostly uncontrolled variables affecting the range and selection of strategies, and the intrinsic limitations imposed by the nature of the tasks, the stimulus presented and the subjects tested (see section 5:2).

It is not necessary to invoke some specific rule for storage like the compound-coordinate opposition (chapter 4:3.1.1) in order to account for the characteristics of information access in subgroups of polyglots. Neither is it necessary to highlight features of 'acquisition' or 'learning' *per se* to provide a baseline for behavioural differences in the laboratory. The contrasts which these accounts are designed to explain fall neatly out of the Focusing Hypothesis as it stands, by simply assuming that when an individual, of any age, tackles a new language, he uses the neurological and psychological resources he already both possesses and utilises and, specifically, that he uses them in the way in which he is accustomed to deal with information of the same kind as he is now presented with in his encounter with that new language. This is not to deny, for indeed it is fundamental to the account, that man is a learning creature. He will develop new strategies but, crucially, only in response to specific needs. Rather than saying, then, that some forms of teaching better equip a language learner to translate because they set up some compound as opposed to coordinate relationship between the L1 and L2, the question can be addressed in a rather more rational and simplistic way; thus it is suggested that perhaps one L2 speaker can translate better than another because he has learnt (or otherwise developed the strategies necessary)

to do so. This is not a truism, nor even gratuitous, because the development of strategies to make up a greater or smaller range of options is central to the account of how people operate their language which the Focusing Hypothesis provides.

Closely on the heels of the proposal that the ability to switch from language to language is a direct reflection of how the individual has chosen, or been directed, to deal with the relationship between them (i.e. that new links are forged as they are required and not otherwise), comes the idea that all contrasts in L1 and L2 performance in psycholinguistic experiments reflect contrasts in the way those two languages are regarded and/or employed. Furthermore, individual variation in the use of knowledge already acquired could lead to some polyglots transferring strategies learnt in relation to, say, an L2 *lingua franca* used as the medium of literacy, back onto the previously unanalysed L1, while other polyglots did not.

Certain specific predictions can be made and tested (to some extent) against the reports in the literature:

- a) There may be considerable variation across studies due to a variety of strategy determining factors.
- b) Similar patterns of behaviour will obtain where both languages have been and are treated in the same way with respect to self-monitoring, literacy etc.
- c) Different patterns of behaviour will obtain where the languages are used for different purposes (e.g. communication versus formal analysis) or where their acquisition has involved the development of different strategies in relation to each.
- d) Pertaining to the above, individual differences (but perhaps with group tendencies) may exist in the extent to which a strategy is transferred from its operation in one language to the other.

Unfortunately, these individually quite legitimate predictions do, be-

tween them, cater for more or less every eventuality. The first prediction is borne out by Tables A4:i-ii (Appendix). The references given there are, of course, far from exhaustive, but they do illustrate that the early-late and formal-informal categorisation of bilinguals' acquisition is not particularly helpful, at least on its own, as a means of predicting relative hemispheric activity in L1 and L2.

The second prediction, that a similar usage and attitude towards the two languages will result in similar behavioural patterns is, of course, not dissimilar to the *age-stage-manner* predictions and observations described in chapter 4:3. It can be plausibly argued that a language learnt or acquired after childhood, perhaps even after early childhood, (cf. Sussman et al's 1982 finger tapping experiment, where L1 and L2 patterns were the same for subjects who learnt L2 before the age of six, but not after six (Oblor 1984:201), see account in chapter 4:4.1.1) will be viewed in a different way to the mother tongue. Yet this must be qualified with the observation that this depends upon the linguistic environment in which the subject is operating. An expatriot will surely utilise and view his L2 in a very different way to the home-based individual who 'switches on' his L2 only in a particular, marked and perhaps rare environment. Carroll (1980) believes that "in a nonformal setting adults can reinvoke childhood acquisition processes" (p.84). This he considers to be compatible with the observations that adults are most prone to use different, monitoring strategies, while "young learners focus on something else entirely" (p.85), because some teaching methods used with adults may be successful in overcoming those natural adult tendencies, and "may influence processing strategies" (p.84). He believes that:

the extremely intensive nature of an immersion program may pre-

clude internal analysis of components and allow or force learners to reactivate earlier learning strategies. (p.85)

Despite Carroll's (1980) assertions that an L2 may be learnt in adulthood via the L1 acquisition mechanisms and, more importantly, despite the potential for this for which the Focusing Hypothesis argues, the examination of prediction b will address only those studies dealing with early acquisition. The reason for this is that the operation of L1 acquisitional strategies in adulthood is considered unlikely in populations of literate, Western-educated subjects, as the analytic strategies developed for other learning will prevent it. However, this is not to suggest that informal L2 acquisition in the L2 environment in adulthood will not bring the L1 and L2 strategies closer together than they are when L2 is formally taught. This is explicit in the examination of prediction c below. The segregation of early and late acquisition is considered necessary only because to overlook it would be to ignore the importance of the time and stage at which strategies were developed for processing the two languages. To examine prediction b, it is important to differentiate, within the early learners, not only whether they have been 'acquirers' or 'learners', but also whether they are living in an L1 or an L2 environment and whether they are equally literate in both languages and equally likely to employ their literacy skills in each. Restricted to just those studies named in Tables A4:i and A4:ii, then, this evaluation will entail consideration of the following:

dichotic listening test studies: Rupp 1980, Carroll 1980, Albert & Obler 1978, Bever 1974, Gordon 1980, Bellisle 1975, Galloway 1981 and Schönle & Breuniger 1977.

tachistoscopic tests: Gaziel et al 1978, Hamers & Lambert 1977, Walters & Zatorre 1978 and Mishkin & Forgy 1952.

These studies are classified below for formal versus informal acquisition and for whether the subjects were in the L1 or the L2 environment at the time of L2 acquisition and at the time of testing:

STUDY	TEST TYPE	FORMAL/ INFORMAL	ENVIRONMENT OF:		RELATIVE HEMI- SPHERIC INVOLVE- MENT IN L1 & L2 ³⁰
			a)L2 ACQ.	b)TEST	
Albert & Obler '78	dlt	informal	L1	L1	more rh in L2 ³¹
Rupp '80	dlt	informal	L2	L2	more lh in L2
Bever '74	dlt	informal	L2	L2	more rh in L2
Galloway '81	dlt	informal	L2	L2	no difference
Hamers & Lambert'77	tachi.	informal	L2	L2	no difference
Mishkin & Forgays'52	tachi.	informal	L2	L2	more rh in L2 ³²

TABLE 5:iv

Other potential classes are 'formal - L1 - L1' and 'formal - L2 - L2'. There are no studies in those categories amongst the ones under examination here. Two studies (Bellisle 1974 & Schönle & Breuniger 1977) could not be classified here as they were cited by other authors without the necessary details about the subjects and testing. The study by Gaziel et al (1978) is also excluded as it is too complex to easily classify in these terms.

Table 5:iv does not furnish sufficient variation in subject type to enable a satisfactory assessment of the prediction. On the other hand,

30. 'No difference' means here an equal right ear advantage (REA) or right visual field advantage (RVFA) in both languages, unless otherwise stated.

31. These were balanced Hebrew-English bilinguals living in Israel. It is not entirely clear which of the languages should be termed L1 and which L2. In this context, English has been called L2.

32. Subjects were 12-14 year olds in the U.S. with some knowledge of Yiddish but limited proficiency. If Yiddish was acquired at home it falls between the strict definitions of 'mother tongue' and L2.

In this context it has been treated as an L2.

there is no corresponding uniformity in the experimental results. However, in at least three of the four cases where a difference was found in the patterns of hemispheric superiority (Obler's, Rupp's and Mishkin & Forgay's), it is difficult to be sure which language should be counted as L2. To put it another way, as the two languages often vie so closely for the status of L1, it is questionable whether differences in hemispheric superiority can be due to one being the first language to be learnt and the other the second. It is perhaps more likely that differences in the attitudes towards and experience and confidence in using each language are responsible.

The third prediction was that a different use of or attitude towards the two languages could be reflected in different patterns of hemispheric superiority, because different task strategies may be adopted according to those most familiar to the language-specific operations of the individual's experience. Gordon (1980) is supportive with the observation that "subjects with different language backgrounds may well have different ear asymmetries" (p.256). Prediction c, then, is examined with reference to the studies classified in Tables A4:iv and A4:v as 'late' (see text below table 5:v).

dichotic listening test studies: Kotik 1975, Kotik 1984, Carroll 1980, Albert & Obler 1978, Maitre 1974, Schneiderman & Wesche 1980, Gordon 1980 and Galloway & Scarcella 1982.

tachistoscopic tests: Silverberg et al 1979, Walters & Zatorre 1978 and Soares & Grosjean 1981.

Reclassified in the same way as in Table 5:iv, the groupings in table 5:v emerge.

STUDY	TEST TYPE	FORMAL/ INFORMAL	ENVIRONMENT OF:		RELATIVE HEMI- SPHERIC INVOLVE- MENT IN L1 & L2
			a)L2 ACQ.	b)TEST	
Gordon'80 group 2	dlt	informal	L2	L2	trend towards more rh in L2
Galloway & Scarcella '82	dlt	informal	L2	L2	no difference
Albert & Obler '78	dlt	informal	L2	L2	more rh in L2
Soares & Grosjean '81	tachi.	informal	L2	L2	no difference
Carroll'80 study 3	dlt	informal	L1	L1	trend towards more rh in L2
Kotik '75	dlt	formal	L2?	L2?	more lh in L2
Kotik '84	dlt	formal	L2	L2	high proficiency: no difference; mid:more lh in L2 low:more rh in L2
Carroll'80 study 1	dlt	formal	L2	L2	no difference:no EA for either
Walters & Zatorre '78 group2	tachi.	formal	L2?	L2	no difference
Maitre'74	dlt	formal	L1	L1	words:more rh in L2;sentences: no difference
Schneider- man & We- sche '80	dlt	formal	L1	L1	more rh in L2
Carroll'80 study 2	dlt	formal	L1	L1	more lh in L2
Gordon'80 group 1	dlt	formal	L1	L1	more lh in L2
Albert & Obler '78	dlt	formal	L1	L1	more lh in L2
Silverberg et al '79	tachi.	formal	L1	L1	high proficiency: no difference; low:more rh in L2
Walters & Zatorre '78 group1	tachi.	formal	L1	L1	no difference

TABLE 5:v

NOTES: 'No difference' means here an equal right ear advantage (REA) or right visual field advantage (RVFA) in both languages, unless otherwise stated.

Regarding Gordon (1980) (1st row), it is not clear whether the reduced REA was found in only L2 or in both L1 and L2.

Once again, no clear pattern can be seen in Table 5:v, but this,

ironically, only provides further support for prediction a. However, a stronger REA/RVFA in L2 than L1 is predicted where the tuition was formal and in the L1 environment, and there is some evidence of that at least.

Finally, prediction d regards individual variation in the extent of transfer from one language's strategies into the operations involving the other language. It is not easy to see how this could be examined and so no attempt will be made.

To summarise, this discussion has illustrated once again the problems inherent in assessing psycholinguistic experiments in terms of the predictions of the Focusing Hypothesis. It could be considered that the evidence here, as in some other places, provides serious opposition to the Focusing Hypothesis, by not displaying the predicted patterns. It could also be asserted that the Focusing Hypothesis is unacceptable because it predicts that those very patterns will be obscured by the interaction of other variables, thereby covering itself for all possible outcomes. This is, at one level, a legitimate criticism, but it seems justifiable to argue in return that the problem lies in knowing how to relate the complex (but principled) predictions of the Hypothesis to the findings of experiments which it in any case condemns as flawed and as intrinsically prone to contradictory results. As already observed, the actual reasoning behind these predictions is not at all dissimilar to that which justifies the *age-stage-manner* hypothesis, which also meets apparent opposition in experimental results but which, by virtue of the integral complexity of the three-factor interactions, is never lost for a circumstantial explanation. The Focusing Hypothesis, then, is not faring any worse than that account, and it seems jus-

tifiable to lay most emphasis on the reasoning behind the predictions and less on the *post hoc* examination of results from inappropriate experiments.

5:5.3 CLINICAL STUDIES

Despite the failure to find much support in the examination of psycholinguistic experiments on polyglot subjects in the previous section, the same general criteria will be applied to the projection of expected findings in the clinical data pertaining to localised left hemisphere damage in polyglots. This is because, as already stated, the principles underlying these predictions are still considered to be sound. Before this is done, however, a general examination will be made of the relationship between the Focusing Hypothesis and Ribot's and Pitres' rules.

As described in chapter 4:5.2, Ribot's rule predicts that the earliest language to be learnt will be least affected by loss. Pitres' rule, more specifically aimed at recovery from polyglot aphasia, states that the most familiar language will reappear first and recover most fully. Discussion in chapter 4 indicated that Pitres' rule is the better supported by findings in polyglot aphasic research. The support found for Ribot's rule is, of course, largely explicable in terms of Pitres' rule, because most often the earliest language learnt is also the best known. The preference for Pitres' rule is based on those exceptional cases where this is not so.

It is not difficult to see that the predictions of the Focusing Hypothesis also closely align with those of Pitres' rule, for the best known language will, in most cases, be one learnt early and informally

in its own environment. Where the two views part company is in the significance placed by the Focusing Hypothesis on the subsequent requirements made of each language, which will determine the total range of strategies available for dealing with it and, within that, the preferred ones. Different strategies for different languages will lead to more or less tendency for each to inhibit the right hemisphere in aphasia, by focusing on the linguistic level itself. Accomplished polyglots may develop a particular sensitivity to the precise task required and become, as Krashen puts it, *optimal monitor users* (Krashen & Terrell 1983:44f), knowing not only how to focus on linguistic form as required, but also how not to when the primary aim is communication. This technique of operating strategy choices would counteract other strategy determining factors such as literacy, and it is this that leads to the general prediction that the languages most often used for propositional exchange, even if they have been subjected to the analysis concomitant with literacy, will be most resistant to a blanket application of language-focused strategies. Rather, a number of strategies may be available and selected in different situations. Their general availability may be greater than in monolinguals (see section 5:3) so that polyglots recover L1 better than monolinguals do, because of their heightened ability, as optimal monitor users, to relinquish linguistic focus when it is not specifically required. On the other hand, less well known formally learnt languages would be subject, in aphasia, to the double focusing constraint of (a) the longstanding need for thoughtful, non-spontaneous production and (b) the expectation of apha-

sic symptoms³³. However, as ever, one of the greatest problems in assessing the amount of L2 loss in polyglot aphasia is the lack of certain knowledge about how good the language was before.

Returning now to the predictions made by the Focusing Hypothesis, the following can be identified:

- a) The most overwhelming tendency in patients will be to focus on their language processing and thus debilitate the undamaged right hemisphere. This will lead to serious aphasic problems in any language in which such focusing is a customary option.
- b) Similar patterns of language loss will obtain where both languages have a similar status with respect to use, including literacy, and attitude.
- c) Different patterns may be observed where the languages have been acquired or used differently, because this will be reflected in different strategy option ranges and preferences. For example, a little known, formally acquired L2 might be more affected than L1 because analytic-based strategies have dominated the use of that language. Conversely, a well known and informally acquired L2 in which literacy has not figured, while it has figured in L1, might be less affected.
- d) Individual differences might obtain, relating to the extent to which strategies for L1 may have been assimilated into L2 (or vice versa).

The wide range of studies discussed in chapter 4:5 cannot be exhaustively examined in the light of these predictions because in most cases too little information has been given in the reports to enable a subclassification of the kind required. These studies have, however, been evaluated by others (as reviewed in chapter 4) in terms of Ribot's and Pitres' rules, and so are implicitly included in the present assessment by virtue of the close alignment, in some respects, of the Focusing Hypothesis' predictions and those of Pitres' rule, as outlined

33. Dr. Johnson tested his sanity following a stroke by constructing Latin verse: "The lines were not very good, but I knew them not to be very good, I made them easily, and concluded myself to be unimpaired in my faculties" (quoted in Lott 1981:31).

above. In the light of this, the direct assessment of case histories will be restricted to one exceptionally detailed report of an unusual patient, namely, the heptalingual aphasic reported by Galloway (1978).

Table 5:vi classifies the languages of Galloway's (1978) patient according to the criteria of type of acquisition, environment of acquisition and use in adulthood. Details not given here can be found in chapter 4:5.

LANGUAGE	AGE OF AC- QUISITION	FORMAL/ INFORMAL	LANG.OF AREA OF RESIDENCE?	ADULT USAGE	ABILITY AFTER APHA- SIA & SYMPTOM GROUP
Hungari- ian (MT)	0-4 6-10 ³⁴	informal	Yes	little	c:some;p:isolated words;sg:3
Polish	4-6	informal	Yes	none	c:none;p:isolated words;sg:4
Rumanian	10-12	informal	Yes	none	c:none;p:isolated words;sg:4
Yiddish	10-12	informal	No	some	c:some;p:isolated words;sg:3
German	10-12	informal	No	some	c:alright p:isolated words sg:2
	12-17	formal	No		
	18-25	informal	Yes		
	19-25	formal	Yes		
English	12-17	formal	No	used mostly	c:good;p:word sub- stitutions etc.but fluent sg:1
	25-47	informal	Yes		
Biblical Hebrew	3-17	formal	No	little	c:none;p:isolated words;sg.4

TABLE 5:vi KEY: c = comprehension p = production
sg = symptom group (based on details given)

Prediction a leads to a grouping of these languages according to the following criteria: (i) formally acquired in the environment of a different language, (ii) formally acquired in that L2's environment, (iii) informally acquired in that L2's environment and (iv) informally ac-

34. He had to entirely relearn his Hungarian at the age of 6.

quired in the environment of another language³⁵.

Furthermore, the expectation is that group (i) languages will be most likely to attract language-focus and group (iv) languages least so.

The groupings are as follows:

- i) Hebrew (English) (German)
- ii) German
- iii) English (German) Rumanian Polish Hungarian
- iv) Yiddish

The languages in each of these would be predicted to experience the same level of loss in the aphasia. But this is not borne out. However, it can be noted that a language which the patient had not used much might require special effort in any case, this increasing the likelihood of focusing. A regrouping with this consideration taken into account is hard to set in order, but it would predict a severity of symptoms in something like the following order:

Hebrew (formal, alien environment, little used in adulthood)
Rumanian, Polish (informal, own environment, never used in adulthood)
Yiddish (informal, alien environment, some use in adulthood, low proficiency)
Hungarian (informal, own environment, some use, high proficiency)
German (informal & formal, alien & own environment, once exclusively used, then some use only)
English (informal & formal, alien & own environment, major language of use till CVA)

This ordering matches up with the symptom groupings in Table vi (4,4,4, 3,3,2,1) which supports the notion that criteria of the kind listed here may have some bearing on the relative severity of aphasic sym-

35. The reason for ordering (iii) and (iv) in this way is the same as that described in the previous section, namely, that a language learnt informally in the environment of a different language is likely to be the language commonly spoken by some subculture in which the individually habitually finds himself. This would create an immediate L2 environment inside a wider L1 (or L3) one, in comparison to an immediate L1 environment inside an L2 one as when a whole family moves to a new country.

ptoms. The order presented here is also, more or less, that predicted by Pitres' rule.

The evaluations of predictions b and c can be effected in the same way. Members of groups (v) to (viii) are predicted to align with the symptom groups, which, it will be recalled, relate to the severity of the symptoms (see table 5:vi), with English in symptom group (sg.)1, German in sg.2, Hungarian & Yiddish in sg.3 and Polish, Rumanian & Hebrew in sg.4.:

- v) used in own environment (in childhood)
- vi) used in own environment (in adulthood)
- vii) used in alien environment only
- viii) advanced literacy skills

According to the details given in Galloway (1978) regarding the patient's pre-CVA use of the languages, the memberships are as follows:

- v) Hungarian (sg:3) Polish (sg:4) Rumanian (sg:4) Yiddish (sg:3)
- vi) German (sg:2) English (sg:1)
- vii) Yiddish (sg:3) Hebrew (sg:4) (English sg:1) (German sg:2)
- viii) Hungarian (sg:3) German (sg:2) English (sg:1) Hebrew (sg:4)

Thus, predictions b and c are supported by subgroups (v) and (vi) only. Prediction d, which regards individual variation, cannot be examined in this way.

5:5.4 SUMMARY AND COMMENT

As already observed, examination of the psycholinguistic research data does not lend much direct support to the Focusing Hypothesis, but neither does it contradict it. The examination of polyglot aphasia has been necessarily cursory and has been unable to shed more than a little light on the points of difference between the Focusing Hypothesis and the well supported Pitres' rule. It has been proposed, however, that

little unambiguous support is to be expected from investigations in these areas, and that the key factors upon which the Focusing Hypothesis' predictions are built are not any less theoretically justified, nor the predictions any worse supported, than those of other accounts.

5:6 TOWARDS A MODEL FOR OUTPUT

It is inevitable that any observation-based discussion of language processing will rely to a large extent on the *OUTPUT* of the subjects or patients examined. Even if an experiment or clinical assessment is designed to ascertain the extent and/or nature of an individual's language comprehension, still the signs of that comprehension will mostly be mediated by some sort of output, whether consisting of a linguistic or a motor response. Despite the central rôle of output in the empirical side of the exploration of language processing mechanisms, the theoretical model which has been presented as the Focusing Hypothesis has addressed only input mechanisms. The justification for this has had to rest upon the belief that input and output are sufficiently different to prevent the detailed examination of both in a work of this size, but similar enough for the one to be 'taken as read' during the evaluation of the other, and for facts about the one not to threaten to undermine an account proposed for the other.

Were an output aspect of the Focusing Hypothesis to have been fully developed here, how would it have differed from the input model? Answering this question requires some appreciation of what makes input and output different from each other. The difference which seems most central in the context of the discussion already presented is the following. In initiating speech, you choose what to say and how to say

it. It should, in theory, be possible to stay within your own processing limitations. In receiving speech you have no such control, for anything may be presented to you. This is precisely the observation that Hughlings Jackson made (see chapter 2:2.2) when he said that the hearer is the "victim" of the speaker (Hughlings Jackson 1874:132). It is because the hearer has no control over input that syntactic theory has had to adopt the premise that an ability to deal with every possible grammatical sentence (and to disentangle many ungrammatical ones) underlies the processing operations of the individual. If only output needed to be accounted for, it would never be possible to be quite sure that sentences were not drawn, ready-formed, from some, albeit vast, inventory of previously constructed (or otherwise adopted) and lexically stored grammatical strings.

The fact that the speaker controls his output in a way he does not control his input (but see Krashen's *filter* component in L2 acquisition, e.g. Krashen & Terrell 1983) therefore paves the way for what could be much stronger hypotheses to account for the former than the latter. In particular, as the formulation of the proposition precedes the lexical selection, it is possible, at the non-specific level at least, to envisage a lexically-specified sentence selection, whereas input processing could not operate in that way without an infinite inventory of sentences³⁶. The desire to develop an integrated account has inevitably tended to draw theoreticians away from a lexically based account for output simply because it appears impossible to reconcile it

36. However, care has to be taken to ensure that this is not tantamount to saying that a speaker only wants to say what he is able to say. Such a danger is avoided if an account also provides for innovation and first-time construction, as both the Focusing Hypothesis and the hypothesis of Pawley & Syder (1983), described below, do.

with the necessary characteristics of input processing. But perhaps this has been too radical a move.

Supposing a model existed in which output processing was lexically specified, and input processing was not, what objections would arise? The first might be that two such systems would be incompatible within a single higher system because they would operate according to entirely different principles. This would certainly be true if the input processing model was fundamentally generative in nature. But in the Focusing Hypothesis there is a non-generative component too. A second objection would be that a non-generative processing account violates the Occam's Razor Principle. However, the Principle is only applied to decide between two otherwise equally plausible theories. If an account can be independently demonstrated to enjoy explanatory advantages over some other less complex ones, then despite its complexity, it is preferable. Pawley & Syder (1983), whose output processing hypothesis will be discussed in detail below, argue this point, observing that if an account permits redundancy, but the system it is describing also contains it, then "anything else would be incomplete" (p.217). And again, the Focusing Hypothesis, already observed to violate the Occam's Razor Principle (see section 5:3.4 above), will be less at odds with an output processing account which also defies this maxim of (apparent) explanatory economy.

In the following discussion an examination will be made of an output processing account by Pawley & Syder (1983) which possesses many features in common with the (independently developed) Focusing Hypothesis, and which differs in the ways predicted to possibly characterise the contrast between input and output models.

Two questions form the starting point for Pawley & Syder:

- a) Why do native speakers not produce anything approaching the full range of constructions which could be generated and would be grammatical, but rather restrict themselves largely to 'idiomatic'-type familiar and much-used sentences and constructions?
- b) How do native speakers retain such a remarkable fluency in production at the same time as concentrating on so many other aspects of communication including content and register?

The first of these questions is based on their own observations of stereotypy in the sequences occurring in natural conversation. It leads them to assert that processing accounts in which all grammatical strings are constructed (from scratch) specifically for the propositional event, and in which all strings are equally easily processed are too strong, for they predict the occurrence of many strings which, although grammatical and therefore able to occur, normally do not:

native speakers do not exercise the creative potential of syntactic rules to anything like their full extent, and...indeed, if they did so they would not be accepted as exhibiting nativelike control of the language. (p.193)

This is very reminiscent of one of the claims that underlies the Focusing Hypothesis, viz. that "although language has the potential for unpredictability, it is, the majority of the time, predictable within certain definable bounds" (chapter 1:7). Using a fragment of narrative and a paraphrase of it, Pawley & Syder (1983) illustrate that certain strings are preferred to others which are equally easily generated by the hypothetical rules of the grammar:

- 4) I had /four /uncles -
they /all volun/teered to /go a/way
and ah /that was /one Christmas -
th't /I'll /always re/member...

- 5) The brothers of my parents were four
Their offering to soldier in lands elsewhere in the army of our
country had occurred.
There is not a time when my remembering that Christmas will not
take place... (p.194)

Pawley & Syder propose that native speakers customarily employ not syntactical rules to generate the sentences they use, but a system of retrieval for ready-lexicalised³⁷ sentences or *sentence stems*. These are "unit[s] of clause length or longer whose grammatical form and lexical content is wholly or largely fixed" (p.191). They are *automised* then in the same way as Van Lancker's (1972,1987) *automatic language* (see 2:2.2), which consisted, for her, of idioms and deliberately memorised sequences. But Pawley & Syder are not referring only to items of these types, but also to regular constructions whose meaning is immediate and literal (cf. the discussion of Code's (1987) examples in chapter 2:2.2). It will be recalled that in chapter 1:5 the Focusing Hypothesis was carefully differentiated from what might be termed *sentence inventory theories* in which every sentence is separately stored and retrieved. Yet here, it seems, Pawley & Syder are making the 'retrograde' step towards the non-generative accounts which, ultimately, are forced to countenance a memory store of infinite size. However, it may be that the Focusing Hypothesis actually legitimises the approach taken by Pawley & Syder, by arguing a rationale for their position (see below).

A major component in the argument presented by Pawley & Syder, then, is that of all the possible strings which are grammatical, it is only a much restricted subset that would be termed *natural* for native

37. 'Lexicalised' is intended to mean 'lexically specified', not 'stored in the lexicon'.

speakers. There are preferred ways of expressing concepts, and where *sentence stems* are semi-lexicalised (see below) there are strong preferences for which items may be paradigmatically aligned, with others still falling well within the bounds of grammaticality without sounding natural. What Pawley & Syder do not do is justify why such a subset should be preferred. Also, they cannot formally explain how it could be that we can generate sentences as well as select them ready-formed, though they do invoke a dual system of some kind. They argue indeed that such a system is already required for other accounts:

Insofar as many regular morpheme sequences are known both holistically (as lexicalised units) and analytically (as products of syntactic rules) it is necessary to specify these sequences at least twice in the grammar. (p.192)

Later they assert that conversational speech consists of three types of clause: lexically entirely novel sequences (but grammatically familiar, in accordance with the syntactic rules of the language), lexically entirely familiar sequences, and sequences halfway between the two, "consisting partly of new collocations of lexical items and partly of memorized lexical and structural material" (p.205). Between them, these three clause types permit a balance between economy in processing and a capacity to deal with novelty:

it is always possible to draw on the fully-productive and semi-productive syntactic and semantic rules to provide morphologically complex descriptions...and in due course one or more of the descriptive expressions for a new concept may become its conventional designation, i.e. it may be lexicalized. (p.218)

This is very reminiscent of the process described in the Focusing Hypothesis with relation to acquisition.

The value to the speaker of drawing on lexicalised strings or *sentence stems*, from a corpus of some "hundreds of thousands" is that:

he minimises the amount of clause-internal encoding work to be done and frees himself to attend to other tasks in talk exchange

including the planning of larger units of discourse. (p.192)

In addition, by using set forms for common cultural concepts he enables himself and the hearer to access a shortcut to the context (p.218). This is strikingly similar to the Focusing Hypothesis' justification for a non-generative processing of input. However, Pawley & Syder fall short of suggesting that the lexicalised sentences could be termed *automatic* or *holistic* or that there might be some association with the right hemisphere. But they do ask:

Is there something in the language learner's natural capacities, in the structure of the human brain, that makes such dual knowledge advantageous, or inevitable? (p.217)

The Focusing Hypothesis is based on the belief that there is, viz. the very limited capacity of the brain to focus on a number of things at once. Furthermore, the examination which has been made of how language might be being accommodated within the processing preferences of the brain during different types of language use provides some independent justification for what is for Pawley & Syder only a theoretical model.

Despite the outward appearance of a system which is nongenerative, their account is designed to address the economy of idiomatic speech, where a phrase will not be used if a single word will suffice, nor a complex sentence if a simple one can be used (p.197). The economy in processing comes firstly from employing tactics to reduce the concentration required to remain fluent and to form novel strings:

[The speaker] is by no means free to concentrate on the grammatical content of his productions. (p.204)

Secondly it comes from the utilisation of the natural abilities of the human brain, viz. its ability to recognise patterns, its limitations in performing several mental tasks simultaneously, and its "enormous memory capacity" (p.218).

Pawley & Syder give examples of lexicalised *sentence stems* which are fundamentally the same as the formulae in the Focusing Hypothesis; the latter were proposed to have a lexicalised component, most probably the verb (see chapter 1:1.3). The common stem they envisage for sentences like (6)-(8) below is (9) and that for (10)-(12) is (13):

- 6) I'm sorry to keep you waiting.
- 7) I'm so sorry to have kept you waiting.
- 8) Mr. X is sorry to keep you waiting all this time.
- 9) NP be-TENSE sorry to keep-TENSE you waiting (p.210)

- 10) Tell the truth!
- 11) Jo seldom tells the truth.
- 12) I wish you had told me the truth.³⁸
- 13) NP tell-TENSE the truth. (Pawley & Syder 1983:210f)

The Focusing Hypothesis had held back from this stronger version of the model, in which so much is lexically realised, but, as has been suggested above, such reticence may be more appropriate to an input processing model than an output processing one. It certainly makes sense in general terms to choose an account which indicates the greatest possible saving of processing effort.

Another point of close contact between the two hypotheses is in the notion of clausal level processing. Pawley & Syder approach the question of native speaker fluency by observing how much easier it is to talk fluently if clauses are 'chained'. 'Clause chaining' involves using a succession of (syntactically but not, of course, propositionally) independent clauses, as opposed to integrated ones. Chaining, they argue, is substantially more popular (in speech) than integration amongst English native speakers (p.204). Apart from being easier for the spea-

38. There is no 'slot' in (13) to account for 'me' in (12), but this appears to be no more than an oversight on Pawley & Syder's part and it is not detrimental to their general point.

ker because less processing is required, they also note that clause-chaining makes the hearer's job easier because:

Listeners are tolerant, up to a point, of mid-construction dysfluencies.... But they do not care for more than a little of this at a time. (p.208)

As Pawley & Syder do not address input processing they do not present any account of why listeners should have such low tolerance to non-fluency. The Focusing Hypothesis, however, does: it is because it is most economical for them to decode holistically at clausal level, and this is hampered by a lack of fluency, to the extent that the analytic mechanisms may become involved in an earlier stage of decoding in an attempt to pre-empt the ends of clauses (see chapter 1:6.2).

An output processing model in the Focusing Hypothesis might not have consisted of all or only the features in Pawley & Syder's model, but it seems likely that the general rationale and also many of the details would be the same. Neither is tied to one interpretation of the specific location of functions in the brain (see chapter 1:10) and both highlight the necessity to examine spoken discourse in preference to other forms of language where the processing strategies might be different (Pawley & Syder 1983:214). Perhaps the most valuable explanatory advantage that these two accounts possess regards the existence and perpetuation of irregularities in languages. As Pawley & Syder note, Chomsky (1965) had to allow for separate lexical entries for forms which could not be generated (p.219). Any account which presents a primarily regular system with constructions generated as they are needed, predicts that it would be easiest for a language to be regular, because fewer items would need to be listed separately. In a system where lexicalised strings and lexically determined formulae are the

preferred medium of expression and comprehension, it is easy to explain how irregular items could enter the system and remain there; furthermore, it is predicted that they would be common in normal interaction, which seems to be the case.

CHAPTER SIX

EXPERIMENTAL INVESTIGATIONS

6:1 INTRODUCTION

In the course of the previous chapters and particularly 5:2, it has been suggested that the psycholinguistic laboratory is not a suitable environment for testing the Focusing Hypothesis. This is because certain factors will prevail to prevent *optimal processing* (chapter 1:3), which is the only condition under which the holistic mechanisms would be in operation to their full potential. These factors are the nature of the stimulus, the nature of the task, the experimental environment and the type of subject (see 5:2).

Making drastic alterations along all four parameters, however, would produce a design which no longer had enough in common with the orthodox experiments to enable comparison. In particular, changing the test environment and removing those factors which might cause some abnormal level of stress would probably entail not using response-time tasks, which are the most direct means of measuring ear or visual field advantage.

Both the experiments reported in this chapter are of standard psycholinguistic experimental design. To take the exact stance argued in the rest of this thesis would be to conduct psycholinguistic experiments only in order to demonstrate that they do not test the Focusing Hypothesis. This is, of course, unsatisfactory, and, ideally, experimental designs are required which can overcome the normal limitations as described above. On the other hand, they need to bear some resemblance to other designs, so that there is some baseline for comparison.

This is a difficult brief. Experiment II (section 6:3) was an attempt to create a contrast between holistic and analytic processing against the odds of operating within a standard listening test set up. In section 6:4 another design is proposed which might instigate strategy choices similar to those considered by the Focusing Hypothesis to be in operation in normal communication.

Experiment I was conducted before the Focusing Hypothesis had been formulated. But as it was designed to test the effect of educational factors on processing strategies, it is highly relevant to the discussion.

6:2 EXPERIMENT I:

INVESTIGATION OF POSSIBLE STRATEGY DIFFERENCES IN RESPONDING TO VISUOSPATIAL STIMULI PRESENTED TACHISTOSCOPICALLY

6:2.1 INTRODUCTION

In a paper published in 1982, O'Leary reported an experiment comparing visual field advantages for male subjects aged 6 to 8 inclusive when presented with line drawings of familiar objects. They had to perform a simple judgement task, to decide whether a stimulus picture, flashed momentarily to one visual half-field, was the same as or different to another picture, which had been presented centrally for a longer period immediately prior to that trial.

Kimura & Durnford (1974) report that across a series of tests presenting shapes and pictures tachistoscopically, no visual field advantage (VFA) was observable (p.35ff). This is less than they might have expected, given "the known asymmetry of function" (p.42) favouring the right hemisphere in visual perception. Nevertheless, it contrasts with the consistent findings of a RVFA when linguistic stimuli are present-

ed. In O'Leary's experiment, then, the picture identification would be predicted to yield no VFA or, if any, then for the left, not the right.

O'Leary drew from the work of Conrad (1971)¹ and Levy (1974) in designing his experiment. Conrad found that children up to the age of five could recall the positions of pictures whose names rhymed as easily as those that did not. Over the age of five, however, the rhyme appeared to lead to muddling in recalling the picture positions. This was taken to be evidence of verbal labelling in the older group (O'Leary 1982:66). Therefore, O'Leary used rhyming (e.g. tie-pie) and non-rhyming (e.g. tie-sock) pairs of stimuli for the 'different' trials (see below). He made a connection between Conrad's (1971) observation and the activity of the two hemispheres by noting Levy's (1974) suggestion that the right hemisphere can decode only semantically and not phonologically. Thus he predicted for his task that:

An increase in reaction time to the pictures whose names rhymed, in comparison to pictures whose names did not rhyme, would indicate the use of a phonological code which Levy claims is an exclusively left hemisphere ability. (p.67)

But this rhyme-nonrhyme difference should, he predicted, obtain only for left hemisphere (i.e. right visual field) presentation (p.67).

O'Leary reported a significant left visual field advantage (LVFA) in the youngest group (mean age 6;9), and a non-significant right visual field advantage (RVFA) in the two older groups (mean ages 8;0 and 8;10). When 'same' and 'different' responses were separately analysed, he found that the change from LVFA to RVFA occurred only in the response times (RTs) to 'different' trials. When he compared the rhyme

1. This reference is not listed in the bibliography at the end of the volume in which O'Leary's article appears, and so far I have not been able to trace it.

and nonrhyme RTs, however, there was no significant difference and thus no support for his hypothesis that the changeover in VFA was the result of the adoption of a verbal strategy in stimulus memorisation. Rather than abandoning the hypothesis, O'Leary proposed that his device for 'trapping' the label-users had not worked, and that revising the inventory of stimuli might enable the predicted difference to be found.

6:2.2 AIM

The aim of the experiment reported here was to replicate and extend the findings made by O'Leary. To this end the basic design and purpose remained the same but a number of alterations were made to widen the scope and to seek the 'rhyme-nonrhyme' differences he predicted between the RVFA and LVFA subjects.

6:2.3 MODIFICATIONS TO O'LEARY'S DESIGN

6:2.3.1 SUBJECTS

6:2.3.1.1 SEX

O'Leary tested only males; this was extended to include an equal number of males and females.

6:2.3.1.2 AGE

O'Leary tested subjects of mean age 6;9, 8;0 & 8;10. In the light of Conrad's (1971) watershed at five years of age for rhyme interference, it was decided to extend the age range downwards to four years. Therefore, subjects in this study were in five ages groups: 4 (mean age = 4;7), 5 (mean age = 5;7), 6 (mean age = 6;8), 7 (mean age = 7;7), 8 (mean age = 8;6). Another reason for extending the age range in this way was the following. O'Leary found a significant correlation between his laterality measure and the mental age of the subjects, the latter

being determined by the Peabody Picture Vocabulary Test. If the change in VFA which O'Leary found was related to educational exposure rather than maturation, then it might be predicted to occur one year earlier in British children, who begin formal education at age 4-5, not 5-6 as in the United States. If, on the other hand, a changeover were observed at the same age in British children, this would be strong support for a maturational determination of the task strategy.

6:2.3.1.3 POOL

O'Leary's subjects were all pupils at a private Catholic school in a middle class area. The subjects in this study lived in the Poppleton Road and Acomb areas of York. Most were pupils at Poppleton Road Infant & Junior School and contact was made by means of a letter to parents, inviting them to volunteer for the study. Additional subjects were obtained with the help of the parents of children already taking part. These were children who lived in the same geographical area but were within the catchment area of other schools of a similar type. There was no reason to suppose that the subjects did not form a relatively homogeneous sample. Without exception the parents were interested and motivated to take part in the experiment; participation was the result of returning a form to the school and arranging the visits of the experimenter.

6:2.3.1.4 SAMPLE SIZES

O'Leary tested 18 male subjects, six in each of the three age groups. In this study, each of the five age groups consisted of five males and five females, making a total of 50 subjects.

6:2.3.1.5 HANDEDNESS

Handedness is known to be a factor requiring some consideration in experimental psycholinguistics (Geschwind 1974,1983). O'Leary tested only right-handers, as ascertained by an informal test of handedness which involved hand preference in writing, drawing, scissor and tool use & throwing, eye preference (telescope) & foot preference (kicking). Only individuals who used their right hand, foot² and eye exclusively in all the relevant tasks were used. In addition, he states that none of the subjects had any left-handed immediate family members.

It was soon discovered that so strict a set of criteria would be impossible to maintain. Although only those subjects whose parents designated them as right-handed on the reply slip were tested, and although the results of obvious left-handers and those with no apparent hand preference were excluded from the analysis, there cannot have been more than one or two children at most (out of 50) who displayed the kind of 'extreme' right-handedness which O'Leary defines as his baseline criterion for inclusion. This is particularly remarkable given that his subjects were male: males are known to be more likely to display features of ambidexterity & left-handedness (Geschwind 1983,1985). Even the females in the current study had at least either a parent or sibling who was left-handed or else themselves displayed some measure of ambivalence in foot or hand preference. Eye preference was found to be particularly variant.

2. O'Leary states that one subject did not use his right foot consistently for kicking.

6:2.3.1.6 READING-AGE

O'Leary administered the Peabody Picture Vocabulary Test to his subjects. Because of the suspected link between literacy and test strategies, a reading-age test was used here instead. The (unrevised) Schonell reading assessment test (Schonell & Schonell 1960) was used for ease of administration. Although it has been widely criticised (Pumfrey 1977:51, Vincent et al 1983:40), it was considered to be accurate enough for the intersubject comparisons required here. Approximately two months later, four of the children were tested at school on the revised Schonell list³; the scores corresponded closely in three cases (11.8, revised:11.8; 7.2, revised:7.4; 12.9, revised:12.6+). The fourth differed considerably (6.9, revised:7.5); this child (age 8;1) was of below average ability.

6:2.3.2 APPARATUS

In parallel with O'Leary's experiment, a two-field tachistoscope was used to present the stimuli. An electronic timer measured the time taken from presentation of the single-field stimulus to the decision. The display of this stimulus was controlled using a hand-operated button. Depression of this button automatically started the timer. The timer was interrupted by the depression of a single morse key wired to the timer and controlled by the subject.

Times and the nature of the subject's response ('same' or 'different', expressed by hitting the key once and twice respectively) were

3. Editions of Schonell & Schonell from 1972 incorporated revised norms drawn from a sample of Salford children by Bookbinder (1970). Shearer (1974), however, on the basis of a sample of Cheshire children, challenged these revised norms and provided others which were more similar to the pre-revision ones (Pumfrey 1976:100).

manually recorded by the experimenter.

6:2.3.3 STIMULI

Six pictures, with which the subject had been familiarised, were the total inventory of stimuli (except for the practice trials, see below). O'Leary's stimuli were as follows:

tie, pie, moon, spoon, sock, clock

In this experiment the following were used⁴:

mountain, mouse, doll, dog, belt, bed

Different stimuli were used in the practice trials:

boat, bone, kangaroo, candle, picture, pig

The reason for using different stimuli in the practice trials was to prevent an early practice effect. The (apparent) potential for any one of twelve pictures rather than merely one of six to appear also made the task appear less tedious to the subjects. The three stimulus pairs selected for the experiment itself were the ones which made the best set according to the parameters of mutually distinct shape, best cross-pair initial phonological similarity matches (see below) and most consistent voluntary naming with the intended label by pilot subjects (i.e. *dog* not *puppy*, *belt* not *watch* or *snake*). However, inevitably, one or two subjects did have initial (occasionally persistent) 'misnamings', (e.g. *rat* for *mouse*, *man* for *doll*) and one or two of the youngest children had to 'learn' the word *mountain*, which did not appear to be part of their vocabulary. Misnaming was not a widespread problem either across the group or within individual performances, except in the case of one child whose results were not used. However, it is po-

4. The pictures used can be found in the Appendix, A6:1.

tentially serious, as the persistent misnaming of a stimulus would spoil the intended phonological correspondences.

The reason for changing the stimuli from O'Leary's was as follows. O'Leary chose rhyming pairs to create confusion for those subjects using linguistic-based decision strategies, but he failed to find the predicted slower decisions for 'different' trials in RVFA subjects as compared to LVFA ones. His hypothesis was that the subjects might be making a phonological comparison of the labels; but such a comparison could conceivably operate in segmental sequence, in which case the fact that the rhyming stimuli were minimal pairs contrasting in initial phoneme might enable their non-identity to be established before the phonologically identical material was encountered. This is consistent with the *word-cohort* theory (Marslen-Wilson & Tyler 1980, Marslen-Wilson & Welsh 1978) as discussed and reinvestigated in Tyler (1984). The cohort theory proposes that a *word initial cohort* is created from some minimal sensory input - perhaps equivalent to the first one or two phonemes of a word, so that:

the recognition of a spoken word involves the activation of a large set of word candidates which gradually diminishes in size until only a single member remains. (Tyler 1984:417)

Therefore, in this experiment the stimuli were paired according to initial rhyme⁵. Specifically, the identical material was the initial CV sequence, which corresponded in size to O'Leary's identical final sequences which were V(C).

In line with O'Leary's design, each stimulus word was paired with

5. For the sake of retaining the correspondences with O'Leary's terminology, 'rhyme' is used to refer to the initial-rhyme feature. An alternative term, 'alliteration' is not strictly accurate and is also rather more cumbersome.

two others: its rhyme partner and a non-rhyme partner. That stimulus would only appear with those two partners. Thus:

2nd presentation (nonrhyme)		1st presentation		2nd presentation (rhyme)
belt	-	mountain	-	mouse
doll	-	mouse	-	mountain
mouse	-	doll	-	dog
bed	-	dog	-	doll
mountain	-	belt	-	bed
dog	-	bed	-	belt

Each stimulus pair appeared an equal number of times with its rhyme and its non-rhyme partner and the total of these two formed the sum of 'different' stimulus presentations. An equal number of 'different' and 'same' combinations occurred, for a total of 48 trials (over two visits)⁶. Thus every stimulus picture occurred four times with itself and twice each with each partner. These occurrences were equally shared between side of presentation (i.e. visual field). In each session of 24 trials an equal number of right and left presentations was administered, in a semi-random order (screened for consistent patterns and more than two consecutive presentations to the same side or of stimulus type ('same' and 'different')).

Stimulus pictures did not exceed 6cm horizontally and 6cm vertically, so that they fitted a notional frame of those dimensions. Although they were not symmetrical, the pictures selected were not off-centre in relation to the frame; that is, the centre of the frame was also (approximately) the balanced centre of the image.

6. O'Leary administered each trial twice, making a corpus of 96 response times for each subject. As 24 was the maximum number of trials that the York subjects could manage in one session, and as four separate sessions for each subject would have been impractical given the size of the subject pool, only the 48 trials were administered.

Cards used for familiarisation purposes (see below), when the tachistoscope was not used, had a forward image. All other cards had a 'reverse' image. Thus, the familiarisation cards depicted the image the same way round as it would appear after mirror reflection in the tachistoscope when the stimulus cards were used. The images on the familiarisation cards were central to the card; those on the stimulus cards were positioned in relation to the centre of the part of the card visible on the screen (the left-most four-fifths or so).

On the cards used for initial (central) presentation on the base screen, the centre of the notional frame coincided with the centre of the viewing screen. This meant that, given the distance from the viewer to the screen (46cm), the peripheries of the image diverged $3^{\circ}44'$ from the centre, which left the whole image fully within the area visible with both eyes, given central gaze.

On the cards used for second (single visual half-field) presentation on the rear screen, the inner edge of the notional frame was 5cm ($6^{\circ}12'$) from the centre of the screen and the outer edge 11cm ($13^{\circ}27'$), so that the image fell entirely within one visual half-field and entirely out of the other, given eye fixation on the centre of the screen.

A single card was used for centring the subjects' vision. This had a black saltire cross, filling a frame 3x3cm. The centre of the cross coincided with the centre of the screen. This card was kept permanently in the base-screen slot and initial presentation cards were slid in and out on top of it.

6:2.3.4 METHOD

O'Leary compared responses by the left and right hand. Half the

subjects responded 'same' by depressing a button operated by the left hand and 'different' with the right, and the other half had the reverse instructions. He found significant interactions between this response pattern and both rhyme-nonrhyme responses and VFA (p.69).

In the present experiment, this variable was removed by instructing the subjects to actively use both hands (one on top of the other) at all times to depress (once or twice, according to their response) a single morse key, positioned centrally in front of them⁷. This was reasoned to present a blanket response condition, though it cannot be ruled out that only one of the hands was active in making the response.

O'Leary conducted his experiment in a quiet, dimly lit room in the school. This experiment, however, took place in the homes of the children. The disadvantages of this are clear. The child was more relaxed⁸, being in a home environment, and therefore not so predisposed to settle down to the task. Inevitably, the less concentration on the part of the child, the longer the session took, making the child more tired and (very occasionally!) bored. Furthermore, in some houses it was not possible to operate in an environment which was quiet or free from distractions, particularly where there were younger siblings in the vicinity.

The reasons for operating in the home were as follows. Firstly, it enabled suitable contact to be made with the parents. This was important not only for their own peace of mind but because some information (e.g. uncorrected sight problems, familial handedness etc.) was more

7. In fact the design of the tachistoscope prevented precisely central positioning of the key and it was positioned approximately 3cm right of centre.

8. It could be argued, on the other hand, that this reduced the likelihood of stress.

easily and reliably obtained from them than the children themselves. Secondly, it seemed unlikely that in dealing with such young children it would be easy to conduct an experiment 'from cold' in an alien environment. Thirdly, some of the subjects were preschool, so could not have easily been tested other than in the home. Fourthly, in many cases siblings were tested. It made for a more economical use of time to test several subjects on the same occasion. Fifthly, the experimental project involved such a large number of individuals that it would have required fulltime occupancy of a classroom for a considerable time and consistent disruption to classes. In addition, individual sessions were so long that they might easily have involved a child's absence from a whole taught session, which would not have been popular with parents. The school day is also not structured to allow for sequences of long sessions. If one session was not interrupted by a playtime, then the second could not start until after one, which would involve some wastage of time. Individuals varied considerably in the amount of time it took to complete a session, which would have made it impossible to liaise with teachers about the future availability of subsequent subjects⁹. It seems inevitable that with the noise levels of a primary school and the need to personally fetch subjects from classes rather than sending each child to summon the next one, it would have been far from easy to conduct the experiment in the school.

9. In another experiment, not reported here, secondary school children were tested on a much shorter task in the school environment. The 'quiet' classroom was not quiet during lesson changes, with disruption from pupils passing by or lining up outside neighbouring rooms continuing for a good 15 minutes on some occasions. Despite a high level of cooperation from all the teaching staff, it was clearly disruptive for them to keep sending pupils out in the middle of class time.

6:2.4 PROCEDURE

6:2.4.1 PREPARATION

All subjects were tested by the author. In advance of the experimental trials, subjects were familiarised with the equipment and allowed to 'try it out'. On many occasions a parent was also encouraged to do so.

The subject was then shown twelve flashcards, each of which had on it one of the pictures to be used in the practice or experimental trials. The flashcards used at this stage were specially prepared for this purpose, as described in section 6:2.3.3 above. The subject was asked to name the picture and in the majority of cases this elicited the intended target label. Where this was not the case (e.g. *dog* -> *puppy*, *doll* -> *man*), the desired label was suggested to the child and usually this was adopted and freely used when the flashcard was re-presented.

When the experimenter was satisfied that the subject was labelling the pictures as intended (thus using the intended 'rhyming' pairs), an explanation of the task was given. Subjects were told that they would be shown a picture on the screen, then they would see a cross and then another picture, but only for a very short amount of time. They were warned that they would only be able to see the second picture if they watched the cross carefully. They were to decide whether the second picture was the same as the first or different to it. If it was the same, they should "press the button" (morse key) once, and if it was different, twice. They were instructed to use both hands (one on top of the other) to strike the key.

Subjects received practice in using the key correctly, first with

hand-held cards and then with tachistoscopic presentation.

All practice trials used the practice pictures, not the experimental pictures (see above). Subjects were given positive reinforcement when they responded correctly in the practice trials and they were challenged on false responses and shown them again. Practices continued until the experimenter was satisfied that the child was able to perform the task. Some three or four potential subjects never reached this point and they received a token administration of the test only and were excluded from the analysis. New subjects were selected to replace them and testing continued until the desired quota was achieved.

6:2.4.2 EXPERIMENTAL TRIALS

After a short break, during which the experimenter set out the cards (out of sight of the subject) for swift, ordered selection, the experimental trials began. The same semi-random order (see section 6:2.3.3 above) was used for each subject.

Before each trial began, the second stimulus card was inserted into the rear-screen slot ready for its timed exposure. Then the first picture was inserted into the base-screen slot, where it was immediately visible, because the base-screen was illuminated by default. The first stimulus card for each trial was presented for an exposure time of approximately 10 seconds. This was accompanied by the words "*Here's the first picture. Have a good look at it*". (This ten second period was used by the experimenter to prepare the stimuli for the next trial). Then the stimulus was removed with the words "*I'm taking the picture away now*". When the stimulus card was removed it revealed the gaze-centring card, with a cross in the centre, which was left permanently

in the base-screen slot. Exposure to this was approximately seven seconds, during which the experimenter said *"Watch the cross. If the next picture is the same as the first one, press the button once; if it's different, press it twice. Watch the cross, here it comes...now"*. In the case of one or two of the four year olds, the word 'twice' was replaced by 'two times' if it had been found during the practice trials that this was more easily understood - these were children who did not know the word 'twice', as confirmed by a parent.

Immediately after the word *"now"*, the second stimulus was presented for 30 milliseconds. This exposure time was set during the pilot trials as producing responses approximately 90% of the time and, within that, approximately 80% correct responses.

The remote activation of the rear screen illumination by the experimenter also triggered the timer, which measured the time taken from presentation to the response of the subject. The subject struck the morse key once to communicate the response 'same' and twice for 'different', but in both cases the initial depression broke the circuit and stopped the timer. Although it is feasible that a subject could strike the key once before making the 'same'-'different' decision, this was not considered to be occurring, for two reasons. Firstly, the second depression of the button always occurred immediately after the first, except where the subject changed his mind. Secondly, subjects were not told that the timer was stopped by an identical process whether they struck the key once or twice; they could not see the timer during a trial and the circuitry was not explained to them.

The experimenter always checked the response with the subject to ensure that he had not mistakenly pressed or failed to press the key

for a second time. A note was kept of both initial and amended responses, but only the amended ones were used in the analysis, as there was no indication that the decision itself had been altered, only that the wrong response code had been used.

Subjects were praised equally for all responses and were not given any indication of how many correct decisions they had made. Wherever possible subjects were not told how many more trials there were to go, but in a very small number of cases it was necessary to say "*only a few more*" in order to encourage the subject to continue with the test.

Responses considered at the time to be grossly outside the characteristic response-time range for that subject (e.g. over 2.5 seconds for a subject characteristically responding in 0.9-1.5 seconds), as well as defaulted trials, were readministered at the end of the session¹⁰.

A routine of changing stimulus cards swiftly meant that trials could be administered continuously. The subject had time to sit back from the tachistoscope, but it was only a matter of seconds before he was called upon to begin the next trial. After a set of six trials the subject was given a distraction (or 'rest') task to do, which formed part of the handedness or reading-age assessment: The sequence of these was as follows:

Trials 1-6

Task: draw a circle (2nd session: triangle) and cut it out

Trials 7-12

Task: mime using a hammer, eating an apple and brushing teeth; fold arms; clasp hands; look through a 'telescope' (cardboard tube)

Trials 13-18

Task: catch a ball six times; kick a ball six times

Trials 19-24

Task: Schonell reading-age assessment

Retrials as required (maximum 6 before any additional distraction task)

10. Because this was done at the time, no information is available regarding the type of stimulus most often providing such responses.

At the end of each of the two sessions of 24 trials (plus retrials) the subject received a small chocolate bar.

After the first session, a parent was asked general questions loosely related to handedness (see below). An informal, subjective socioeconomic rating was also made by the experimenter, based on type and area of residence and father's occupation. This information was not used in the analysis as there was only a minimal amount of variation; it was observed that the few children from professional families who were included in the study tended to have a higher than average reading-age in relation to their chronological age. As the influence of reading-age on performance was tested statistically, and as socioeconomic status was not of immediate interest, this informally observed correlation was not subjected to any formal analysis.

The second session of 24 trials occurred between 3 and 7 days later, wherever possible at the same time of day and in the same environmental conditions. In almost every case, this session took less time over all (average c.40 minutes) than the first (average c.50 minutes). The procedure was the same, including the picture familiarisation and the practices, but a different stimulus presentation order (semi-random & the same for all subjects, as described in section 6:2.3.3) was used.

6:2.5 RESULTS

6:2.5.1 RESULTS OF THE HANDEDNESS TEST

The handedness test involved the following exercises: drawing a circle or triangle and cutting it out, throwing a ball (six times per session), miming eating an apple, hammering a nail and brushing teeth.

In addition, subjects kicked a ball (six times per session) and used a 'telescope' to determine foot and eye preference respectively. The starting foot was also noted (six times per session) as the child was running towards the ball to kick it, and also the uppermost arm in arm folding and uppermost thumb in hand clasping. Details were gathered of familial handedness and, in line with Geschwind's (1983,1985) hypothesis, also of stuttering, dyslexia, eczema, asthma, hayfever and food allergies in the subject or immediate family. The validity of any informal scoring on the basis of this wide inventory would be difficult to justify, as the relative importance of these different factors is not clear. Therefore, the details that had been collected in the activity part of the assessment were subjected to a scoring procedure modified from the Edinburgh Handedness Inventory (Oldfield 1971). This utilised the following EHI categories:

2) drawing, 3) throwing, 4) scissors, 5) toothbrush
i) foot preference, ii) eye preference.

Two additional categories were added:

a) eating, b) hammering.

Categories (2),(4),(5),(ii),(a) and (b) were scored using one point, added either to the left or the right total. (3) and (ii) were scored as follows: 2-0 for consistent preference; 2-1 for preference but some variation; 1-1 for no preference. This was intended to retain the general flavour of the EHI scoring system, even though only eight, rather than 12 categories were used. Calculations were the same as for the EHI, viz. $100 \cdot ((R-L)/(R+L))$, but, of course, the figures may only be taken as a rough guide because of the alterations made. Scored in the above manner, the mean LQ value for the males was +90.00 (decile R.7).

range +57.14--+100; for the females the mean LQ was +94.04 (decile R.8), range +77.78--+100. Like the EHI, this assessment did not take account of familial handedness, starting foot or dominant hand and arm in clasping/folding. All of these manifested considerable variation. Most striking was the almost total absence of any subjects who were entirely consistent in their use of their right hand, foot and eye and who had no sinistral family members. This contrasts with O'Leary's claim to have used only boys who were consistent in this respect.

6:2.5.2 EXPERIMENTAL RESULTS

All calculations took into account only those response times (RTs) associated with correct identifications of the stimulus type (i.e. correct 'same'-'different' judgements). This excluded 3.92% of the responses. In addition, the corpus of RTs for each subject was purged of outliers by removing times that were more than 1.5 standard deviations from the mean. This removed 13.18% of the remaining data. Thus, just over 83% of the total corpus of RT scores was used in the analysis. The reason for purging the database of outliers was that there was a small number of abnormally slow times attributable to loss of concentration. As the RT curve was skew, with hardly any abnormally fast scores and a low median, the effect of this procedure was to remove only the abnormally slow times, as desired.

Mean reaction times (RTs) are given in Table 6:i. The mean RTs for males and females for left and right presentation are represented in Figure 6:I. As Figure 6:I illustrates, the males showed a fairly consistent, but very small, Right Visual Field Advantage (RVFA); the fe-

MALES	MEAN AGE	COMBINED	R	L
4s	4:08	1.122	1.092	1.153
5s	5:06	1.141	1.122	1.161
6s	6:08	1.295	1.276	1.313
7s	7:08	1.049	1.026	1.073
8s	8:04	0.925	0.927	0.923

FEMALES	MEAN AGE	COMBINED	R	L
4s	4:07	1.240	1.277	1.204
5s	5:07	1.471	1.471	1.471
6s	6:08	1.203	1.205	1.200
7s	7:05	1.178	1.168	1.189
8s	8:08	0.845	0.854	0.836

ALL SUBJECTS	MEAN AGE	COMBINED
4s	4:07	1.181
5s	5:07	1.306
6s	6:08	1.249
7s	7:07	1.114
8s	8:06	0.885

TABLE 6:i MEAN REACTION TIMES FOR CORRECT RESPONSES (R=RVF presentation, L=LVF presentation; N=50, 10 in each age group).

Mean
RT (secs)

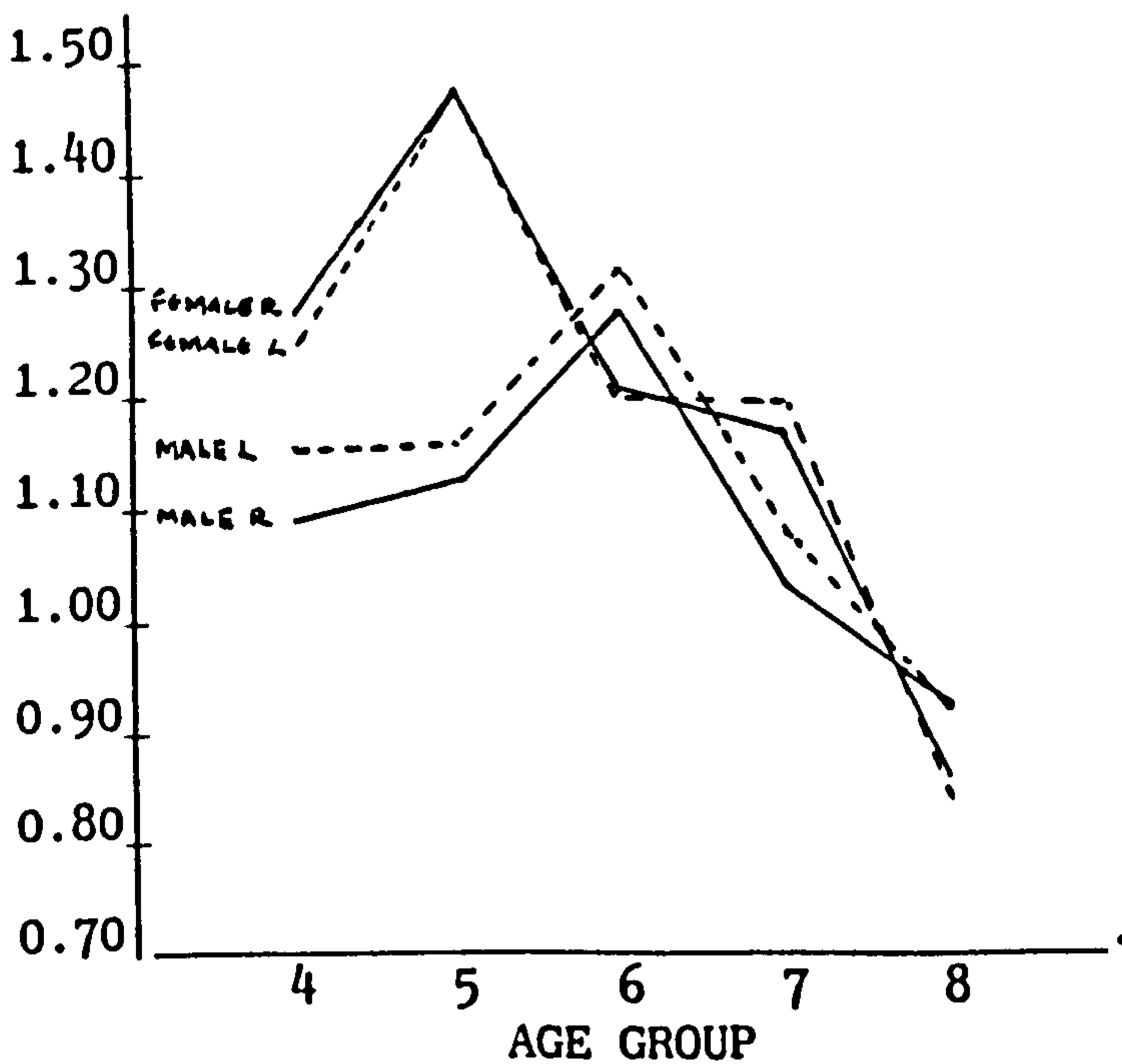


FIGURE 6:I MALE AND FEMALE MEAN RTS (SECS) FOR AGE GROUPS 4-8 RIGHT AND LEFT VISUAL FIELD PRESENTATIONS

males did not show a consistent pattern. Figure 6:II shows the trend

in males towards an RVFA, while the females' VFA appears negligible.

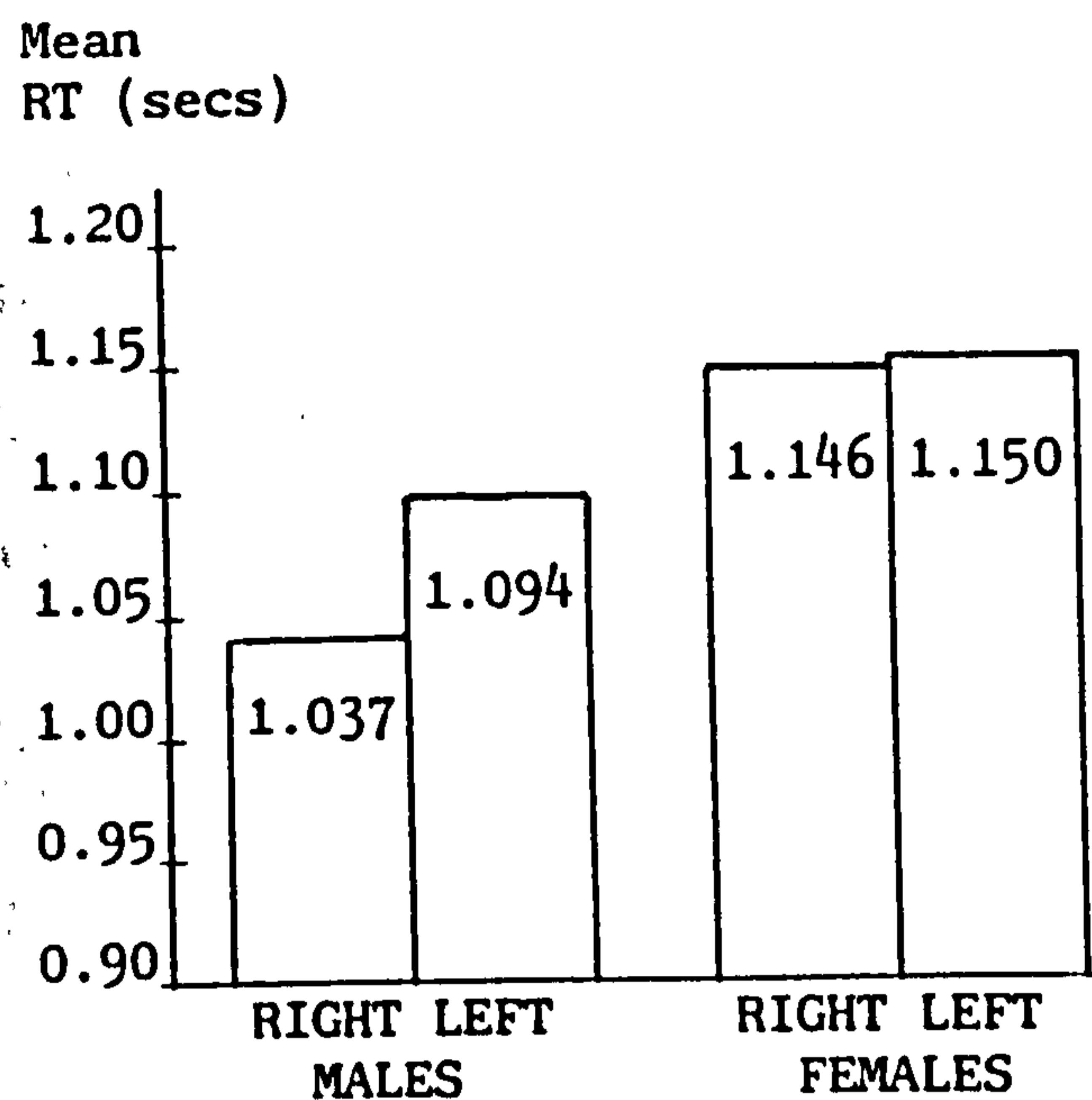


FIGURE 6:II OVERALL MEAN RESPONSE TIMES FOR MALES AND FEMALES TO LEFT AND RIGHT PRESENTATION (N=50: 25 males, 25 females)

A repeated measures ANOVA was computed for the two between subjects variables sex (male, female) and age (4,5,6,7,8) and the two within subject variables side-of-presentation (right, left) and stimulus-type (same, different). The apparent sexgroup effect mentioned above was not significant, probably due to the large spread of RT scores. However, there was a significant age effect $F(4,40)=1.10$ ($p<0.03$).

The subjects were divided according to two agegroups (age $< 7;6$ and $\geq 7;6$). A two-way interaction of side-of-presentation and stimulus-type across age and sex approached significance $F(1,46)=3.32$ ($p<0.075$). Table 6:ii demonstrates the cell values of this interaction.

SIDE OF PRESENTATION	STIMULUS TYPE	
	SAME	DIFFERENT
RIGHT	1.138	1.145
LEFT	1.131	1.173

TABLE 6:ii OVERALL MEAN REACTION TIMES FOR COMBINED AGEGROUPS (N=50: Each cell value represents a maximum of 12 responses from each child)

For the purpose of a third computation the data was redistributed according to two reading-age groups: reading-age < 5.5 (7 males and 4 females) and ≥ 5.5 (18 males and 21 females). A three-way ANOVA (reading-age group, side-of-presentation and stimulus-type across sex) was highly significant, $F(1,46)=9.85$ ($p<0.003$). Figure 6:III illustrates the interaction of these variables.

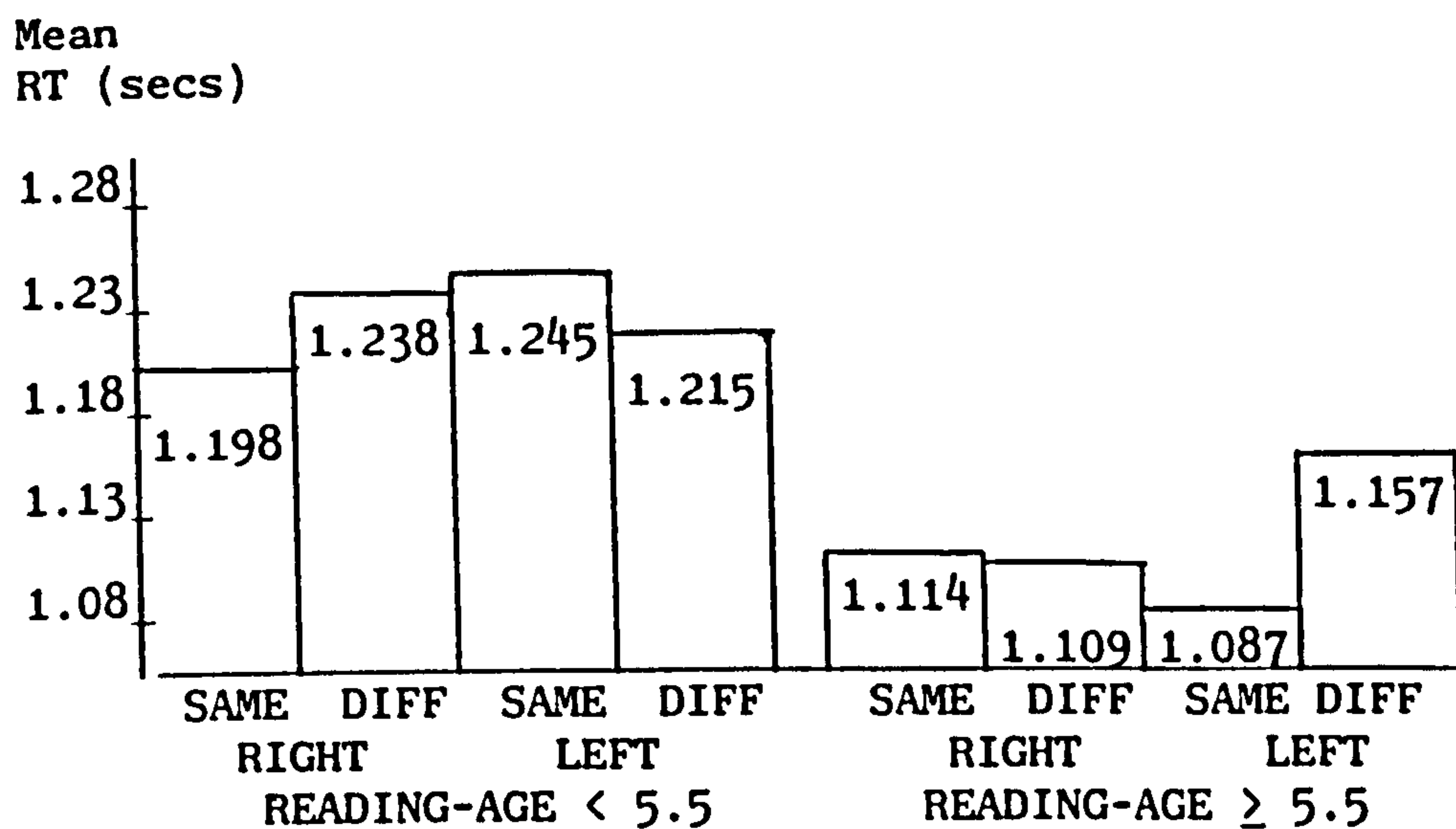


FIGURE 6:III SAME AND DIFFERENT FOR LEFT AND RIGHT FOR THE READING-AGE GROUPS < 5.5 AND ≥ 5.5

Despite the highly significant interaction, caution is required in interpreting the pattern in the graph (Figure 6:III). This is because the cell values used in the calculations from which it is derived are not independent, the same subject appearing in all four cells in the row. (This was not a problem with the ANOVA calculations, however, because a repeated measures test was used). Furthermore, the differences are very small: even the greatest one, between the left 'same' scores across the two reading-ages is only a matter of 0.158 sec, while the

Mean
RT (secs)

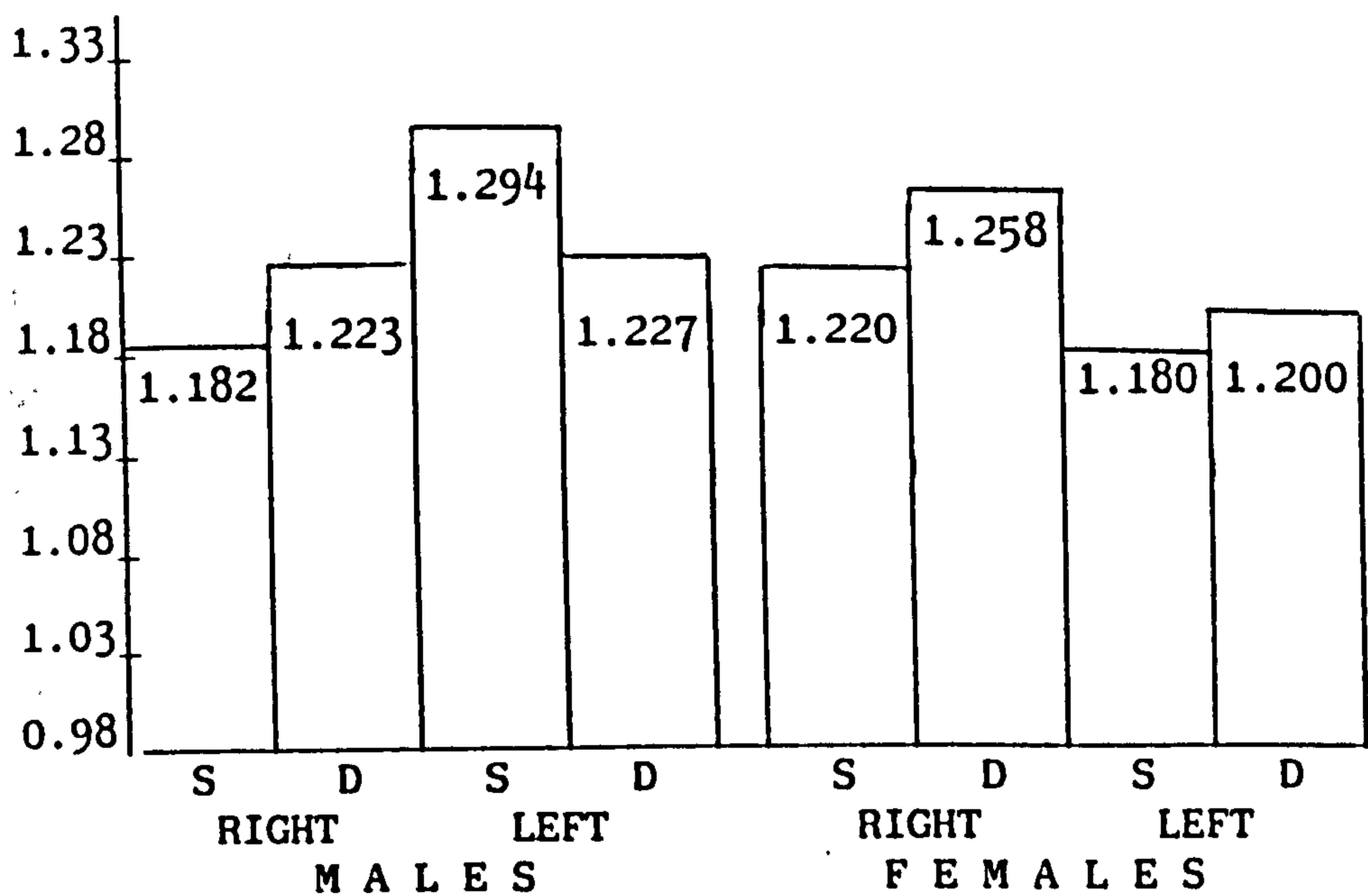


FIGURE 6:IV MEAN RTs FOR SAME AND DIFFERENT FOR READING-AGE < 5.5

Mean
RT (secs)

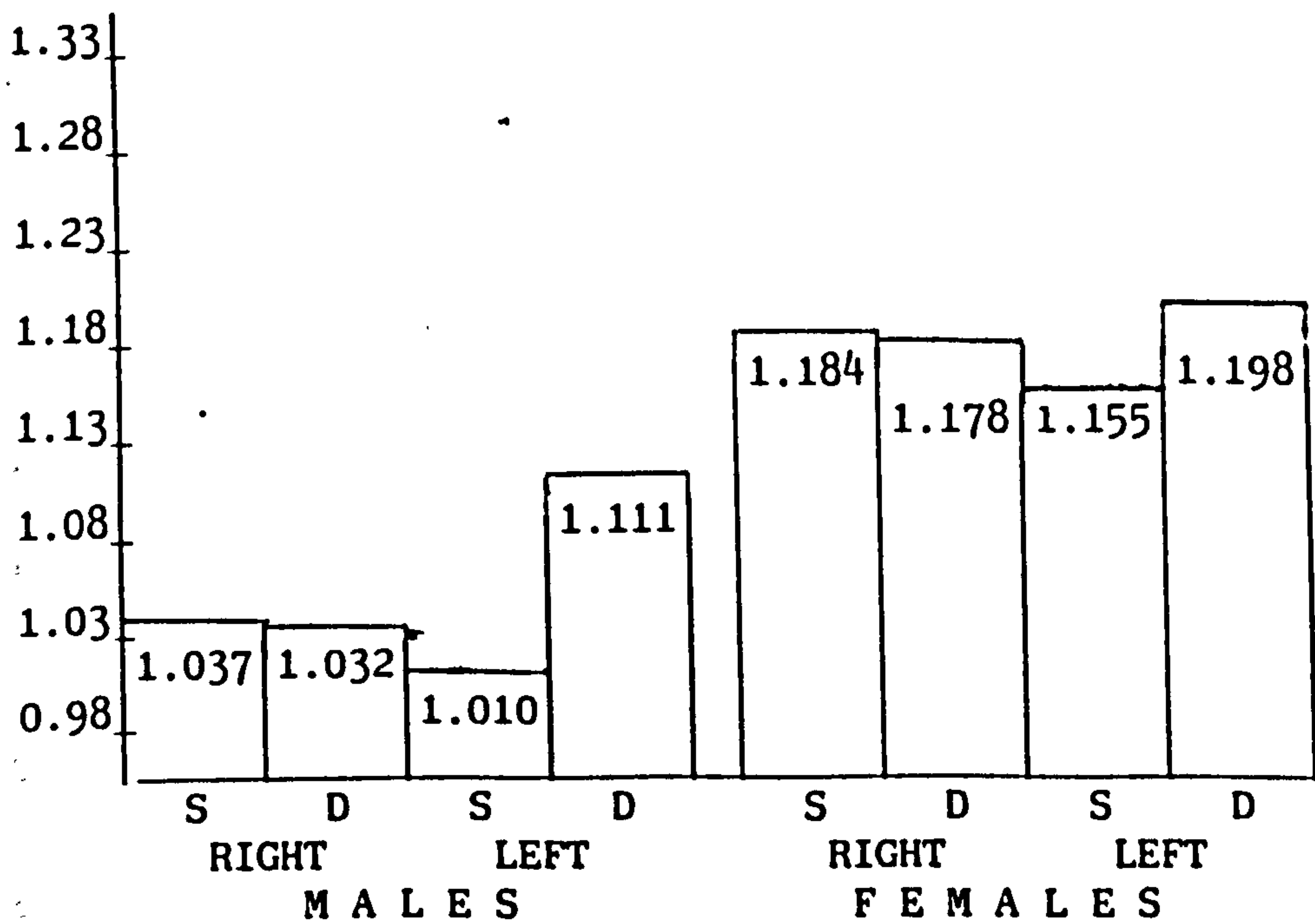


FIGURE 6:V MEAN RTs FOR SAME AND DIFFERENT FOR READING-AGE \geq 5.5

spreads were large; on the other hand, the sample sizes are fairly large. Figures 6:IV & 6:V illustrate the same interactions, according to sexgroup.

To see if there was any rhyme-nonrhyme effect in the 'different' trials, ANOVA calculations were repeated using only the 'different' responses, divided into a 'rhyme' and a 'nonrhyme' group. These calculations, which were otherwise the same as those reported above, produced no significant main effects and only one significant interaction, for rhyme-nonrhyme, sex and age (5 chronological age-groups) across side-of-presentation, $F(4,40) = 3.44$ ($p < 0.017$); see Figures 6:VI and 6:VII. The values relating to these graphs can be found in the Appendix, Table A6:i.

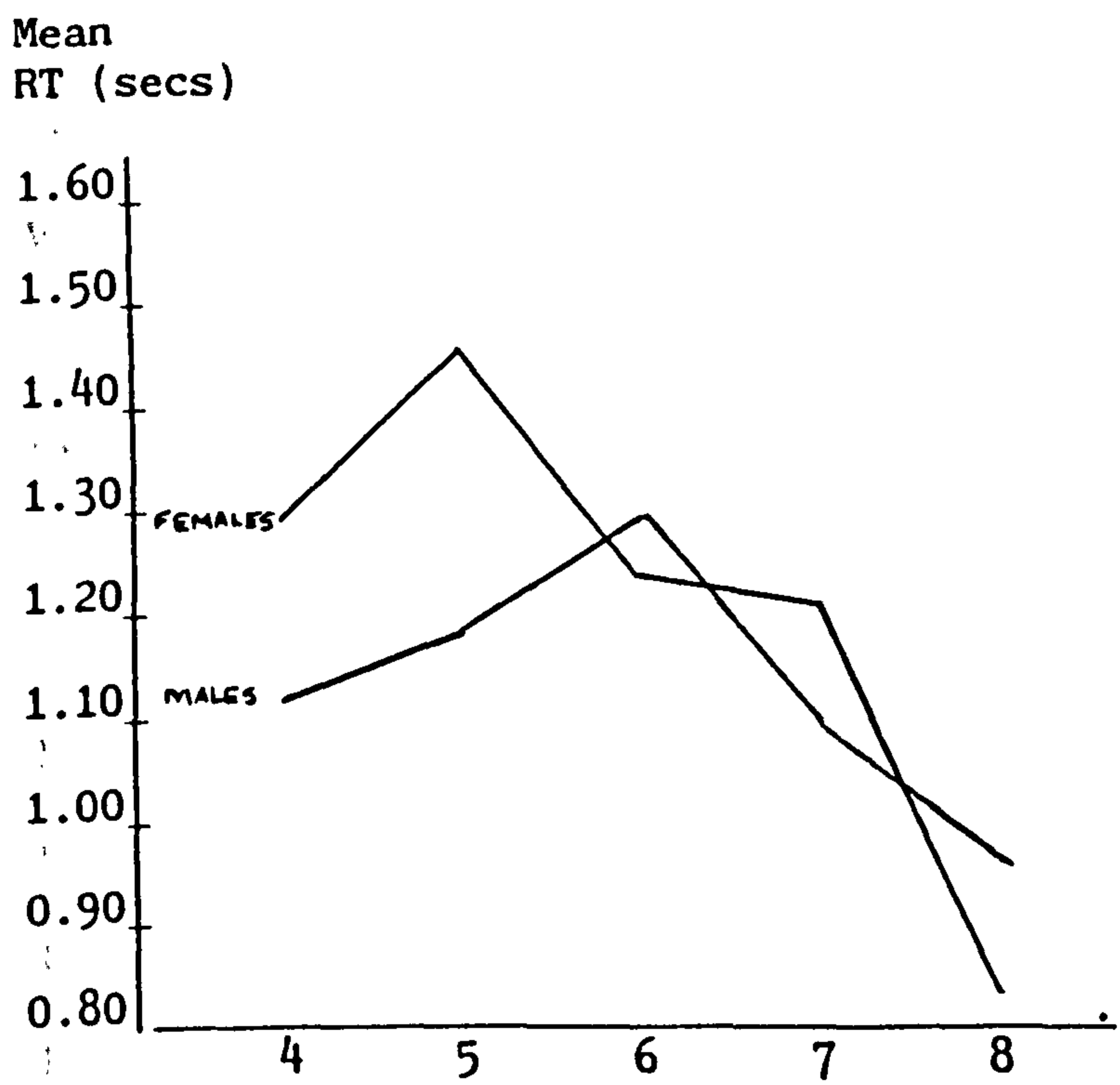


FIGURE 6:VI NONRHYMES FOR MALES AND FEMALES

Mean
RT (secs)

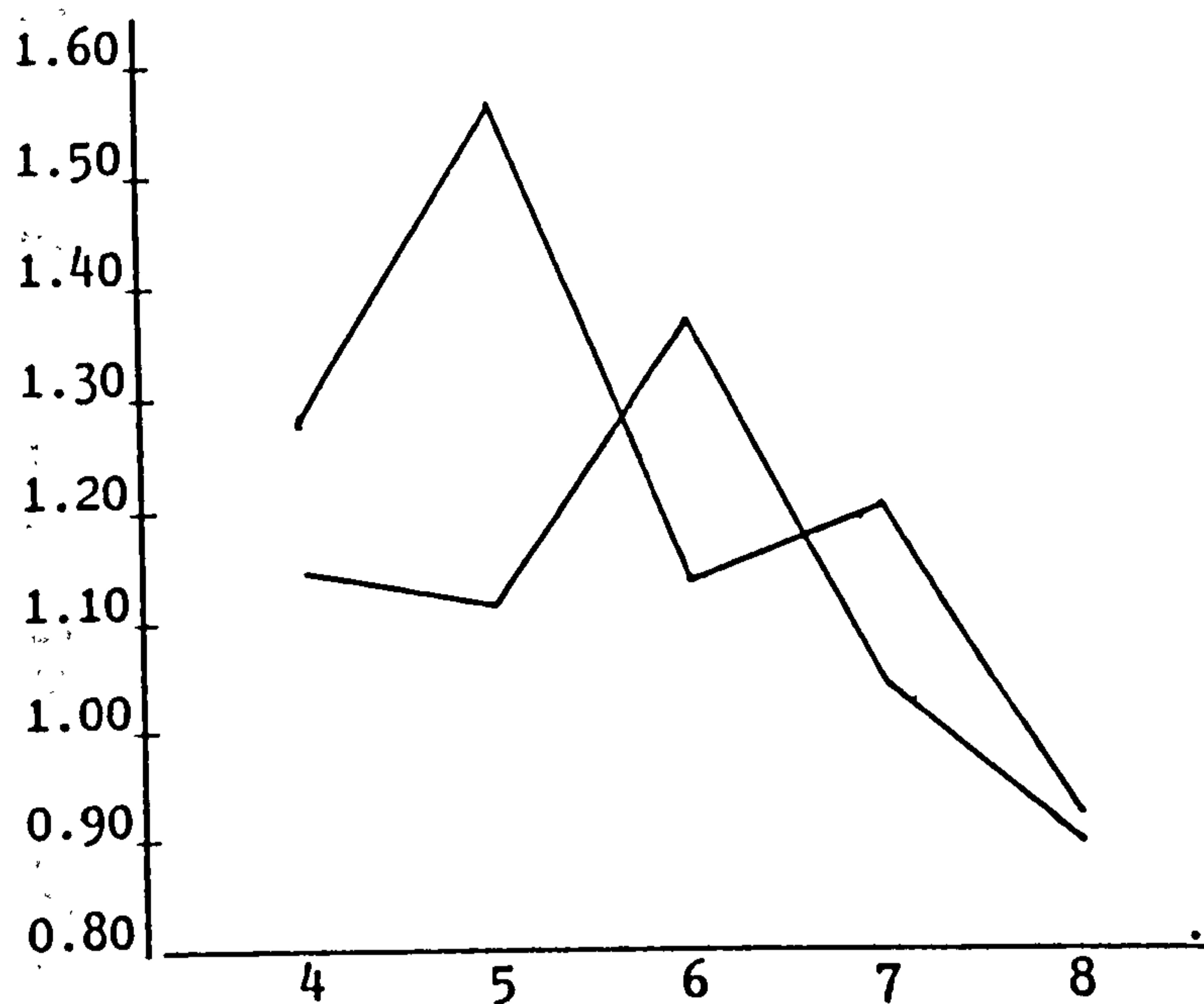


FIGURE 6:VII RHYMES FOR MALES AND FEMALES

Finally, subjects were regrouped according to whether or not their mean RT was longer for 'different' than 'same' judgements. Figure 6:VIII illustrates the mean RTs for these groups.

Mean
RT (secs)

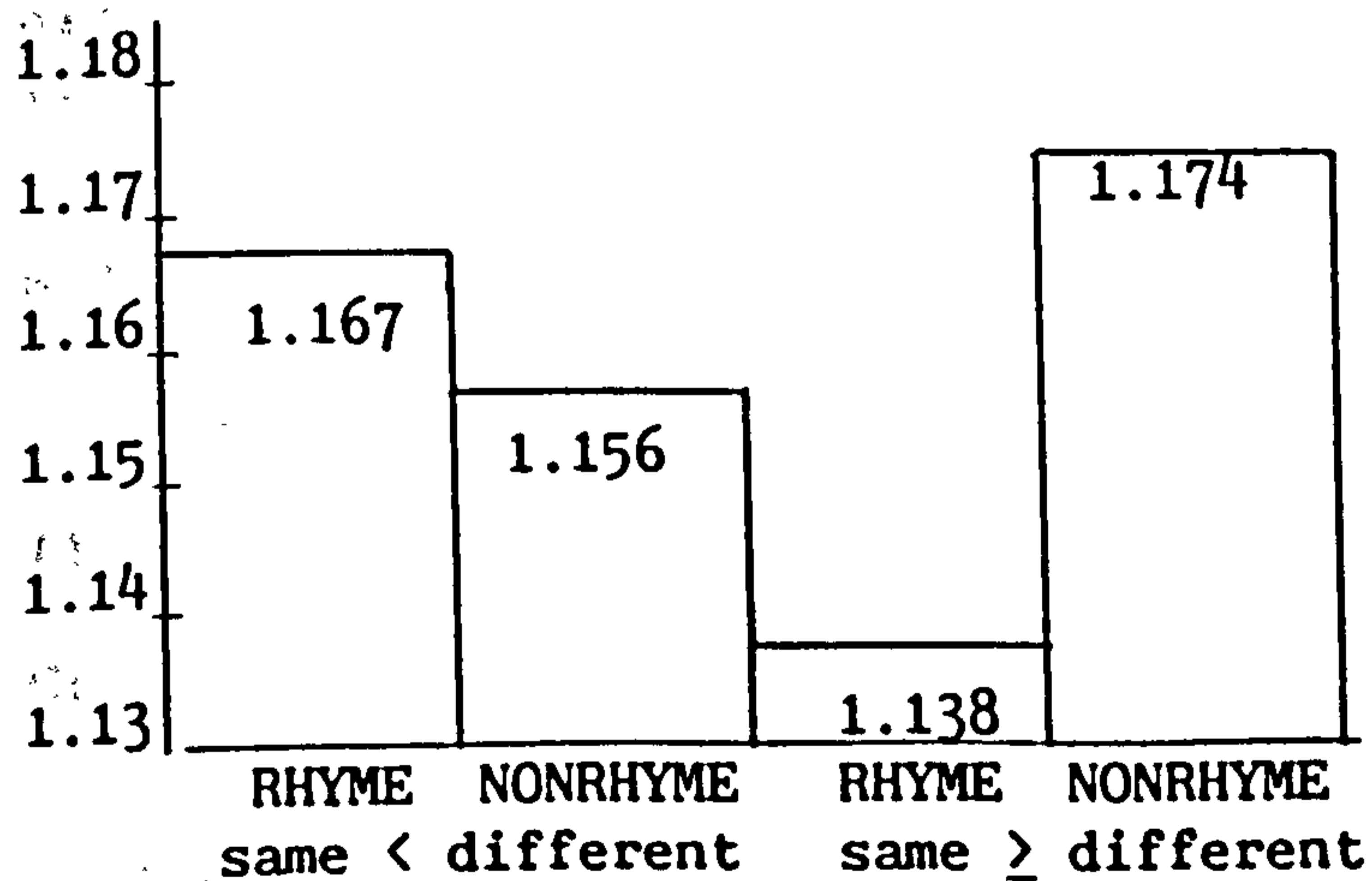


FIGURE 6:VIII MEAN RTs ON RHYME AND NONRHYME TRIALS FOR THE GROUPS SAME < DIFFERENT AND SAME > DIFFERENT

The contrast illustrated in Figure 6:VIII, though striking, is very small and was not statistically significant.

6:2.5.3 SUMMARY OF RESULTS

The following results were obtained in the analysis.

- 1) There was no statistically significant VFA but there was a non-significant trend in males towards RVFA.
- 2) There was a significant age effect, both in calculations involving the five agegroups and when subjects were divided into those younger than 7;6 and those 7;6 or older.
- 3) The interaction of stimulus-type with side-of-presentation approached significance. This was due to a small RVFA in 'different' trials, while there was no VFA in 'same' trials.
- 4) The interaction of stimulus-type with side-of-presentation and reading-age group (divided at 5.5) was highly significant. In the lower reading-age group, 'different' responses took longer in right presentation, 'same's longer in left presentation. In the higher reading-age group the opposite was the case. The differences were, however, small.
- 5) These patterns were reflected in both sex groups.
- 6) Within the 'different' response data, there was a significant interaction of rhyme-nonrhyme, sex and age (five groups).
- 7) Rhyme responses took longer than nonrhyme responses in those subjects who also responded faster in 'same' than 'different' trials. Those who did not, took longer to respond to nonrhymes than to rhymes. This interaction was not significant.

6:2.6 DISCUSSION

The lack of any significant VFA corresponds to Kimura & Durnford's (1974) findings (see section 6:2.2 above). It also relates in part to Cramer's (1976) results. She found that:

first graders tend to encode material visually, while fourth graders are as likely to encode verbally as visually. (p.55)

The equality of RTs was most striking in the females (Figure 6:II). O'Leary found a significant interaction for side-of-presentation and

age, reflecting a significant LVFA for his youngest group (mean age 6;9) and a non-significant RVFA for the older groups (8;0 and 8;10). No such interaction was observable here; thus, there was no evidence to support Cramer's claim regarding first graders (see above). However, there was a significant age effect, by virtue of the RTs being shorter in the older subjects. In fact, however, the youngest age group was not the slowest; female RTs peaked at age 5 and males at age 6. It is possible that this pattern reflects the adoption of a different strategy at age 5 in the girls and age 6 in the boys. If this were the case, the difference in age for the sexes could be attributed to the advanced maturational stage of girls relative to boys (cf. Buffery 1971, cited in Harris 1978). It is, however, quite possible that the pattern seen in Figure 6:1 was caused by chance. As each value consists of the mean of only five subjects' mean scores, a single 'slow responder' in a group could have a considerable influence.

As in O'Leary's results, a contrast was found in response times for 'same' and 'different' trials (i.e. for stimulus type) but only his was statistically significant. Both experiments elicited more of a VFA in the 'different' than in the 'same' trials, but while it was here a consistent trend towards an RVFA, in O'Leary's results there was a swing from LVFA to RVFA in the different responses as a function of increasing age. O'Leary's prediction was that the presence of rhyming pairs would slow the RTs only for RVF presentation; this should have yielded an LVFA for 'different' trials. Furthermore, the comparison of rhyme with nonrhyme trials should have shown an LVFA for rhymes and no VFA for nonrhymes. This was not forthcoming in O'Leary's results. In the experiment reported here, although there was a significant interaction

of age, sex and rhyme-nonrhyme, this appears to be attributable to the faster RTs in males in the youngest age-groups, coupled with the later peak in RTs in males than females as described above (see Figures 6:VI & 6:VII). Nevertheless, as Figure 6:VIII indicates, there was a non-significant tendency for those subjects who took longer to respond to 'different' than 'same' trials to respond faster to nonrhymes than to rhymes, as O'Leary predicted. However, there is a problem in interpreting this as a 'rhyme effect' because there is no obvious way of accounting for the opposite trend (i.e. rhymes taking less time) in the subjects who responded quicker to 'different' than 'same' trials. This question will be raised again presently.

As there was no changeover in VFA at either age seven (as with O'Leary and with Cramer 1976) or age five (as with Conrad 1971), the redistribution of subjects according to reading-age was used to search for effects relating to educational experience. Underwood (1969) supports the view that educational experience may have an effect on the perception and memorising of stimuli:

In a very young child, the associative attributes [of memory] may be subordinate to other attributes, particularly the acoustic and spatial.... As the child ages, and particularly as he concomitantly is exposed to successive learning experiences in the school systems, the primary attributes developed in learning may change, with the associative verbal attributes becoming more and more common. (p.571)

The cut-off point of reading-age = 5.5 was perhaps rather low, considering the likely reading-age of the private school children in O'Leary's study at age 6;9. It was selected, however, because it marked the general dividing line between pre-school children and school children in the York sample. Although it did not offer close correspondence with O'Leary's age division, it did enable comparisons with the find-

ings of Conrad (1971, cited in O'Leary 1982) and Cramer (1976):

The...data indicate that visual memory organisation is dominant for children just beginning school, but that for fourth graders, neither verbal nor visual encoding predominates. (Cramer 1976:56)

Furthermore, it roughly separated the pre-peak from the peak and post-peak groups (Figure 6:I). Again, the trends were not significant, but a contrast was found (Figure 6:III). However, this was the opposite to what O'Leary predicted: it was the lower reading-age group which showed the effect he predicted for the older (supposedly verbal-labelling) group, viz. slower 'different' responses during right field presentation.

The 'rhyme effect' thus manifested itself in two puzzling ways. Firstly, while rhymes took longer than nonrhymes for those subjects for whom 'different' responses also took longer than 'same' responses, they took less time in the remaining subjects. Secondly, the 'same'-'different' effect, attributed by O'Leary to the rhyme variable, was most marked in the group with the lowest reading-ages. This would mean that the verbal labelling was being carried out by the least educated, indeed virtually illiterate subjects. Although this is the opposite of what O'Leary predicted, it does correspond to the findings of Bach & Underwood (1970), who tested second- and sixth-grade children on acoustic and associative attributes in memory. The second graders displayed dominance in the acoustic attribute, the sixth graders in the associative. Although their experiment compared the phonological and semantic encoding of words, rather than the phonological and visual encoding of pictures, it is of interest that it was the younger group who displayed the acoustic dominance, because the results of the experiment reported here may be indicating the same thing, i.e. a phonological la-

belling. If it were to be the case that this picture memorising was approached in the same (general) way as Bach & Underwood's (1970) word memorising, then it is possible that the older group were utilising an associative rather than a verbal strategy and thus were not affected by the rhyme variable. However, this still does not explain the concomitant findings of the data, namely the slower 'different' responses in left field presentation in the higher reading-age group. If Levy's (1974) claim that only the left hemisphere can deal with phonological verbal labelling is to be believed (though much discussion has been presented regarding this matter: see chapters 3, 4 and 5), then the 'same'-'different' effect cannot be attributed to the rhyme variable.

Various general observations can be made regarding the results reported above, the design and execution of the experiment and the hypothesis which O'Leary (1982) presented. Firstly, there could be verbal labelling which was not phonological but semantic. (This might correspond in some way to the associative attribute of memory mentioned above). In that case, the rhyme variable would have no effect. However, an RVFA might be expected for those subjects employing such a strategy and there was none.

Secondly, a phonological verbal strategy could operate without being affected by rhyme, if only the first picture was labelled. The same-different judgement could be effected by means of the question 'Is that [2nd picture] an x?'. One informal observation supports this. The subjects often verbalised their response as "yes" or "no" rather than "same" or "different" during the routine check on their intended judgement. On the other hand, the subjects often proffered gratuitously the names of the two pictures they had seen. This would not neces-

sarily have been easy for them if they only had the information 'not an x', though it is possible that they retrieved the information from some visual trace only after they had made their response. The slower response to 'different' suggests that some extra step was required in the decision and this might most obviously be the identification, whether by form or verbal label, of the second stimulus. As such an identification was not required for the completion of the task, we may hypothesize that this step was necessary for the decision because of the particular strategy employed. It is equally compatible with the Focusing Hypothesis that a far more complex pattern of strategies than a simple binary opposition would be in operation. The association of changes in strategy with sex and reading-age is in keeping with subject-type being a decisive variable as discussed in chapter 5:2. Conversely, if it is argued (as in chapter 5:2) that educational experience plays a major rôle in paring down the strategy option range, then that range might be wider and the choices less principled in children of primary school age than older subjects. In that case, individual variation would be so great as to defy the useful grouping of subjects. One individual might employ different strategies on different trials, and, conversely, a variety of strategies might lie behind the most apparently systematic of findings, an artifact of the experimental design. Equally, wide ranging and erratic patterns of RTs could result from alterations in the relative weight of affective factors and in attention (cf. chapter 4:1.2), such that the VFAs in studies like this were as good as random. This only highlights the inevitable shortcomings of conducting an experiment on such a young population. It is ironic, but, of course, fundamental to the very argument presented in

this thesis, that the design of response time psycholinguistic experiments is such that probably only analytically trained and highly motivated adult subjects can be relied upon not to confound the results with extraneous variables like attentional fluctuation; this was, seen retrospectively, probably the largest single random variable in the experiment reported here. One observation, then, is clear: there are experimental designs which may, by their very nature, preclude their reliable use on all but somewhat unrepresentative subgroups of the population.

6:3 EXPERIMENT II

INVESTIGATION OF POSSIBLE STRATEGY DIFFERENCES IN COMPLETING A PROPOSITIONAL AND A NON-PROPOSITIONAL LINGUISTIC TASK USING MONAURAL BLOCK PRESENTATION

6:3.1 AIM

The Focusing Hypothesis draws a distinction between the kind of linguistic stimuli commonly used in psycholinguistic experiments and the language of normal communicational interaction. It suggests that an experimental subject is not usually called upon to exercise the dual system for processing which is operational during communicative interaction because (a) the task does not require propositional evaluation, (b) the circumstances of the experiment encourage focus on a lower level of input and/or output and (c) the subject is probably drawn from the small but convenient population of educationally successful individuals, i.e. university students.

The purpose of the following experiment was to compare two types of

linguistic task, one of which required only a (spoken) reaction to what was heard and the other of which required a response resulting from propositional decoding and evaluation. It was hypothesised that, given appropriate conditions, which freed the strategy option range sufficiently, different strategies might be selected for each task. The word repetition task, which did not require nor, practically speaking, permit propositional evaluation, was predicted to attract a language-focused strategy, while the one requiring propositional evaluation would require a proposition-focused strategy, either with or without holistic decoding.

As noted in the discussion in Chapter 5:2, however, a contrast between two types of linguistic task administered in standard psycholinguistic conditions would only be found if the task variable were stronger than the other variables, which might otherwise combine to narrow the range of strategy options too much to permit the tasks to be differently approached. Rather than drastically altering the experimental conditions, which would preclude satisfactory comparisons with other studies, a monotic block presentation was chosen instead of the more customary dichotic and random one. Monotic presentation has a number of advantages over dichotic. On the purely practical level it is easier to prepare the stimulus tapes as there is no need to align onset between two channels. The subject is submitted to a rather less stressful task, as he is not fighting to perceive and deal with two simultaneous contrasting inputs or to actively ignore one in favour of the other. Furthermore, as Haydon & Spellacy (1974) point out, work by Bakker (1967, 1968, 1969, 1970), Murphy & Venables (1970) and Doerhing (1972) contradicts Kimura's (1964:357) assertion that auditory functional a-

symmetry can only be found in conditions of stimulus competition (Haydon & Spellacy 1974:288; see also Dimond 1972:156-7).

When combined with block presentation, the monotic listening test appears to have the advantage of commencing at a base-line neutral for attentional factors. The intrusion of attention, which may be responsible for some or all of the characteristic dichotic listening test pattern of REA for language (Shadden & Peterson 1981) has been suggested to be salient by Kinsbourne (1978). He proposed that in a verbal task the expectation of verbal stimuli sets up an attentional bias to the right side of space (p.10). If the experiment reported here had been dichotic, the prediction made by the Focusing Hypothesis would have been that of the two verbal tasks administered, only in the non-propositional one would an attentional bias to the right have been advantageous; in the propositional task it would have led to a high load upon the analytic mechanisms as they dealt with the linguistic decoding and the propositional evaluation. Haydon & Spellacy (1974) found that, in the monotic presentation of speech stimuli, an REA obtained only when presentation was random with respect to ear. When ear presentation was in blocks, the ear advantage disappeared. This was considered to indicate that attention to the right side of space was less a function of the task being verbal than of this being the default state of alertness. This corresponds to the association made by the Focusing Hypothesis between the left hemisphere and analysis or, more particularly, focus for attention. Shadden & Peterson (1981) compared ear superiority patterns in a monotic presentation of verbal stimuli in the two conditions of random and block presentation. In the random presentation there was a non-significant REA; in the expected condition ten of the

11 subjects displayed an LEA. This latter correlated negatively with the same subjects' ear advantage pattern in dichotic presentation. Shadden & Peterson's two potential explanations for this both hinge on the greater simplicity of a monotic over a dichotic task. The first account is that in a simple auditory task the ipsilateral pathways play an increased rôle (p.186). However, this is not in keeping with the fact that the ipsilateral pathways are still considered to be inferior to the contralateral ones (Gazzaniga 1967); although increased ipsilateral involvement might reduce the size of an REA, it should not be able to reverse it.

Their second account is that when the left hemisphere is presented with a simple task to do which involves linguistic stimuli, it tends to over-react and to subject them to more analysis than is necessary. In that case, the right hemisphere would display an advantage in the task because it was not equipped to do such analysis (p.186-7). The general corpus of psycholinguistic evidence regarding the right hemisphere's ability to deal with language at some levels (see chapter 3:5.3) supports the notion that the right hemisphere would not at any rate have any trouble coping with a straightforward perception of and reaction to linguistic stimuli of the standard type.

By the use of monotic block presentation in this experiment it was hoped to remove the effects of a default attentional bias to the right, and to come a little closer to measuring the actual efficiency of the contralateral (and perhaps ipsilateral) connections of ear and brain.

6:3.2 DESIGN

6:3.2.1 TASKS

In the propositional task the subject was required to respond to statements with a spoken (later written) judgement of *TRUE*, *FALSE* or *DON'T KNOW*. The score was the number of incorrect responses as judged by the subject himself. In the non-propositional task the subject was asked to list, verbally, the last three words of the statement in reverse order. This task was designed as a result of observations made with pilot subjects (not included in the analysis); trial tasks administered to pilot subjects included naming the initial letter of the final word (too easy), of the final two words (too easy) and of the final three words (too difficult). Listing the final two words of the statement in reverse order was also too easy; three words gave a performance level high enough to leave subjects encouraged but low enough to provide a suitable number of errors or defaults for the analysis.

6:3.2.2 SUBJECTS

17 male and 20 female students at the University of York acted as subjects in the experiment. Most were in the age range 19-24 (14 males, 13 females). The remainder were in the ranges under 19 (3 females), 25-35 (2 males, 2 females) and over 35 (1 male, 2 females). 14 (2 males and 12 females) were students of linguistics or psychology, 4 (2 males and 2 females) of social science subjects, education or language teaching, 7 (6 males, 1 female) of science, including maths and economics, and 12 (7 males and 5 females) of humanities (music, philosophy, English and history), with the largest group being music students (5 males and 2 females). The distribution of the sexes across the subjects reflects the general trend in the student population at York.

All subjects were right-handed, scoring over LQ +60 (decile R.2) on

the Edinburgh Handedness Inventory (Oldfield 1971). Mean EHI scores were +87.15 (decile R.6) for males (range +61.54 - +100) and +88.57 (decile R.7) for females (range +66.67 - +100). No subjects had any known major hearing defect.

6:3.2.3 MATERIAL

80 sentences were constructed on the subject of *The University of York*. 40 constituted statements which were true and 40 that were false (see Appendix, A6:2), to the best knowledge of the experimenter¹¹. A second set of 80 sentences was similarly constructed; on the subject of *The City of York*. The reason for using subject matter which referred to trivial, local matters rather than general knowledge was to avoid subjects feeling embarrassed about not knowing some of the facts in question.

The statements were tested out on a small number of volunteers whose knowledge of the City and/or University was as good, if not better, than that of the subjects. They were invited to comment on the truth and clarity of the statements, and a number of amendments were made on that basis. The mean number of words in each subject set of 80 sentences was 8.68 (range 5 - 14). Each set was divided in half to

11. In the course of the weeks during which the experiment was prepared and administered, two statements changed their value: City (C) 61 and University (U) 66. The latter concerned the closest supermarket to the Campus changing its name. Subjects who knew of this appear, without exception, to have assumed that the experimenter did not, and reacted accordingly. The statement 'The closest supermarket to the University Campus is Hillards', although literally speaking false, would have been, in the pragmatic circumstances of its falsity, meaningless, seeing as, with its takeover, there was no supermarket in the whole city with that name. The clear and spontaneous response of the subjects faced with this dilemma was to make allowances for what the statement was intended to mean.

form Groups A and B. Each Group retained the same mean word length and an equal number of true and false statements.

Groups A and B of each set were then further subdivided into 30 test items and 10 foils. Only the test items were used in the analysis. There was no qualitative difference between the sentences used as test items and those used as foils. In Group A, which was to be presented first, all 10 foils preceded the test items and acted as practice trials. In Group B, presented second and to the other ear, five foils preceded the test items to allow for subjects becoming accustomed to the new ear presentation. The other five followed the test items, to reduce the impact of any fatigue or relief effect.

Foils were balanced for true-false values and word length. In addition, the sentences were balanced with respect to the constituent structure of the last group of three words, as this was potentially pertinent to the difficulty of the non-propositional task. In the *City of York* set, there were 9 incomplete constituents (e.g. (1) below), which all appeared in the test items, 5 in Group A and 4 in Group B.

- 1)(C42) [The Minster took about two hundred and fifty] years to build.
- 2)(U56) [The nearest University town to] York is Hull.
- 3)(U48) [Wentworth is the most] recently built college.

In the *University of York* set, there were 19 incomplete constituents (e.g.(2)-(3) above), of which 2 appeared in Group A foils, 7 in Group A test items, 2 in Group B foils and 8 in Group B test items. The fact that there were more incomplete constituents in the University set was not considered to be important, as the analysis did not include any comparison of the two sets.

Neither set contained more than 10% of statements considered to be

likely to evoke a visuo-spatial response (e.g. x is next to y), but because of the other balancing procedures, it was not possible to distribute these equally across Groups nor, within Groups, across test items and foils.

The sentences were recorded onto ordinary cassette tapes, preceded by instructions (see Appendix, A6:3). The sentences were all spoken at a moderate to fast speed by the same female voice. Each sentence was immediately followed by a bell, which indicated that it had finished. The next sentence began no more than 1 second after the bell marking the end of the previous one. Four master tapes were compiled (see Appendix, A6:4), to accommodate both orderings of the tasks and both sets of sentences. The ear presentation variable was operated independently of the tapes, by means of written instructions.

The test was administered in a language laboratory in the Department of Language and Linguistic Science, University of York. The laboratory booths did not permit stereo reception, so the monaural presentation was effected by inserting suitable padding into one earphone. The subjects recorded their responses on a separate track of the tape, using the *student record* facility.

6:3.3 PROCEDURE

A maximum of four subjects were tested at any one time. They sat at non-adjacent individual booths equipped with a cassette player and headphones. The headphones had been padded on one side to prevent binaural (monophonic) output. All subjects first received written instructions describing the general nature of the experiment (Appendix, A6:3). They were told that the experiment was about listening to how sen-

tences sound while ignoring their meaning. The non-propositional task was referred to as the *experimental test*¹². The propositional task was mentioned briefly and was defined as a *control task*. It was referred to as the *quiz*. The reason for introducing the tasks in this precise way was to heighten the subject's awareness of the non-propositional task as a linguistic test, and suppress a similar perception of the propositional task. To aid the latter, the subjects were given the impression that the *quiz* was being made as easy as possible, by permitting them to choose the set of statements on which they felt they could perform better. The subjects were also told that there was to be a prize for the person who made the most correct responses in the *quiz*. This was hoped to act as an incentive to concentrate on the propositional content of the sentences in that part of the experiment. Lastly, they were told that although it was advantageous for them to score as highly as possible on the aural presentation, they would have the opportunity to improve their score afterwards. When they did the non-propositional task the subjects were told that there would be no opportunity to improve on their score, so it was important that they concentrate as hard as possible. Also, they were specifically advised that there was no need to pay any attention to the meaning of the sentences whose final words they were repeating.

Subjects selected their preferred theme for the *quiz* and they were assigned an appropriate tape. They had already been allotted to one of four groups, varying for both side of initial presentation and task order. Subjects in the two 'propositional (*quiz*) task first' (PTF) groups received tape A if they elected to do the *quiz* on the University

12. Only the non-propositional task was referred to as a 'test'.

and tape B if on the City. Subjects doing the non-propositional task first (NTF) received tape D for the University *quiz* of tape C for the City *quiz* (see Appendix, A6:4). Their group-specific written instructions specified which ear to put the working earphone to first and the experimenter checked that this instruction had been adhered to. The initial instruction sheet also contained general information about the operation of the equipment (see Appendix, A6:3).

The tape was fitted by the experimenter into the booth machine and tested for clarity. The master volume level was set at 7 (of 10) and subjects were told that that they could alter it as they wished. The purpose of this was to retain some leeway should one ear be weaker than the other. However, as the tape was not particularly loud, and the tasks were complex, once the volume was raised to maximum it tended to be kept there. The use of the earphones was explained to the subject, because their design was such that the microphone could easily be moved from its position near the mouth.

Then the subject received a new set of instructions (Appendix, A6:3) as relevant to the task to be undertaken first. The instructions for the non-propositional task told the subject to repeat the last three words of each sentence in reverse order and an example was given. There was a warning that halfway through the task they would be instructed on the tape to turn their headphones round. The propositional task instructions required the subject to respond to each statement with the words *TRUE*, *FALSE* or *DON'T KNOW*. All details not specific to one task were identical on both sets of written instructions.

The subjects commenced the experiment in their own time. The tape began with a reminder of the instructions and then, after a short

pause, the sentences began. Responses were recorded onto a separate track of the tape and the subjects did not need to take any action to effect this after starting the tape. They were not permitted to replay the tape or to switch it off until they received instructions to that effect.

After 40 sentences they were told to change their earphones round and to stop the tape while they did so. Immediately after this instruction were the words "*You should now have changed your earphones round ...*", which acted as a check. In addition, the experimenter watched the subjects to ensure that they did so. They were then told that the task would continue as before, and the remaining 40 sentences were presented.

At the end of the task they were instructed on the tape to switch off the machine and raise their hand. They then received a written task to do. The non-propositional task was always followed by a questionnaire, which enquired about the subject's University and A-level study, age and handedness (Edinburgh Handedness Inventory). The propositional task was followed by a written version of the same *quiz* that they had just heard on tape. The statements were in a different order, which was the same for all subjects. The instructions required them to fill in the letters T (*TRUE*), F (*FALSE*) or DK (*DON'T KNOW*) after each statement. They were told that this exercise was to help them improve their *quiz* score and so they should answer to the best of their ability, irrespective of whether they had given the same response in the taped version.

When the written task was completed, the experimenter presented the written instructions appropriate to the second task and the procedure

was repeated for this.

The whole experiment took 40-45 minutes. The subjects' responses were transcribed the same day onto a specially prepared checklist which gave the statements in the same order as they appeared on the tape. The tape was then ready to be used again, with the new responses over-recording the old ones. The student track of the tapes was, nevertheless, periodically cleaned by running the 'record' function with the microphone disconnected.

6:3.4 RESULTS

6:3.4.1 SCORING

The propositional task was scored by counting up the number of disagreements between a subject's taped responses and subsequent written ones. It was assumed that the latter would most accurately represent what the subject really believed to be true and that taped responses which were different would reflect limitations on the efficiency of evaluating propositions at speed. No distinction in scoring was made between a change from *TRUE* to *FALSE*, *FALSE* to *TRUE* or to or from *DON'T KNOW*, because the most obvious response to make if a proposition could not be suitably evaluated in the tape condition was *DON'T KNOW*. The actual number of correct responses was also calculated, but this was only used for the purpose of finding the highest score. The winning subject subsequently received a prize.

The non-propositional task was scored as follows. Only the first three words of the subject's response were taken into account except in obvious cases of repair. Two points were awarded for a correct word in the correct position. One point was awarded for a correct word in the

incorrect position. For example:

STIMULUS	RESPONSE	SCORE
4)(C23)...site of a Roman gateway.	gateway,Roman,a	6
5)(C15)...have a war memorial.	memorial,war,not	4
6)(C73)...ten miles from York.	York,from	4
7)(C61)...is open every Sunday.	Woolworths,open,Sunday	2

If a word such as 'gateway' ((4) above) was treated as two words, this was permitted, so that the response 'way,gate,Roman' would also receive six points. But, despite the frequency of its occurrence in subjects' responses, 'two hundred' was not permitted to count as one word:

STIMULUS	RESPONSE	SCORE
8)(C1)...two hundred years old.	old,years,two hundred	4

This scoring system was not without its problems. Most notably, the following configurations attracted scores which seemed misrepresentative:

STIMULUS	RESPONSE	SCORE
9)(C63)...became the Roman Emperor.	Emperor,became,the	4
10)(C12)...due south of York.	south,of,York	4
11)(C12)...due south of York.	south,York,of	3
12)(C18)...the Merchant Adventurers' Hall	Adventurers',Merchant,the	2

However, other scoring systems which were considered (e.g. 1 point per word, regardless of position; 1 point per word in correct position) had their own shortcomings. In retrospect it might have been better to apply the slightly more complex criterion of only awarding position points if no extraneous word intervened. Thus, (9) above would have been awarded 3 points, not 4. The niceties of the scoring system are most relevant to the relationship which responses had to constituent structure configurations. Therefore, the system would only have been unfair across subjects if different subjects either responded according

to differently perceived constituent structure patterns or, and more in line with the hypotheses under examination in this chapter, if some subjects adopted a strategy which dealt in constituents and others did not. It might be argued, then, that the scoring system was potentially biased in a crucial way. On the other hand, if such inter-subject differences were of a significant order, then they would, by very virtue of appearing as score differences, be highlighted by such a bias; in other words, the bias could be advantageous because strategy differences are of primary interest to the analysis. However, the bias would only be advantageous if those strategy differences were associated with specific, recognised subgroups of the subject sample (see below).

6:3.4.2 ANALYSIS

As the subjects were permitted to choose which set of statements to use for the *quiz* the groups were not balanced in this respect. 10 males and 14 females used the *University* statements for the propositional task (*quiz*) (tapes A & D) and 7 males and 6 females used the *City* list. 9 males and 11 females did the propositional task first and 8 males and 9 females did it second.

The potential range of scores on the propositional task was 0-30 per ear and on the non-propositional task 0-180. The actual ranges were 1-19 and 33-180 respectively. The scores on the propositional task increased with decreasing accuracy, whereas those on the non-propositional task increased with increasing accuracy. Therefore, all the propositional task scores were given negative values.

The individual scores are given in Table A6:iii in the Appendix. The mean scores were as follows:

	PROPOSITIONAL TASK		NON-PROPOSITIONAL TASK	
	R	L	R	L
MALES (n=17)	-5.76	-6.88	109.65	109.24
FEMALES (n=20)	-4.85	-6.45	122.15	125.60

TABLE 6:iii

TABLE 6:iv

As Tables 6:iii and 6:iv indicate, the females performed better on both tasks. Both males and females displayed an apparent right ear advantage on the propositional task but no ear advantage on the non-propositional task. In a matched pairs t-test (one-tailed) on the right and left scores in the propositional task it was not significant for the males but it was for the females ($p < 0.05$).

Table 6:v shows the number of individuals displaying an REA and an LEA in each task and Table 6:iv the distributions of the EA combinations across the two tasks.

		PROPOSITIONAL TASK	NON-PROPOSITIONAL TASK
M A L E S	REA	9	9
	LEA	5	8
	no EA	3	0
F E M A L E S	REA	12	9
	LEA	7	10
	no EA	1	1

TABLE 6:v

EA FOR PROPOSITIONAL(P) AND NON-PROPOSITIONAL(N) TASK					
	P=REA, N=REA	P=REA, N=LEA	P=LEA, N=LEA	P=LEA, N=REA	N/A
MALES	4	5	2	3	3
FEMALES	6	6	4	2	2

TABLE 6:vi

Table 6:vii redistributes these for task order.

EA FOR FIRST(1) AND SECOND(2) TASK					
	1=REA, 2=REA	1=REA, 2=LEA	1=LEA, 2=LEA	1=LEA, 2=REA	N/A
MALES	4	4	2	4	3
FEMALES	6	6	4	2	2

TABLE 6:vii

A chi-squared test on the proportion of subjects with an LEA in the propositional task (see table 6:v for these figures) did not reach significance (males: chi-squared = 2.882, d.f.=1; females: chi-squared = 1.8, d.f.=1).

A four factor analysis of variance (repeated measures) was calculated separately for each task, using the within subject factor side-of-presentation and the between subject factors sex, task-order and ear-order. For neither task were there any significant interactions, but in the within subjects analysis for non-propositional task the interaction between side-of-presentation and ear-order approached significance, $F(1,29)=3.22$ ($p<0.083$) (see Figures 6:IX and 6:X).

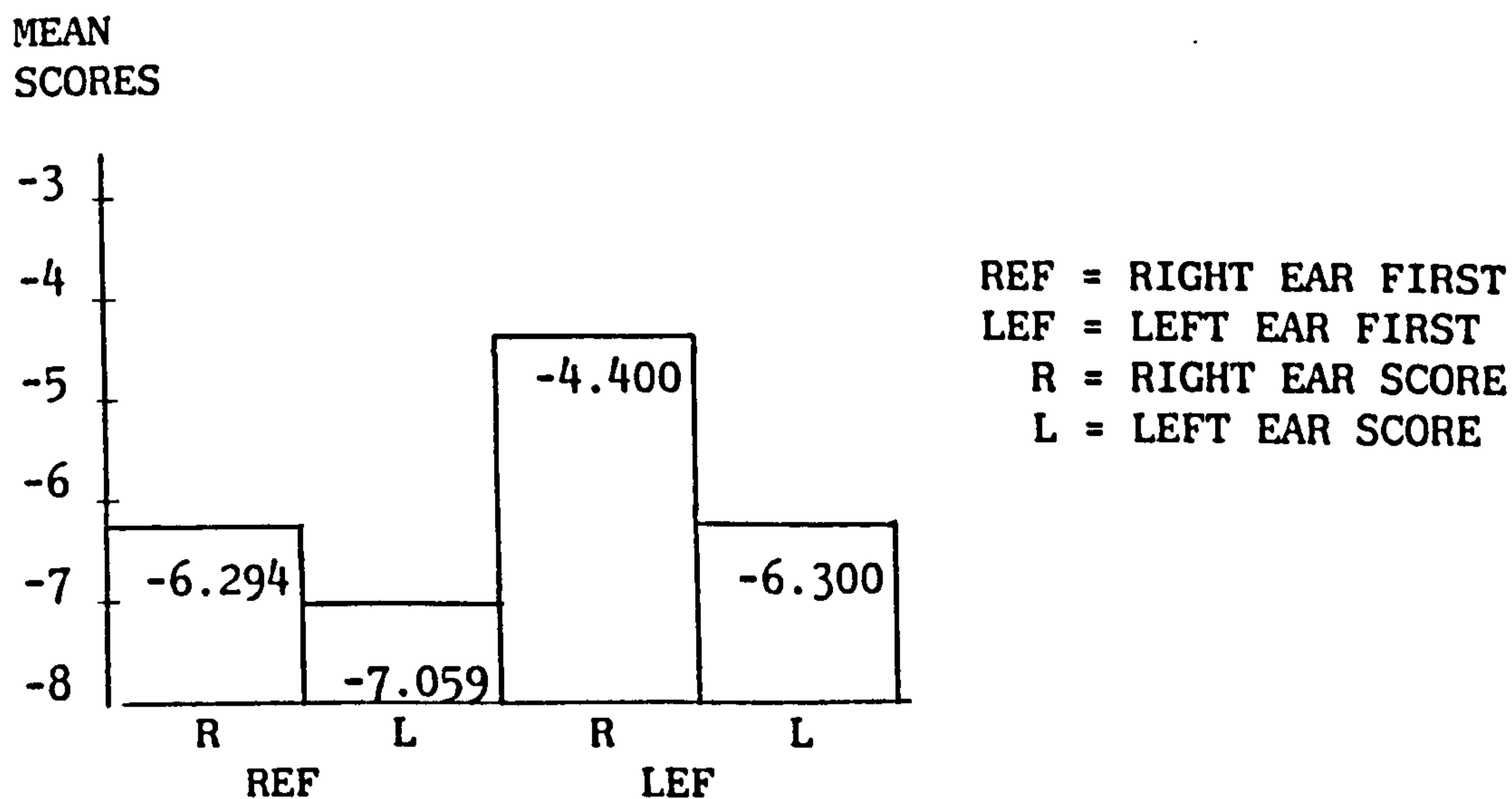


FIGURE 6:IX MEAN SCORES FOR RIGHT EAR FIRST (REF) AND LEFT EAR FIRST (LEF) FOR THE PROPOSITIONAL TASK¹³

13. The purpose of using negative figures displayed in this way is to enable visual comparisons to be made between the results from the two tasks. In both cases the highest column represents the best score.

MEAN
SCORES

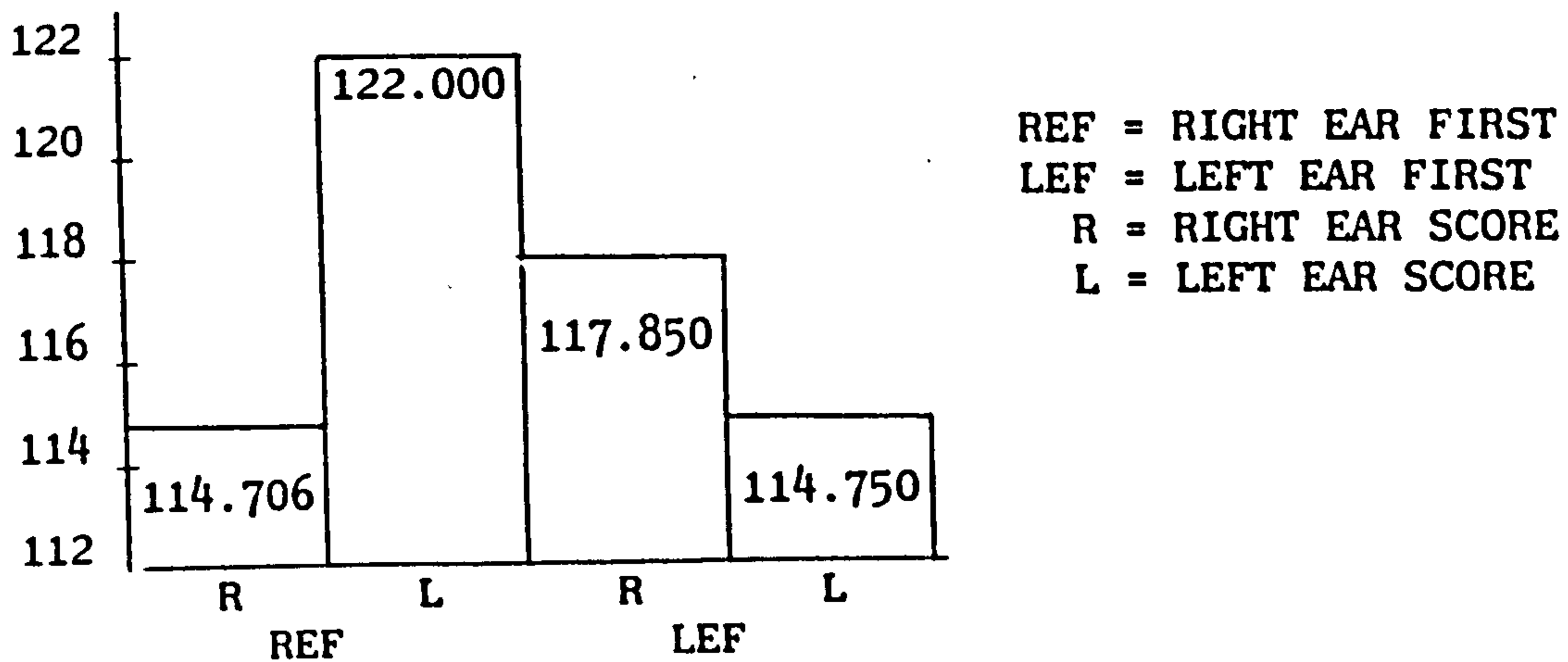


FIGURE 6:X MEAN SCORES FOR RIGHT EAR FIRST (REF) AND LEFT EAR FIRST (LEF) FOR THE NON-PROPOSITIONAL TASK

Figures 6:IX and 6:X demonstrate that in both tasks the REF and the LEF groups had the same mean score for their first ear. In the propositional task the second ear performed worse if it was the left and better if it was the right. In the non-propositional task the second ear always performed better, whichever it was.

Scores were overall better in the group who received the non-propositional task first (Figures 6:XI and 6:XII).

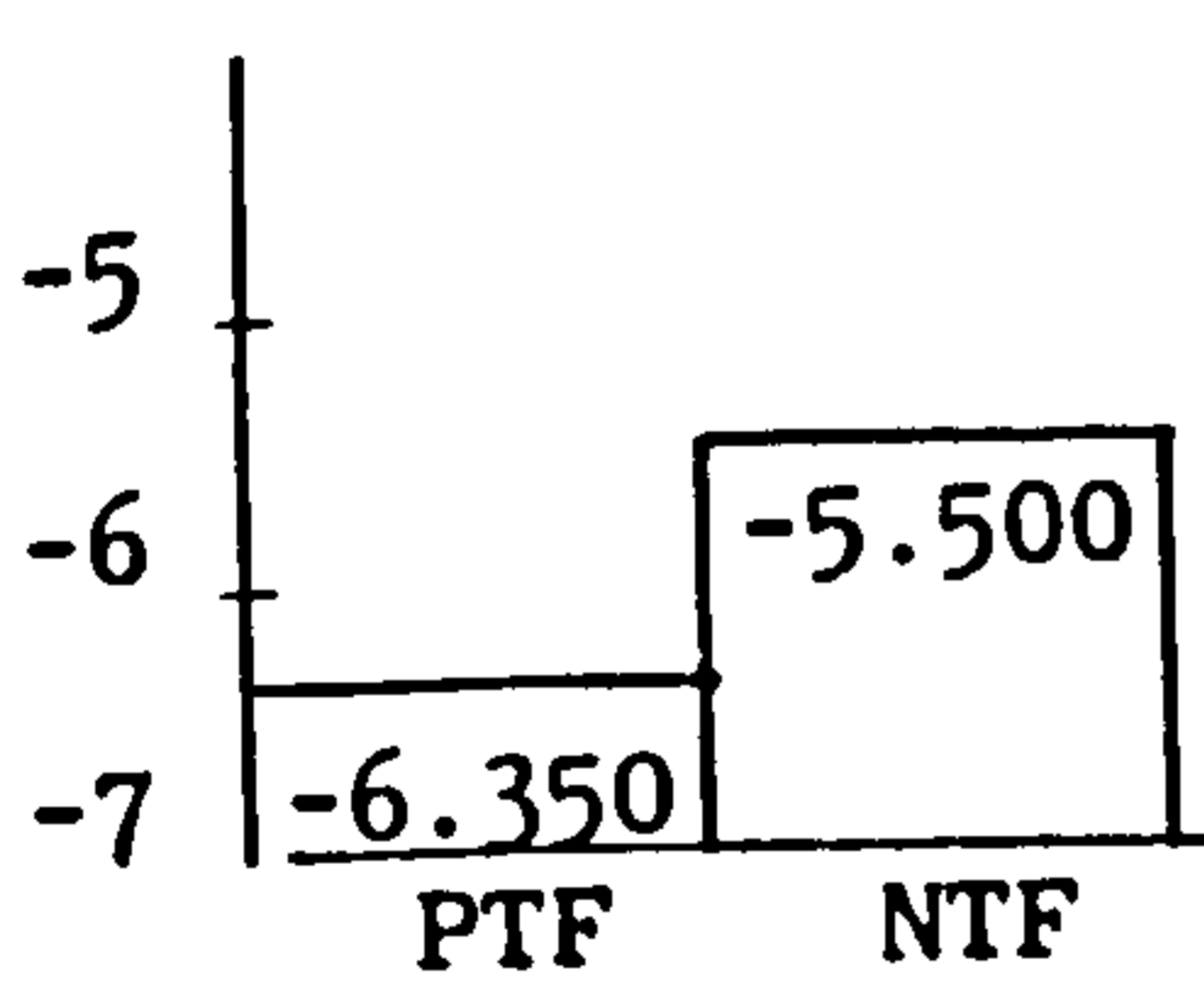


FIGURE 6:XI

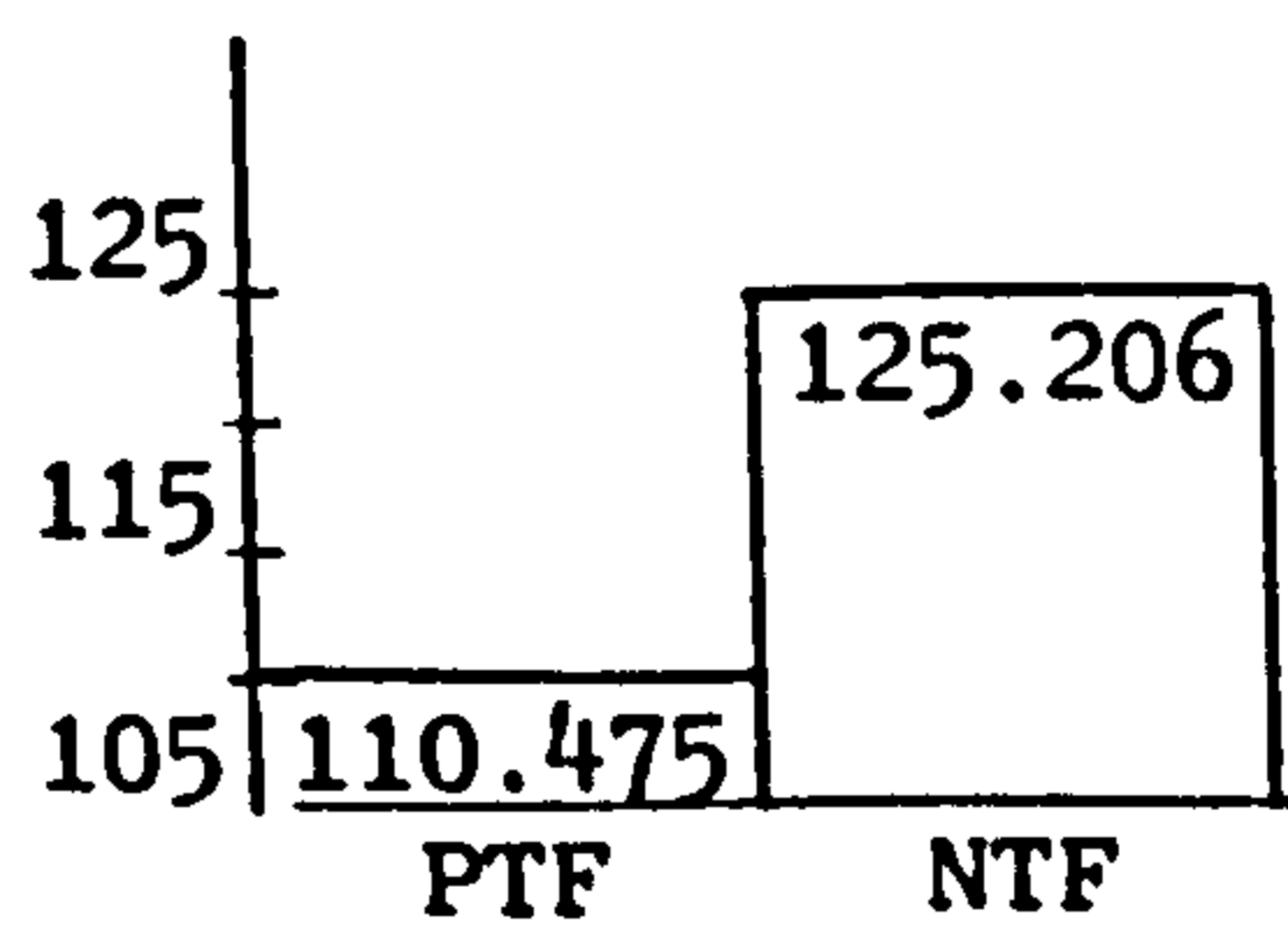


FIGURE 6:XII

MEAN SCORES ACROSS SEX AND SIDE OF PRESENTATION FOR THE GROUPS PROPOSITIONAL TASK FIRST (PTF) AND NON-PROPOSITIONAL TASK FIRST (NTF) IN THE PROPOSITIONAL TASK (FIGURE 6:XI) AND THE NON-PROPOSITIONAL TASK (FIGURE 6:XII)

Order of task presentation had no effect in the females but in the

males the group receiving the propositional task first performed less well in both tasks (Figures 6:XIII and 6:XIV). The male-female difference (averaged across right and left scores) was not significant in a one-tailed t-test for the propositional task but it was significant ($p < 0.025$) for the non-propositional task.

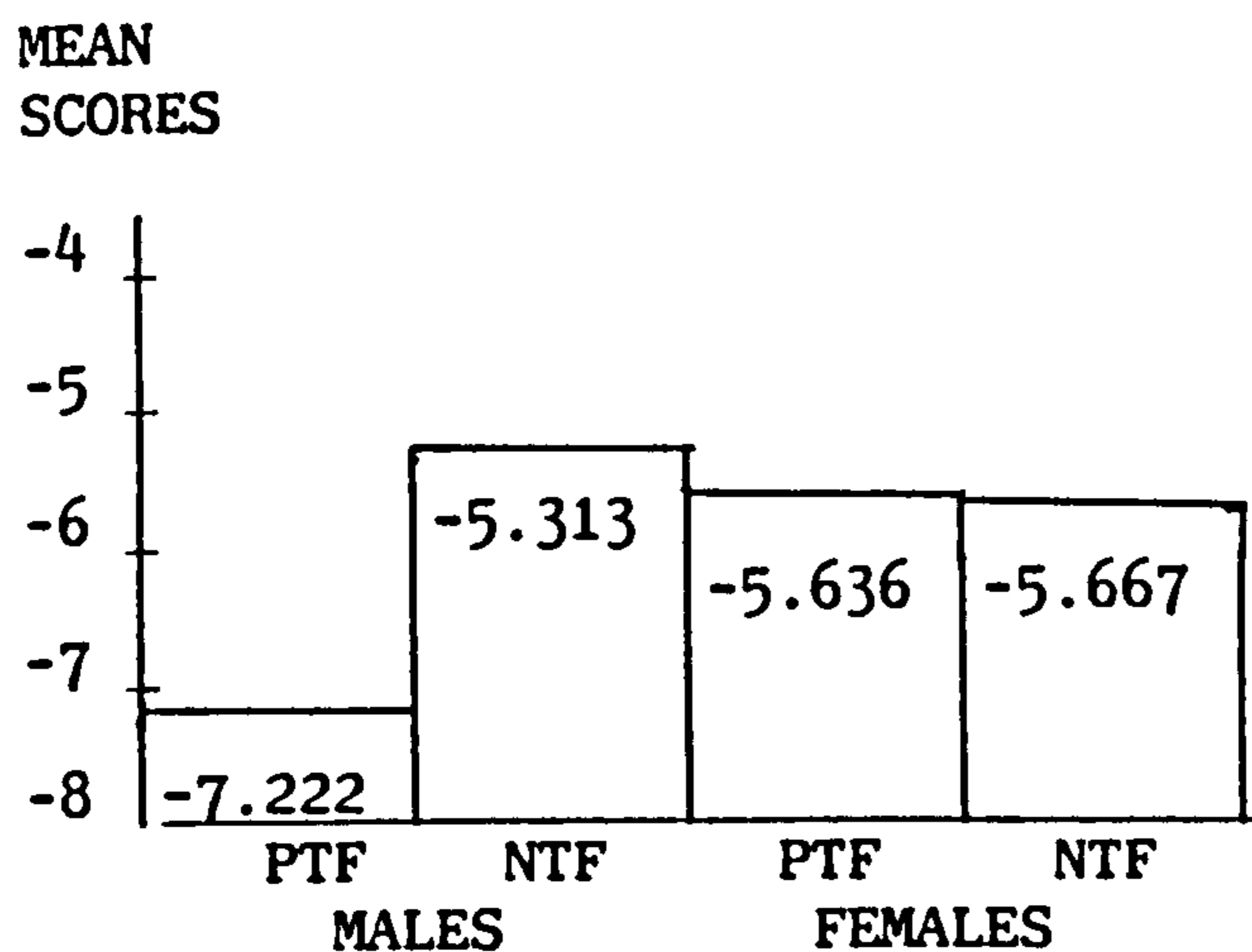


FIGURE 6:XIII MEAN SCORES IN THE PROPOSITIONAL TASK, ACROSS SIDE OF PRESENTATION FOR PROPOSITIONAL TASK FIRST (PTF) AND NON-PROPOSITIONAL TASK FIRST (NTF) FOR MALES AND FEMALES

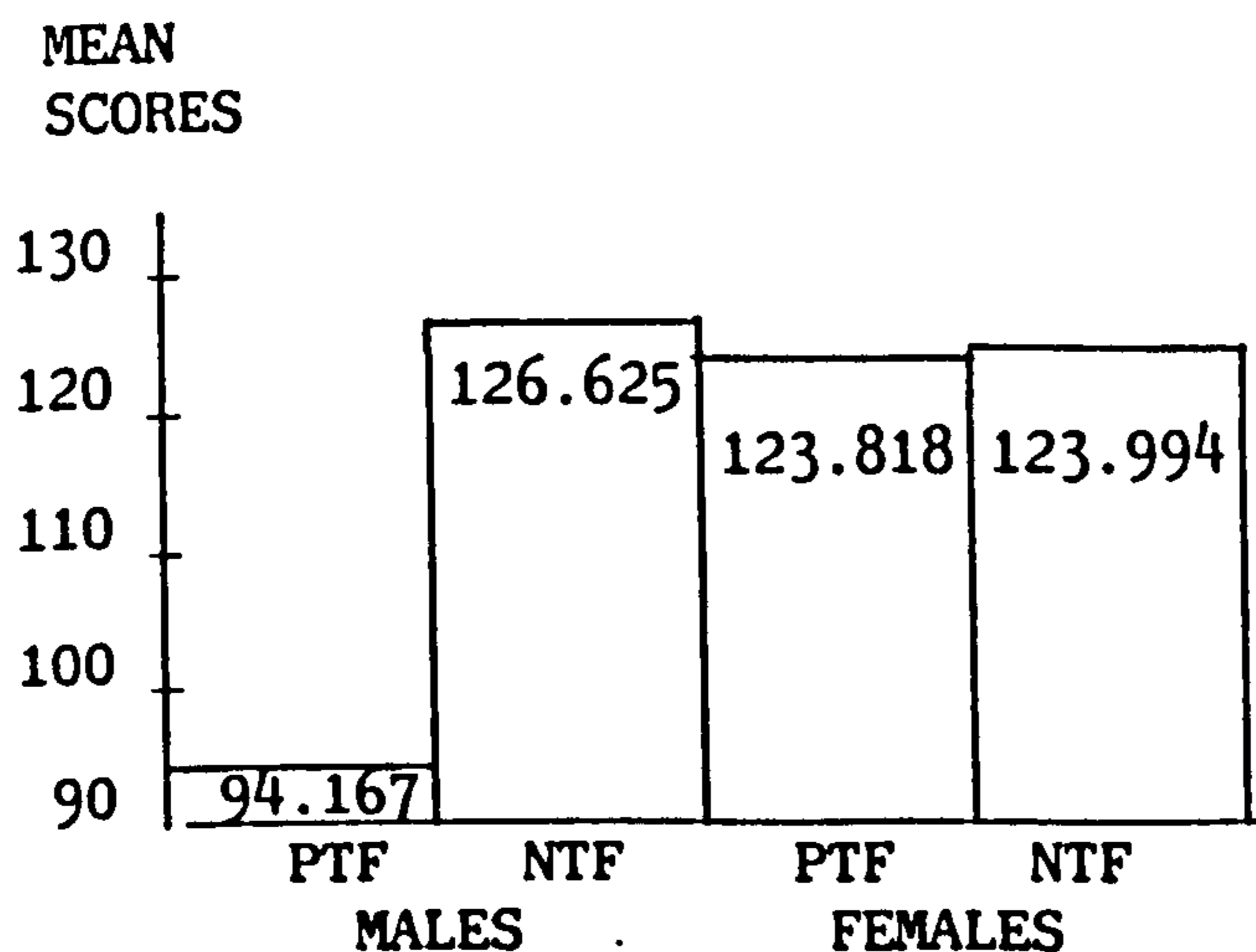


FIGURE 6:XIV MEAN SCORES FOR THE NON-PROPOSITIONAL TASK, ACROSS SIDE OF PRESENTATION FOR PROPOSITIONAL TASK FIRST (PTF) AND NON-PROPOSITIONAL TASK FIRST (NTF) FOR MALES AND FEMALES

Finally, the subjects were allocated, according to their A-level

subjects, to a *sciences* or a *humanities* group. Those with mixed A-levels (e.g. French, Biology & Geography) were classified according to their University study¹⁴. Only two female subjects fell into the *sciences* category, but the males were split equally, with eight in the *humanities* and nine in the *sciences* group. Because of this distribution, analysis was restricted to the male subjects.

Scores were significantly better for the *sciences* than the *humanities* group in the propositional task, as indicated by a one-tailed t-test using scores averaged over right and left presentation ($p < 0.025$). The difference was not significant for the non-propositional task. Figures 6:XV and 6:XVI illustrate the relationships of side-of-presentation, task and A-level group, revealing a greater tendency towards an REA for both tasks in the humanities than the sciences group. The sciences group indeed have a trend towards an LEA on the non-propositional task.

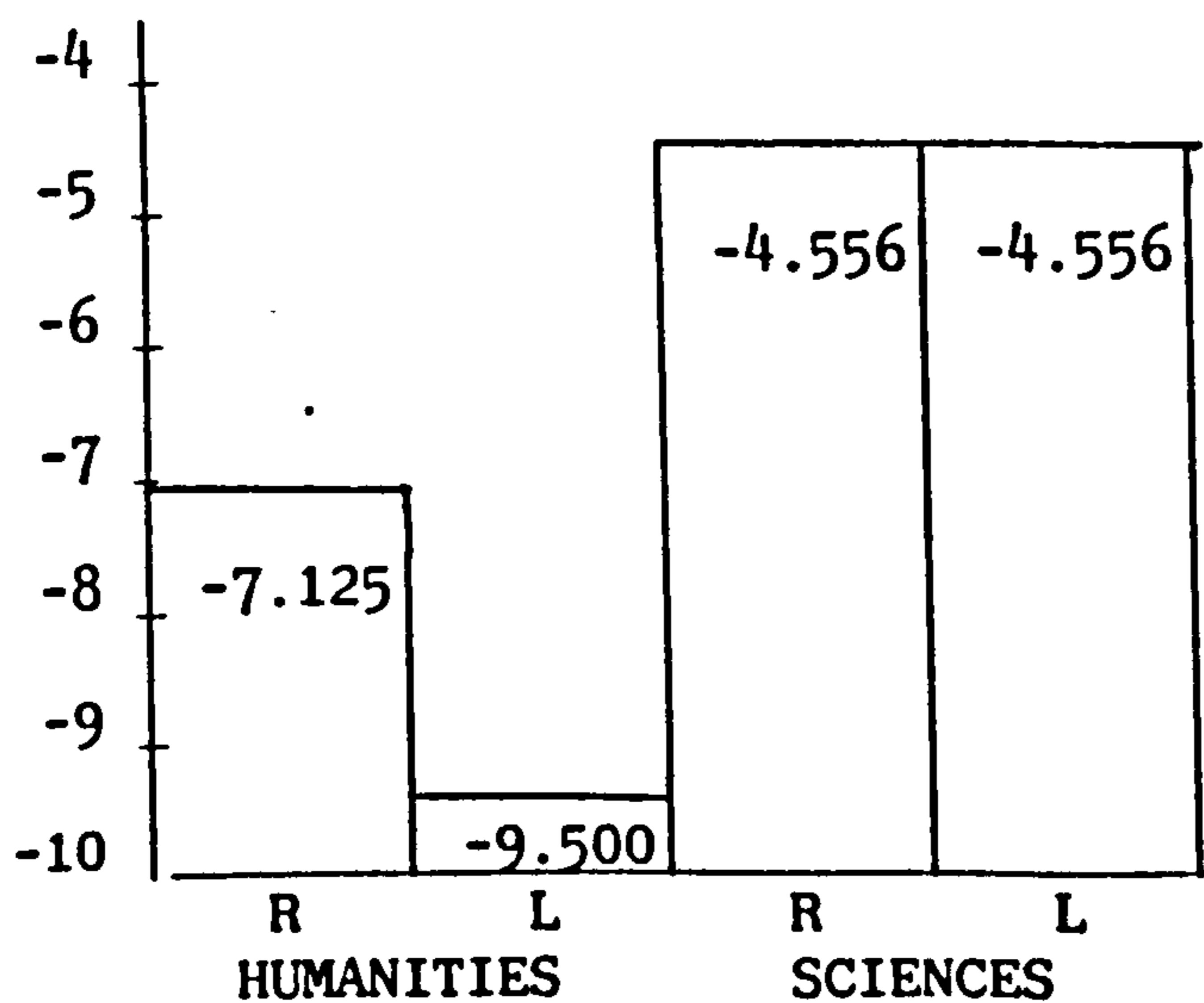


FIGURE 6:XV RIGHT AND LEFT EAR SCORES FOR HUMANITIES AND SCIENCE GROUPS (MALES ONLY, N=17) IN THE PROPOSITIONAL TASK

14. In this context linguistics was treated as a humanities subject.

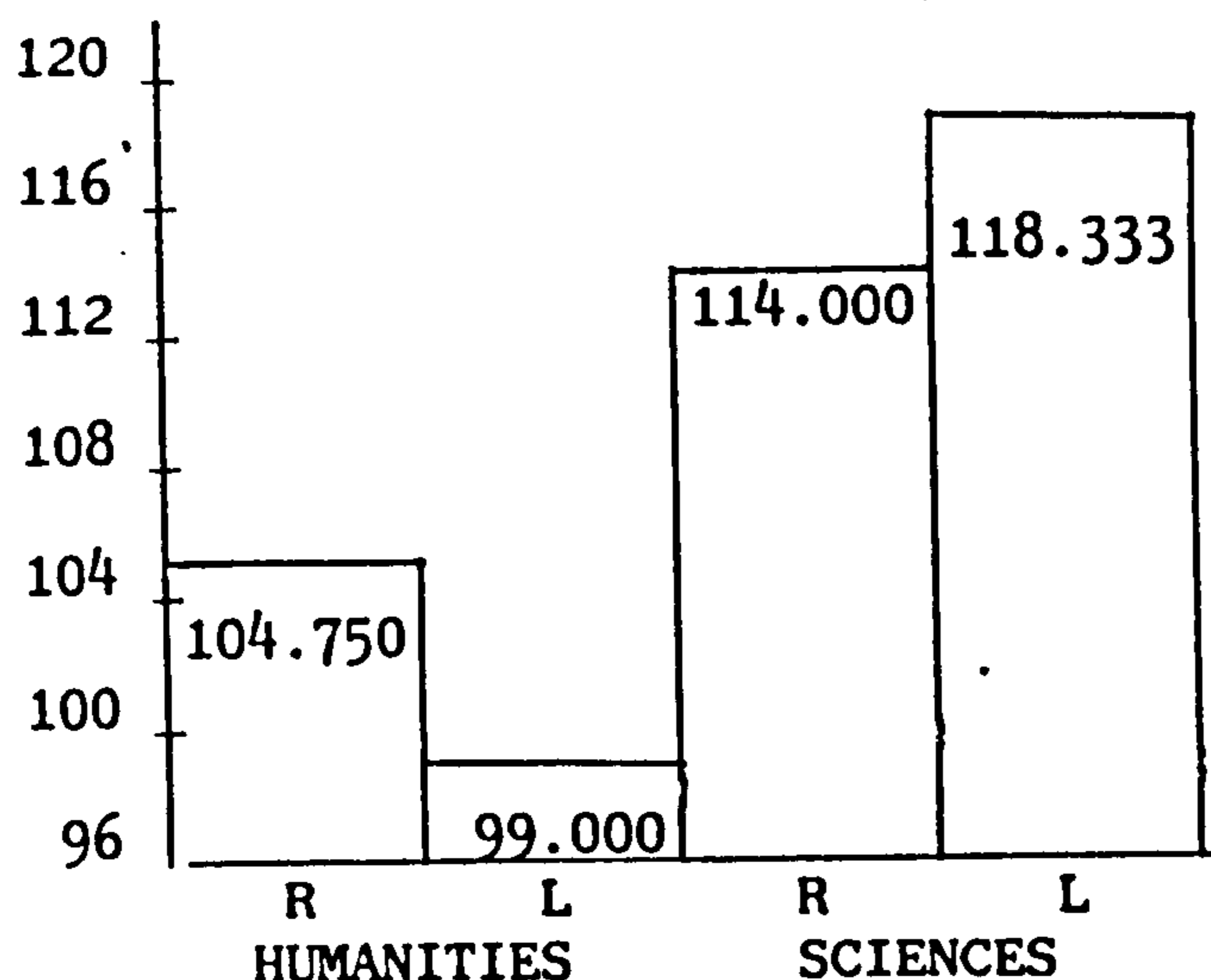


FIGURE 6:XVI RIGHT AND LEFT EAR SCORES FOR HUMANITIES AND SCIENCE GROUPS (MALES ONLY, N=17) IN THE NON-PROPOSITIONAL TASK

As the A-level groups were not balanced for task presentation order (*humanities*: 6 of 8 had PTF; *sciences*: 3 of 9 had PTF) it is important to compare Figure 6:XV with a breakdown of the task-order pattern for the propositional task (Figure 6:XIII) for right and left presentation (Figure 6:XVII).

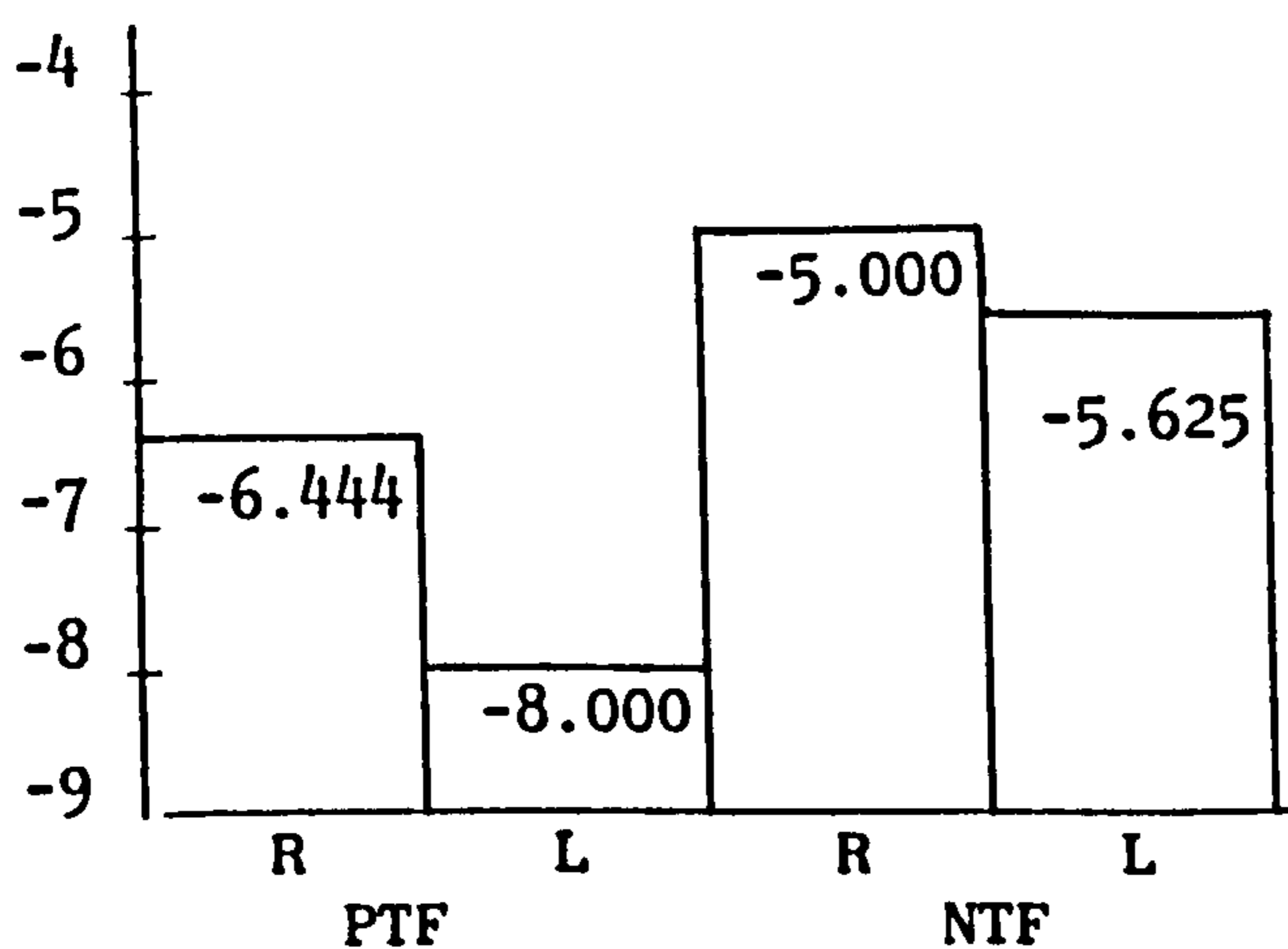


FIGURE T:XVII RIGHT AND LEFT SCORES FOR THE PROPOSITIONAL TASK FOR THE GROUPS PROPOSITIONAL TASK FIRST (PTF) AND NONPROPOSITIONAL TASK FIRST (NTF) (MALES ONLY, N=17)

The similarity of the pattern in Figures 6:XV and 6:XVII indicates that probably only one or other of the variables is decisive.

Dealing still only with the males' scores, a four factor analysis of variance (repeated measures) for the propositional task did not reveal any significant interactions. For the non-propositional task, in the between-subjects tests there was a significant main effect for A-level group, $F(1,9)=5.83$ ($p<0.039$), but there was also a significant three-way interaction of A-level group, task-order and ear-order, $F(1,9)=8.02$ ($p<0.02$), which devalues the former. On the other hand, the cells for the three-way interaction contained only between one and three values and a complex pattern of inter-relationships could easily occur just because of the idiosyncracies of individual scores.

6:3.4.3 SUMMARY OF RESULTS

- 1) The females scored better than the males on both tasks.
- 2) Males and females both displayed an REA on the propositional task and this was significant for the females ($p<0.05$).
- 3) There was no ear advantage for males or females on the non-propositional task.
- 4) Five out of 17 males and seven out of 20 females had an LEA in the propositional task. This difference did not reach significance.
- 5) There were no significant interactions between right and left scores, sex, task-order and ear-order on the propositional task.
- 6) On the non-propositional task the interaction between right and left scores and ear-order approached significance ($p<0.083$).
- 7) The mean score for the first ear to receive the stimulus was the same for both ear order groups. This was true for both tasks. In the propositional task, the second ear score was worse if it was the left ear, but better if it was the right. In the non-propositional task, the second ear was always better.
- 8) The males who did the propositional task first performed worse on both tasks than those who did it second. This difference between task-order groups was significant ($p<0.025$) for the non-propositional task.
- 9) Amongst the males, those who had specialised in sciences at A-level performed better than those who had specialised in humanities. This difference was significant ($p<0.025$) for the propositional task.

10) The male *humanities* group displayed more of a trend towards an REA in both tasks than did the male *science* group. The *science* group displayed a trend towards an LEA in the non-propositional task.

11) These A-level groupings largely coincided with the task order groupings, which displayed the same pattern (males only).

12) The main effect for A-level group (males only) was significant in the non-propositional task ($p < 0.039$) but the interaction between A-level group, task-order and ear-order was also significant ($p < 0.02$).

6:3.5 DISCUSSION

As subjects were no more likely to display an REA for a given task than an LEA or no EA (Table 6:v), analysis using means of whole (e.g. sex) groups have very limited value. Subgroups, on the other hand, might reveal patterns because they separate out salient factors.

The hypothesis under examination in this experiment was that a propositional task would be most efficiently done with the combined involvement of the left and right hemispheres, but a non-propositional task with the exclusive operation of the left hemisphere. Two potential configurations were predicted. The first was of a strong right ear advantage for the non-propositional task and a less strong REA or an LEA for the propositional task. The second, based on Shadden & Peterson's (1981) work was that the non-propositional task would show no ear superiority, or even perhaps a slight LEA because the simplicity of the task was used to advantage only by the right hemisphere. The prediction for the propositional task depended upon the stance taken regarding the involvement of the right hemisphere in the decoding of propositional utterances: the standard theory of left lateralisation for language would predict an REA, while the Focusing Hypothesis would predict no EA or a slight LEA.

The Focusing Hypothesis does not, therefore, fare very well. With regard to the first predicted configuration, it was the propositional task, not the non-propositional one that showed most signs of an REA. Shadden & Peterson's predictions, of no EA for the non-propositional task and an REA for the propositional task were best borne out by the data.

Balancing for order of presentation is a standard procedure in experimental design, but work by Kimura (Kimura & Durnford 1974:39) amongst others has indicated that checks do need to be made to ensure that the results are not being biased by differential influences within such variables. It is not surprising, in the light of the discussion in chapter 1:9 and 5 regarding the *strategy option range* to find that ear advantage may be affected by subject specific and circumstantial factors. The ear-order bias seen here may have had less to do with strategy adoption, at least directly, than a simple practice effect; in the non-propositional task overall performance was better for the second ear of presentation. But this did not hold for the propositional task, where the right ear scored better, irrespective of order. Another possible explanation is that there was a selective priming effect.

The Focusing Hypothesis predicts a certain pattern if the first ear of presentation did have some priming effect. In the propositional task, two processing routes would be potentially available, one incorporating holistic decoding up to propositional level (right and left hemisphere operation) and the other employing only the analytic mechanisms (left hemisphere only). Where left ear presentation was first, the most economical operation would be to allow the right hemisphere to deal with the linguistic decoding. When the ear presentation changed

halfway through the task, this would no longer be the best option, and full analytic processing would take over. When right ear presentation was first, analytic processing would be adopted and, on the changeover to left ear presentation, the strategy already adopted would be retained, despite the possibility of the other, more economical processing route; such would be the effect of analytic priming. This predicts that performance in right ear presentation (first or second) would be less efficient than left ear presentation (first) but more so than left ear presentation (second). Barring other influences, then the following pattern would emerge:

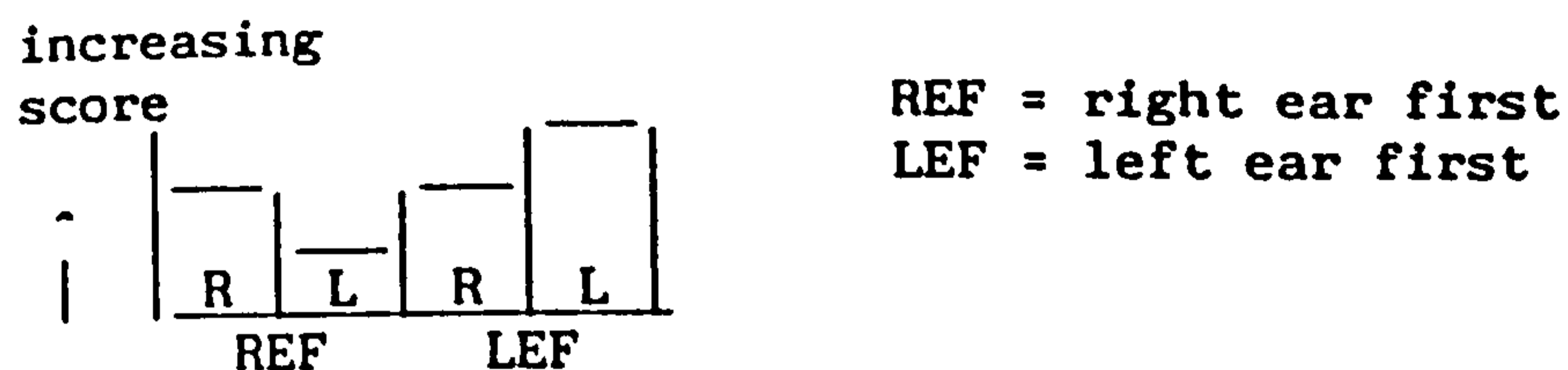


FIGURE 6:XVIII PROJECTION OF EAR PRESENTATION PRIMING EFFECT ON THE PROPOSITIONAL TASK

This pattern is not reflected in the results of this experiment (see Figure 6:IX).

The pattern which the Focusing Hypothesis predicts for the non-propositional task under the sole influence of an ear presentation priming effect differs from the above in that the analytic mechanisms would be exclusively active in all conditions¹⁵ and there would be no conflict for processing space, there being no propositional level. As the right

15. It is, of course, plausible within the terms of the Focusing Hypothesis to envisage, as Shadden & Peterson (1981) do, that the non-propositional task was easy enough for the right hemisphere to deal with in any case; in this case, the predictions change. However, it is not possible to follow up every argument, and so this one is here simply acknowledged and shelved for some future forum.

hemisphere was never active, the left hemisphere priming effect would not alter the pattern. Right ear presentation would show an advantage because of the more efficient connections to the left hemisphere:

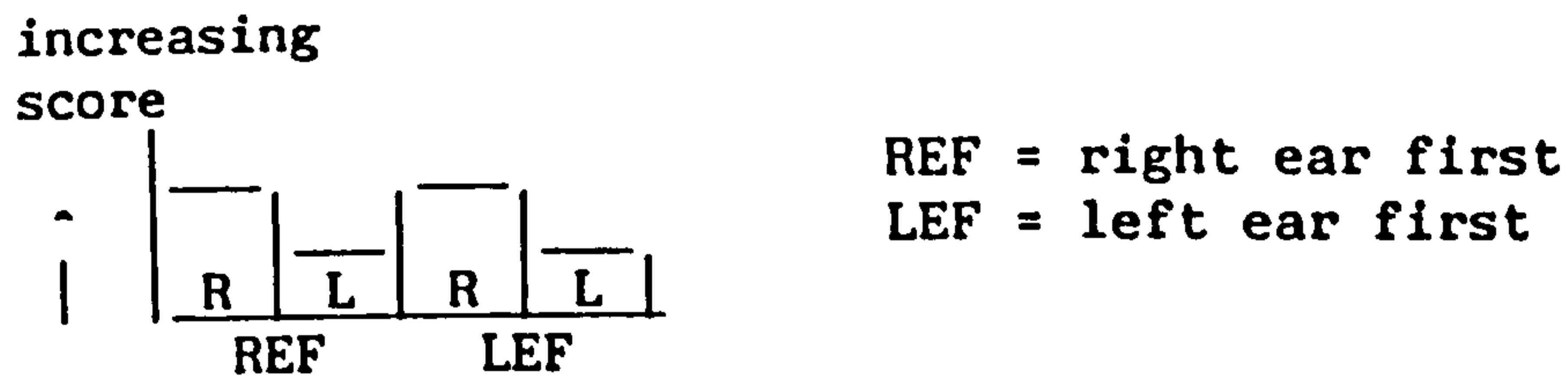


FIGURE 6:XIX PROJECTION OF EAR PRESENTATION PRIMING EFFECT ON THE NON-PROPOSITIONAL TASK

Again, the results (see Figure 6:X) do not support this prediction.

There may be reasons for this which do not involve the contradiction of the Focusing Hypothesis. Firstly, as already mentioned, there may have been a practice effect. Secondly, task-order may have interacted in priming for strategy selection (see below). Thirdly, the sex and/or *science-humanities* variables are not allowed for in the above predictions.

The order in which the tasks were presented appears to have had an effect. This is in keeping with results in work by Kimura, reported in Kimura & Durnford (1974:39). She presented letters and geometrical forms in blocks. One group received the letter identification task before the geometrical form task, the other after it. She found that:

the direction of the field difference for [geometric] forms is affected by whether or not a letter identification task has first been presented, but the letter material is uninfluenced by the prior task. (p.39)

For the males, those who did the propositional task first performed less well in both tasks than those who did it second. Apart from priming (see below) various explanations for this are possible. The propositional task perhaps was, or was perceived as, more difficult, so

that the subject's confidence levels were different according to whether they did the easy or the difficult task first. This is not supported by the comments of subjects afterwards; they mostly said that the non-propositional task was much more taxing. Alternatively, this pattern in the males could reflect the imbalance of task-order presentation between the *humanities* and *sciences* A-levels groups. Of the *science* students, who performed better overall, two thirds did the non-propositional task first and this could have biased the results. The reverse is also possible, of course, i.e. that the *science-humanities* contrast was an artifact of the unbalanced distribution of task presentation order, which was having a priming effect of some sort.

The priming effect which the Focusing Hypothesis predicts is that the non-propositional task would disadvantageously prime analytic-only processing for the propositional task, if they were presented in that order. The pattern predicted then, with respect to general performance over side-of-presentation is that in Figure 6:XX a & b.

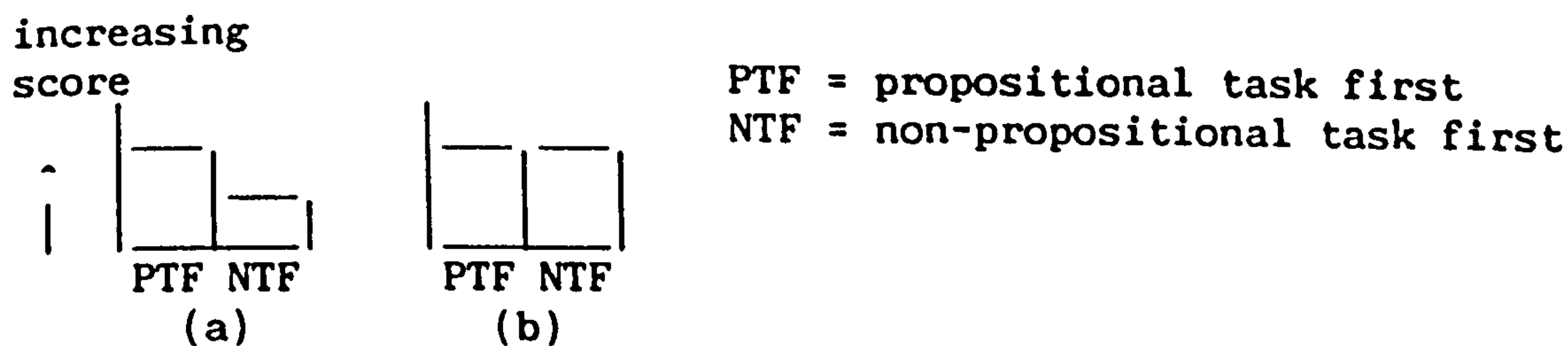


FIGURE 6:XX PROJECTION OF TASK PRESENTATION PRIMING EFFECT ON THE PROPOSITIONAL (a) AND NON-PROPOSITIONAL (b) TASKS

When compared with the results of the experiment (Figure 6:XI & 6:XII) there is not a good correspondence.

Dividing the male subjects according to A-level specialisation revealed some interesting contrasts. The *humanities* group scored lower

overall (significantly so in the propositional task) and displayed a greater (non-significant) trend towards an REA in both tasks. One possible explanation for this is that the skills required for successful creative writing or other prose construction on the one hand and mathematical manipulations and scientific analysis on the other might be associated with different approaches to other tasks. The independent finding across many studies of sex differences in performance on psychological tests (see chapter 4:1.2.4.3) might then be drawn together with the observation that males and females have traditionally gravitated towards different spheres of academic and creative excellence (for whatever reason), such that the same tendency to select different strategies might apply to both the sex and the flair variables. McGlone & Davidson (1973) and Harris (1978) have suggested that sex differences in some tasks are to do with the adoption of verbal strategies in visual tasks by females.

However, this A-level group pattern could be no more than a reflection of, or else could itself be reflected in, the male-female differences - male *humanities* students behaved like the female students, all but two of whom were *humanities* students - and/or the task presentation order differences - six out of eight male *humanities* students but only three out of nine male *sciences* students received the PTF presentation order.

There are certain criticisms which can be levelled at the design of Experiment II, beyond the general question of whether it actually succeeded in testing the hypothesised differences in processing strategies during the decoding of standard test material and proposition-focusing input, or whether the use of laboratory equipment and university stu-

dents, or indeed, of monotic rather than dichotic presentation, was detrimental to the accomplishment of that aim.

Firstly, the subjects were required to respond verbally. Although any response, whether spoken or manual, must activate the relevant motor areas of the brain, there may be specific asymmetric effects in the former case. The left hemisphere motor centres for language appear to be quicker to respond than the right hemisphere ones (Guyton 1981) and if this is so, there would be a permanent bias in brain activity which could not be balanced in the same way as alternating the hand used for hitting a key can for manual response.

Secondly, the volume level for the tape was not properly controlled and subjects with one ear weaker than the other would have been disadvantaged unless they happened to receive presentation to their good ear first, without raising the volume, and then raise it for the weaker ear. If they raised it in the first presentation condition, they were unlikely to alter it again, whether the second ear was stronger or not.

6:3.6 CONCLUSION

The predicted patterns contrasting ear advantage on the propositional and the non-propositional tasks did not obtain in any clear way. As so few interactions were significant, it is possible that all the patterns which have been observed are due to chance only. One reason for such a result might be that Kimura (1964:357) was correct after all, and only dichotic listening tests can access ear superiority effects (see 6:3), at least in respect of this specific experimental design. On the other hand, a complex interaction of variables would also confound any general contrasts and it seems plausible that this is what

happened.

6:4 COMMENT AND DIRECTIONS FOR FUTURE RESEARCH

Built into the Focusing Hypothesis is the expectation that psycholinguistic experiments will produce a confused picture of hemispheric activity during language tasks. This is both its strength and its weakness. It is a strength because so many experiments, including the two described here, support that prediction. But it is a weakness because the failure to find contrasts at a significant level is scant support for any hypothesis, not least because there are many ways of achieving it, including pure chance. Therefore, as has been remarked elsewhere (chapter 1:10) while it is dangerous enough to make direct connections between behavioural asymmetries in experimental tests and the possible lateralisation of functions, it is even more questionable whether findings of any experiments, even ones proffering more positively identifiable patterns than Experiments I and II above, could provide any kind of direct support for the dual systems aspect of the Focusing Hypothesis. On the other hand, the potential influences upon strategy adoption which the Focusing Hypothesis proposes (see chapter 5:2) are supported in a more positive way by the complex interactions which appear to be occurring during tasks of the kind administered.

This brings us back to the observation that the psycholinguistic laboratory is not the place to test the Focusing Hypothesis. Up to now, however, the environment predicted to be most likely to enable the direct measurement of hemispheric activity during normal language processing has been the neurological laboratory, where such techniques as rCBF and EEG measurements are employed (see chapter 5:4). Such facili-

ties are not only not available to humble research students in linguistics, but also rarely, if ever, to psycholinguists at all; the kind of general research on normal behaviour with which they are concerned justifiably takes second place to the investigation and diagnosis of brain-damaged patients.

There is a need for a simpler and less expensive means of measuring hemispheric activity without compromising the naturalness of the linguistic input used as a stimulus. The *tympanic thermometer* (Swift & Perlman 1985) shows signs of meeting that need. Swift & Perlman describe how, as the temperature of the ear canal is known to correlate with brain temperature, which itself is determined by blood flow, measuring the temperature of the tympanum provides a painless and simple way of monitoring brain activity. Dabbs (1980), Holt & Brainard (1976) and Hancock & Dirkin (1982) have used temperature sensitive earplugs, connected to thermometers and recorders, to monitor brain activity in this way under different conditions. Swift & Perlman (1985) claim to be the first to have applied the technique to psycholinguistic investigation. They presented 11 male and 11 female high school children with two blocks of stimuli. One consisted of non-words and the other of human faces. The task was to decide whether single items had appeared in a previous target set. They did not find a positive relationship between left hemisphere bias (i.e. where net left side temperature increase from rest > net right side increase) and high scores on the verbal task but there was a significant relationship between right hemisphere bias (net left side temperature increase < net right hemisphere increase) and high scores in the face recognition task. The result for the verbal task was not predicted by them and they seek to explain it

in terms of the potential to treat the non-word strings as either verbal or as visual configurations, leading to a cancelling out of two opposing hemispheric preferences.

The Focusing Hypothesis would predict the absence of left hemisphere superiority in linguistic tasks, but, ironically, not in a non-propositional task like Swift & Perlman's. On the other hand, Swift & Perlman's scoring method, based on correct and incorrect judgements rather than on response times, is in keeping with the low-stress conditions which the Focusing Hypothesis favours for the observation of normal processing.

The use of the tympanic thermometer should be of considerable value for psycholinguistic research and would do much to enable the evaluation of the Focusing Hypothesis. The type of opposition of stimuli used in Experiment II might be valuable in directly addressing the predictions made about relative hemispheric involvement. But even more pertinent would be comparisons of left and right tympanic temperatures during ordinary conversational exchange on the one hand and standard psycholinguistic tests on the other.

The major limitation of this method must be that it cannot discriminate the source of temperature rises, so that it would not be possible to decide from, say, an equal activity of left and right hemispheres during normal processing, whether the right hemisphere was involved in the language decoding rather than the propositional evaluation (as implied by Gardner et al 1983, see chapter 5:3.2) or in something else entirely. But the organisation of the two hemispheres is different in any case (chapter 1:10), and even if the localisation of the increase in metabolic exchange could be observed by this method, it

might not correspond to the traditional expectations built up on the basis of 'language centres' in the appropriately arranged left hemisphere. Most of all, however, it is not as if techniques are not available for the observation of localised brain activity. But up to now the rCBF and related studies (see chapter 5:4) have stood alone in suggesting that it might even be worth looking at the right hemisphere for signs of some involvement in normal linguistic processing.

But as for using the tympanic temperature measurements in isolation, care would have to be taken that any number of extraneous factors, from uncontrolled visual or auditory input to fluctuations in attention and wandering thoughts, did not confound the measurements. Despite these limitations, this technique might be the best yet for testing the validity of the various models of processing proposed here and elsewhere.

CONCLUDING REMARKS

A variety of sources of data have been drawn upon in the attempt to assess the plausibility of the Focusing Hypothesis. Not all observations have been supportive, but very few have provided hard counter-evidence either. This is in part due to the nature of the Hypothesis, which predicts contradictory findings caused by a range of uncontrolled strategy determining factors. However, many positive predictions have been supported, in the fields of psycholinguistic, clinical and neurophysiological research. It may be considered a strength of the Focusing Hypothesis that it is equipped within one processing model to account for features of normal and abnormal language.

The Hypothesis itself has been developed here without more than cursory reference to output mechanisms (but see chapter 5:6), and many pertinent areas of interest have been omitted. One is the phenomenon of *deep dyslexia* (e.g. Coltheart et al 1980), the symptoms of which may be predictable from a strategy for normal reading aloud (holistic), which bypassed propositional evaluation. This strategy closely resembles the one described in 5:1.6 whereby 'comprehension' can occur as a function of word and structure recognition without any propositional evaluation. In the breakdown of the bypass system, reading aloud (also repeating, writing to dictation and copying, though any or all of these could have their own, separate strategies which would lead to a different measure of inability) would have to be mediated by semantic decoding (analytic) in which lexical identities would be lost and would have to be reselected from lexically non-specific semantic representations before output could occur. This account avoids the need to invoke se-

veral locations of damage, because it attributes the symptoms of *deep dyslexia* to the utilisation of a route which is part of the normal system, but was previously only used from print into semantic representation or from semantic representation out to print, but not both¹⁶. The supposed location in the right and left hemispheres of these processing routes for reading may be inferred from the description of the Focusing Hypothesis that has been provided, but various questions arise which need to be addressed at length. Therefore, no attempt is being made here to formally embark upon any such account.

Other areas of linguistic interest which could have been discussed include the case of Genie (Fromkin et al 1974), symptoms of types of aphasia and the apparent hemispheric 'bilaterality' of some individuals, particularly left-handers.

A number of areas which are not directly related to language testing and teaching have also been mentioned in passing but not examined. The foremost is probably the possible effect of education, including literacy, on the development of preferred strategies for dealing with a wide range of language-related and unrelated activities. The other main issue which could have been examined more closely relates to the lateralisation of visuo-spatial skills. An important question needs to be addressed: why has the right hemisphere been generally considered to be dominant for these abilities (Harris 1978), when they can be as much the focus of attention as any linguistic skill? This question cannot be satisfactorily answered here, except in a superficial way, by proposing that different strategies are discovered by the learning child to

16. Max Coltheart (personal communication) has recently been examining the possibilities of such a processing route and considers it to have some useful explanatory power.

be more efficient for each type of task. However, it is worth noting Brown's (1983) comment that with the increasing sophistication of investigative techniques, the right-left differences in visuo-spatial skills have become harder to substantiate (p.45), and that what appeared to be a right hemisphere superiority for visuo-spatial skills may have been an artifact¹⁷ of the experimental designs used, which require what he terms *early processing* which is holistic in nature, whereas a task requiring *late processing* (analytic) would have shown a left hemisphere advantage (p.49). This *early-late* dichotomy is part of a specific approach to the nature of information processing which Brown (1983) proposes.

The combination of operations which Brown envisages has in common with the Focusing Hypothesis model that processing is shared in an advantageous way precisely so that both sets of mechanisms can operate simultaneously rather than in sequence. The holistic mechanisms in the Focusing Hypothesis model do not deal with language processing because they are better at it or specialised for it but because their doing so enables the simultaneous operation of higher cognitive levels (e.g. propositional evaluation). The overall effect of this is the same as would be obtained by paying full attention to two different levels of information at once. Seen in this light, the evolutionary advantage of introducing the holistic mechanisms into functions which would otherwise involve full attention is immense, for it multiplies the complexity of possible cognitive interactions.

17. Compare, on the other hand, Young & Ratcliff (1983:23, quoted in Code 1987:4): "[There is] no doubt that the case for right hemisphere superiority is not grounded in artifact".

The arguments presented here have retained an essentially theoretical stance, seeking to offer a new interpretation and, where appropriate, a challenge, to the experimental and clinical work in the fields of neuropsychology and psycholinguistics, without entirely aligning itself with either discipline. It sought to raise questions as much to suggest answers, and to cut across the grain of some traditional beliefs. The details of the hypothesis are in one way only of secondary importance, for the primary challenge comes from the robustness which such a hypothesis unexpectedly displays. That robustness has two forms: empirical and theoretical. It is the latter which, it has been argued, is ultimately more important, even though such a view runs contrary to the primary perspective of the experimental discipline it addresses.

The empirical robustness may, in any case, be no more than superficial. It is not possible to say at this stage, particularly seeing as this thesis has devoted only minimal space to accounts of new experimental investigations. The robustness emanates from the assertion that the empirical obstacles are too great to enable testing of the type required to measure the salient variables, without the use of techniques and equipment beyond the reach of an independent student researcher. The hypothesis is not untestable. What is here predicted may be elsewhere tested, in an experimental environment of suitable sophistication.

A linguist's attempt to offer any sort of contribution to the fields of clinical and experimental neuropsychology might be considered about as valuable as what a student nurse can tell a mother of ten

about child rearing. But there are always new things to be seen, and the very naivety which pervades the approach of an outsider may present new challenges which avoid the covert presuppositions, prejudices and traditions of the discipline.

Discussions with a number of experimental psychologists, have seen one objection repeatedly raised: the scientific way is to provide experimental evidence relevant to any proposed account, so that by that evidence it may stand or fall. That observation did not fall on deaf ears, and the purpose of chapter 5 was to draw on the work of others to find support for the Hypothesis and to explain why a greater number of new experiments has not been set up and run to test it. Nevertheless, this whole account remains at odds with the format which would be required from any psychologist working in the field. The intention here was to present a model and to examine its explanatory and predictive power within a framework which did not attempt to hide its variance from a traditional scientific approach, but rather to use that as a lever to raise the lid on a new range of perspectives. This is not the work of a psychologist and it was not intended to be. It is the work of a linguist operating at the interface of two disciplines. The greatest danger is that it will be acceptable to neither. The deliberate retention of a primarily theoretical approach has been a positive attempt to achieve its acceptance by both.

APPENDIX

[Subclassifications here refer to the chapter to which the information applies, e.g. A5:1 = first appended note for chapter 5; similarly, A5:I = first appended Figure, and A5:i = first appended Table].

A4 Tables i-vi (Chapter 4:1.2.1) (NB. The survey of studies represented in these tables are not intended to be exhaustive but are, hopefully, representative.

SIGNIFICANT RIGHT

REFERENCE	EAR ADVANTAGE?	AGE	DETAILS
Bakker et al 1973 (1)	No Yes	under 9 over 9	
Berlin, Hughes et al 1973 (2)	Yes	5	CV pairs
Berlin, Lowe-Bell et al 1973	Yes	5-13	nonsense syllables
Bever 1971 (3)	Yes	2,6-5,6	digits
Bryden 1970 (3)	Yes	7-10	
Chaney & Webster 1966 (4)	Yes		isolated vowels
Darwin 1971 (4)	No		isolated vowels
Entus 1977	Yes	infants	phonetic stimuli
Geffner & Hochberg 1971	Yes No		middle class lower class
Gilbert & Climan 1974 (1)	Yes	2	
Haggard & Parkinson 1971	Yes	adult	CV contrasting voice & place; LEA for emotional tone
Inglis & Sykes 1967 (3)	Yes No No	6 & 9 5,7,8,10 5-10	3-pair stimulus 3-pair stimulus 1 & 2-pair stimulus
Kimura 1963 (1)	Yes	3-4	most asymmetry in youngest
Kimura 1967 (5)	Yes	4	
Kimura & Folb 1968 (4)	Yes		backwards speech
Kinsbourne & Hiscock 1977	Yes	children	non-signif. increase in REA with age
Ling 1971 (3)	Yes	6-15	
Papçun et al 1974	Yes Yes No	adult adult adult	morse code, users naive S's, sequence length: short long
Satz et al 1971 (3)	Yes	8 & 11	
Shankweiler & Studdert-Kennedy 1967 (2) & (6)	Yes No		CVC, contrasting C CVC, contrasting V
Shedletsky 1981	No	adult	LEA for recognition of words from sentences; explanation: lh. processes deeper
Sommers & Taylor 1972 (3)	Yes No	5-6 5-6	normal speech dev. late speech dev.
Studdert-Kennedy & Shankweiler 1969	Yes No		CVC, contrasting C CVC, contrasting V
Witelson 1962 (3)	No		non-sig trend only
Zurif & Carson 1970 (3)	No	10	non-sig trend only

TABLE A4:i DICHOTIC LISTENING TEST (MONOLINGUAL STUDIES)

KEY to reference sources:

- | | |
|-------------------------|-----------------------------|
| 1. Ten Houten 1982 | 4. Haggard & Parkinson 1971 |
| 2. O'Leary 1982 | 5. Moscovitch 1977 |
| 3. Bryden & Allard 1978 | 6. Code 1987 |

SIGNIFICANT
RIGHT VISUAL HALF-
FIELD ADVANTAGE?

REFERENCE	AGE	DETAILS
Barton et al 1965 (1)	Yes	letters, words, digits in vertical scan
Bryden 1962 (2)	Yes No	according to order of report
Bryden 1970 (3)	Yes	4-letter non-words
Crovitz & Schiffman 1965 (3)	No	8 disconnected letters
Dornbush & Winnick 1965 (3)	Yes No	8-letter words 8-letter anagrams
Harcum & Finckel 1963(3)	Yes	words
Harcum & Jones 1962 (3)	Yes	words
Hirata & Osaka 1967 (3)	Yes	Japanese S's; 2-character words, vertical
Levine & Banich 1982	Yes	adult 10 of 32 S's had LVFA: order of presentation?

TABLE A4:ii TACHISTOSCOPIC TESTS (MONOLINGUAL SUBJECTS)

KEY to references: 1. O'Leary 1982
2. Bryden & Allard 1978
3. Harcum 1978

REFERENCE	TEST	LEFT HEMISPHERE SUPERIORITY?	AGE	DETAILS
Briggs 1975 (1)	bimanual tracking	Yes		
Buffery 1971 (2)	dlt PLUS tachisto.	Yes + No Yes + No	girls:5+ boys:7+	REA and LVFA for best scores
Hicks 1975 (1)	rod balancing + speech	Yes		phonetic complexity increased interference
Hicks et al 1975 (1)	finger movement	Yes		silent & spoken language
Hicks et al 1977 (1)	finger sequencing	Yes		
Kinsbourne 1972	eye movement	Yes		to right for words, left for pictures(*CH)
Kinsbourne & Cook 1971	rod balancing	Yes		r.hand better non-verbal condition, l.hand in verbal
Kinsbourne & Hiscock 1977	finger tapping	Yes	3-11	rhymes & word repetition
Kinsbourne & McMurray 1975		Yes	5+	
Kreuter et al 1972(1)		Yes	adult	callosotomies

TABLE A4:iii OTHER TESTS (MONOLINGUAL SUBJECTS)

KEY to references: 1. Kinsbourne & Hiscock 1978 2. Harris 1978

TYPE OF LEARNER & ACQUISITION	L2 PROCESSING RELATIVE TO L1	SUPPORTIVE STUDIES
Early informal	more left hem.	Rupp 1980
	more right hem.	Albert & Obler '78(1s), Bever'74(2)
	no difference	Gordon 1980(1s), Bellisle 1975(1) Galloway 1981, Schönle & Breuniger 1977(4)
Late formal	more left hem.	Kotik 1979(3), Carroll 1980(study 2) Albert & Obler 1978(1s), Kotik'84(mp)
	more right hem.	Albert & Obler 1978(1s), Maitre 1974 (ssw)(1), Schneiderman & Wesche 1980 (4), Kotik 1984(lp)
	no difference	Carroll 1980, Gordon 1980(1s), Maitre 1974(sss)(1), Kotik 1984(hp)
Late informal	more left hem.	
	more right hem.	
	no difference	Carroll 1980, Gordon 1980(1s), Galloway & Scarcella 1982

TABLE A4:iv DICHOTIC LISTENING TESTS (POLYGLOT SUBJECTS)

a) bilingual-type comparisons

KEY to abbreviations:

ls = language specific

ssw = stimulus specific: word stimulus only

sss = stimulus specific: sentence stimulus only

late = after 11 years old

hp = high proficiency

mp = mid proficiency

lp = low proficiency

KEY to references:

1. Vaid & Genesee 1980

2. Walters & Zatorre 1978

3. Kotik 1984

4. Vaid 1983

Monolinguals same as bilinguals (L1 & L2)		Bellisle 1975(1), Stark et al 1977 (expt.2) Galloway 1981
Monolinguals more lh. than bilinguals'	L1	Starck et al 1977 (expt.1)
	L2	Scott, Hynt, Hunt & Weed 1979
Monolinguals more rh. than bilinguals'	L1	Hynd, Teeter, Stewart 1980
	L2	

b) monolingual-bilingual comparisons

KEY to references: 1. Vaid & Genesee 1980

TYPE OF LEARNER & ACQUISITION	L2 PROCESSING RELATIVE TO L1	SUPPORTIVE STUDIES
Early formal	more left hem.	Gaziel et al 1978(ss,ls)
	more right hem.	Gaziel et al 1978(ss,ls)
	no difference	
Early informal	more left hem.	
	more right hem.	Mishkin & Forgays 1952(ls) ¹
	no difference	Hamers & Lambert 1977, Gaziel, Obler & Albert 1978,
Late formal	more left hem.	
	more right hem.	Mishkin & Forgays 1952(ls)(1), Silverberg et al 1979(ls,lp)
	no difference	Walters & Zatorre 1978
Late informal	more left hem.	
	more right hem.	
	no difference	Soares & Grosjean 1981

TABLE A4:v TACHISTOSCOPIC TESTS (POLYGLOT SUBJECTS)

KEY to abbreviations:

as = age specific lp = low proficiency
ls = language specific hp = high(er) proficiency
ss = stimulus specific late = after 11 years of age
(for references see table A4:iv)

1. Yiddish was a non-proficient but presumably family language, so L1/L2 designations are difficult to apply. The increased right hemisphere involvement (non-significant LVFA) was in Yiddish. There was a significant RVFA for English.

CASE	M/F	MT	L2	L3	L4	FL1	FL2	FL3	FL4
Beattie(p.26)	M	+				x			
Lordat(p.26)	M	+d	xn						
Banks(p.26)	M	+				x	x		
Proust(p.27)	F	x	+r						
Trousseau(p.27)	M	x	+r						
Bourdin(p.27)	F	x	+						
Grasset(p.27)	F	x				+a			
Bastian(p.27)	M	+	xr						
Oré(p.27)	M	+d	x						
Rinckenbach(p.27)	M	+	x						
Bianchi(p.28)	M	+				x	x		
Charcot(p.28)	M	+				x	> x		
Bernard(p.28)	F	x	+			x			
Pitres I(p.28)	M	xd	+						
" II(p.29)	M	xd	+						
" III(p.30)	F	+	> +	xd					
" IV(p.31)	M	+				+	x		
" V(p.32)	M	+	xnc	xnc		xnc	xnc	xnc	
" VI(p.33)	M	+				x	x		
" VII(p.35)	M	+	> +d	=		+ =	+ x	x	

TABLE A4:vi

Cases of polyglot aphasia mentioned in Pitres (1895), showing the status of the languages recovered (+) and permanently lost or impaired (x) (this refers to production only: comprehension remains where not otherwise specified).

KEY: M = male F = female d = dialect n = national language
r = language of residence (where not mother tongue)
MT = mother tongue L = informally acquired language
FL = formally acquired language (foreign language)
a = automatic speech only nc = no comprehension

A5:1 Examples of lexical, surface structure and underlying structure ambiguities (Chapter 5:2.3)

LEXICAL AMBIGUITIES are, in auditory tests, homophones:

- 1) Be sure than you take the right turn. (Bever et al 1973:279)
- 2) The new men started to drill before they were ordered to do so. (Foss 1970:701)
- 10) The spy put out the torch as our signal to attack. (Lackner & Garrett 1972:61)

(3) and (4) are examples of precontextualisation for lexical ambiguities:

- 3a) The electrician was asked to instal the bulbs.
- b) The gardener was asked to plant the bulbs. (Holmes 1979:538 (Expt.IV))
- 4a) The manager forced the robber to run out of the building. The robber was chased from the bank.
- b) The shooter forced the ducks to fly away from the river. The ducks were chased from the bank. (Holmes 1979:583 (Expt.V))

SURFACE STRUCTURE AMBIGUITIES relate to alternatives in bracketting:

- 5) John looked up the street.
- 6) They fed her dog biscuits. (Bever et al 1973:285)
- 7) They are lecturing doctors. (Carey et al 1970, quoted in Bever et al 1973:278)
- 11) John left with a dog he found last Saturday. (Lackner & Garrett 1972:363)

UNDERLYING STRUCTURE AMBIGUITIES are caused by "different underlying 'logical' relationships amongst the words" (Bever et al 1973:279):

- 8) The natives disliked sailing in the harbor.
- 9) The duck is ready to eat.
- 12) The corrupt policemen can't stop drinking. (Lackner & Garrett 1972:363)

A5:2 Extended footnote (Chapter 5:2.4.4)

A possible informal corroboration of this is the response which I received when I tried to explain 'garden path' sentences to my non-linguist friends. Of the three or four people I gave examples (13) and (14) to (individually), all received them with puzzlement.

- 13) The horse raced past the barn fell.
- 14) The florist sent the flowers was very pleased.

They all considered that if the sentences were grammatical at all it could only be because an 'and' had been deleted (13') and (14').

- 13') The horse raced past the barn and fell.
- 14') The florist sent the flowers and was very pleased.

When I objected that it was not grammatical to delete 'and' in that position, but that there was a reading which was grammatical, they could not see it. Nor were they impressed or enlightened when I explained the deletion of 'that'/'who'. They didn't disagree, but seemed to see no relevance in that particular type of grammaticality game to anything that they ever produced or decoded (at least consciously).

A5:3 Extended footnote (Chapter 5:3.2.1)

Van Lancker (1987) quotes, in the Appendix of her paper (p.104ff) some test responses from right and left hemispherectomy patients. In speech sample 1 (right hemispherectomy) it is clear that the patient's language is more or less normal. But one or two curious propositional related mistakes are made:

- "7. I: ...could you tell me three things that a good citizen should do?
P: Vote and obey the law.
I: That's two.
P: You wanted three.
I: Three. Did you think of a third one? Okay.
8. I: Look at this picture, and make up a story that has a beginning, a middle and an end.
P: The boy is with his kite, in Mr. Smith's yard. The kite flew over the house. He took his dog with him. There was a fire in the fireplace.
12. I: What is the thing to do if you find an envelope in the street that is sealed and addressed and has a new stamp?
P: Try to find out to who it belongs."

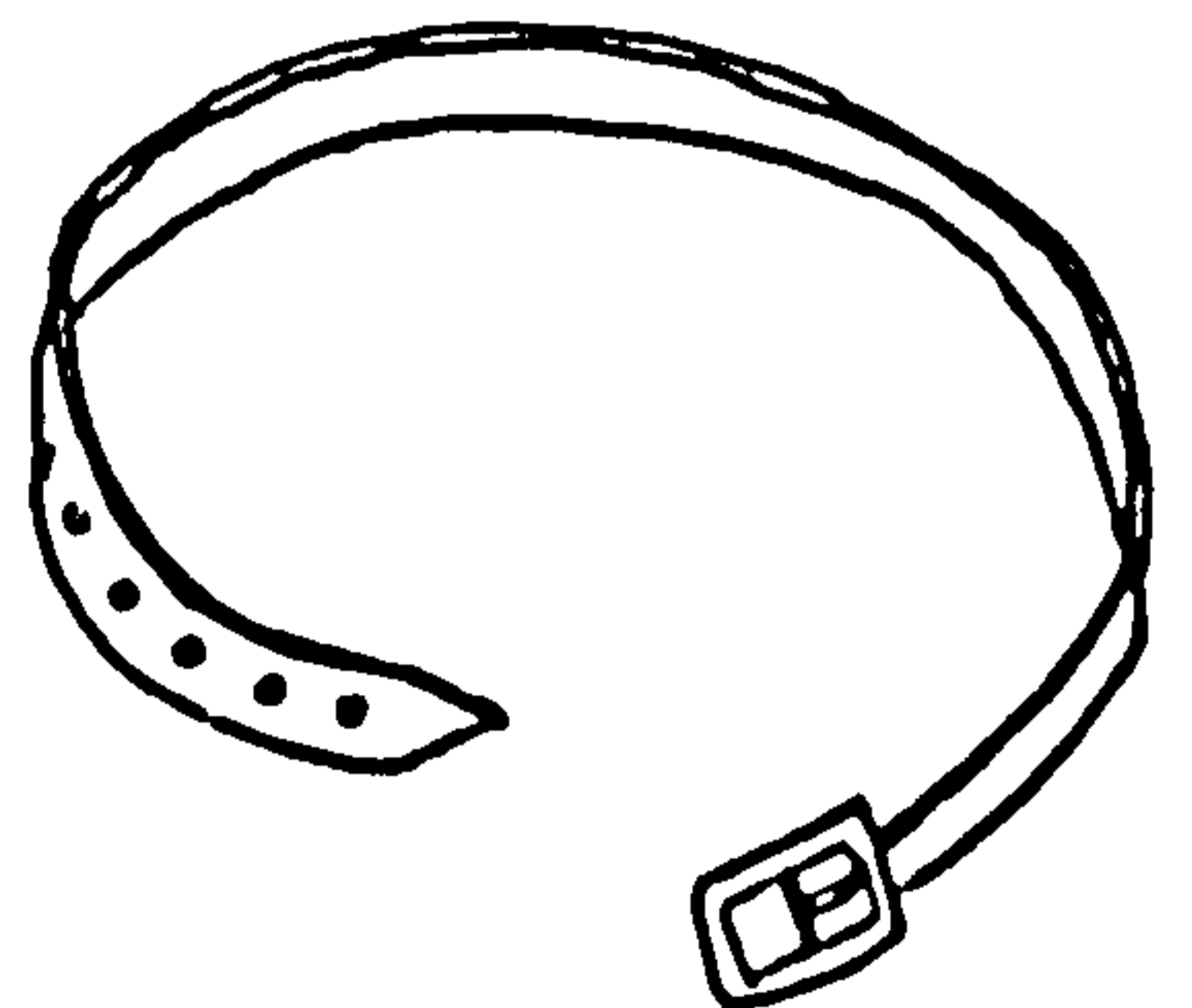
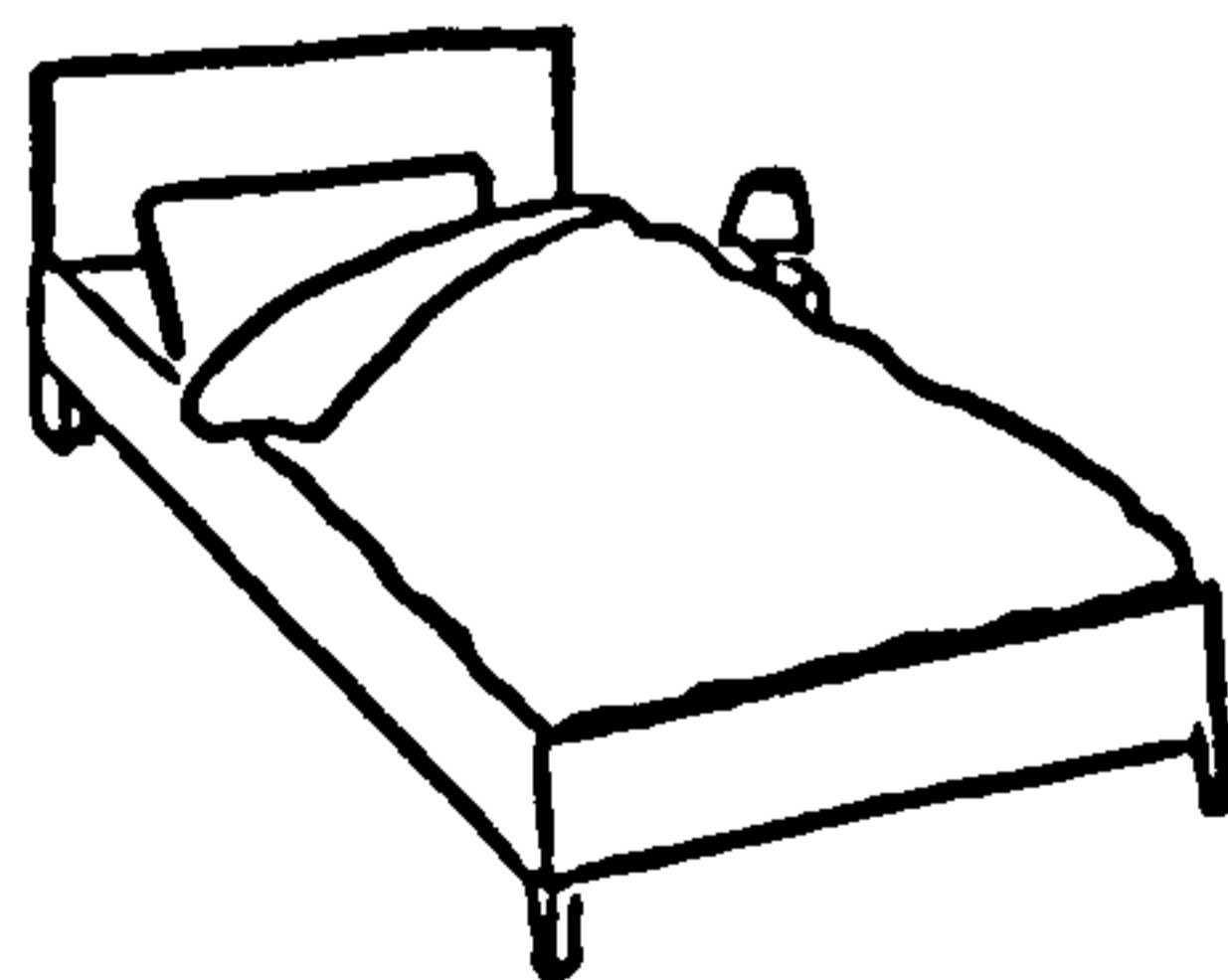
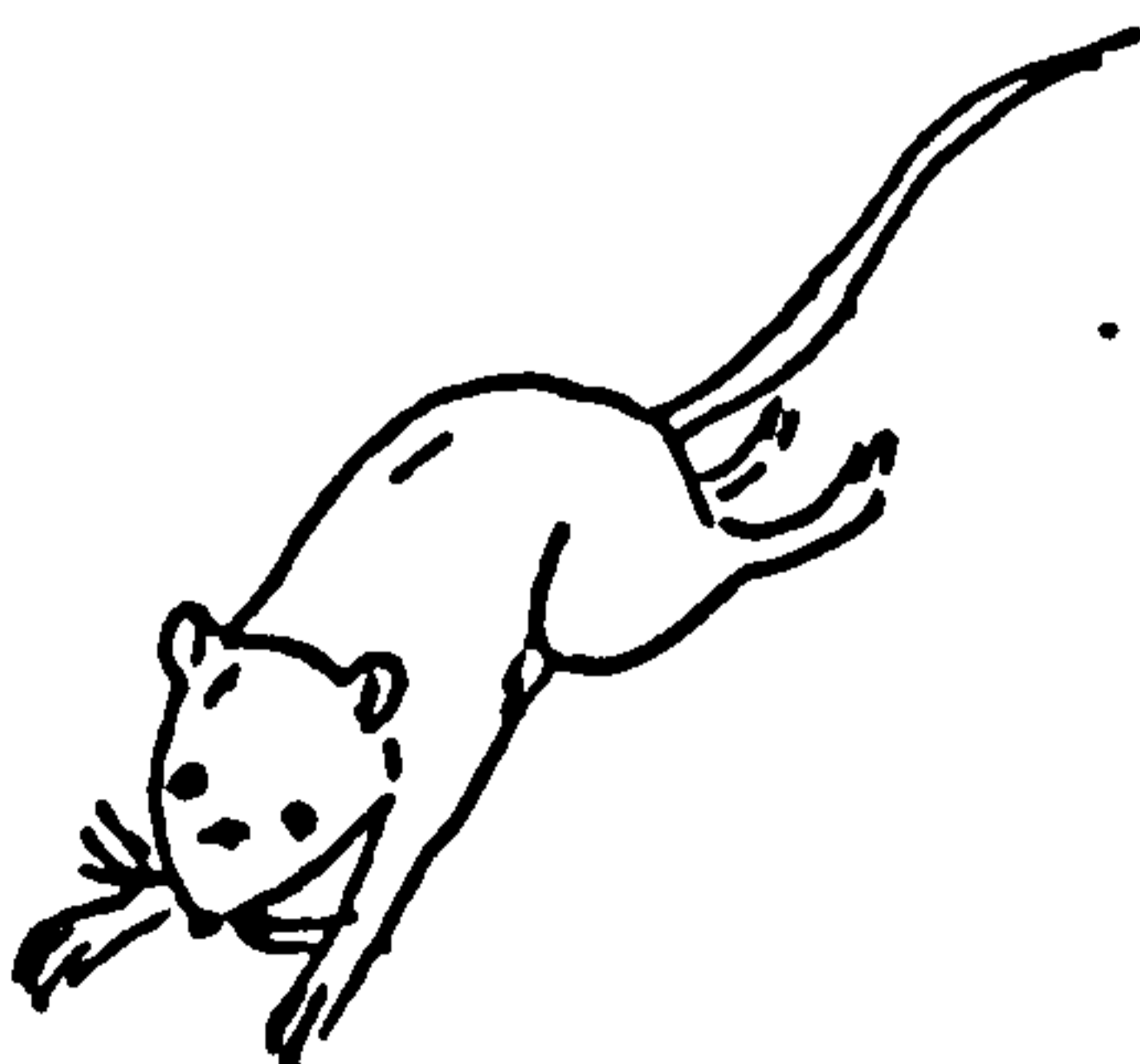
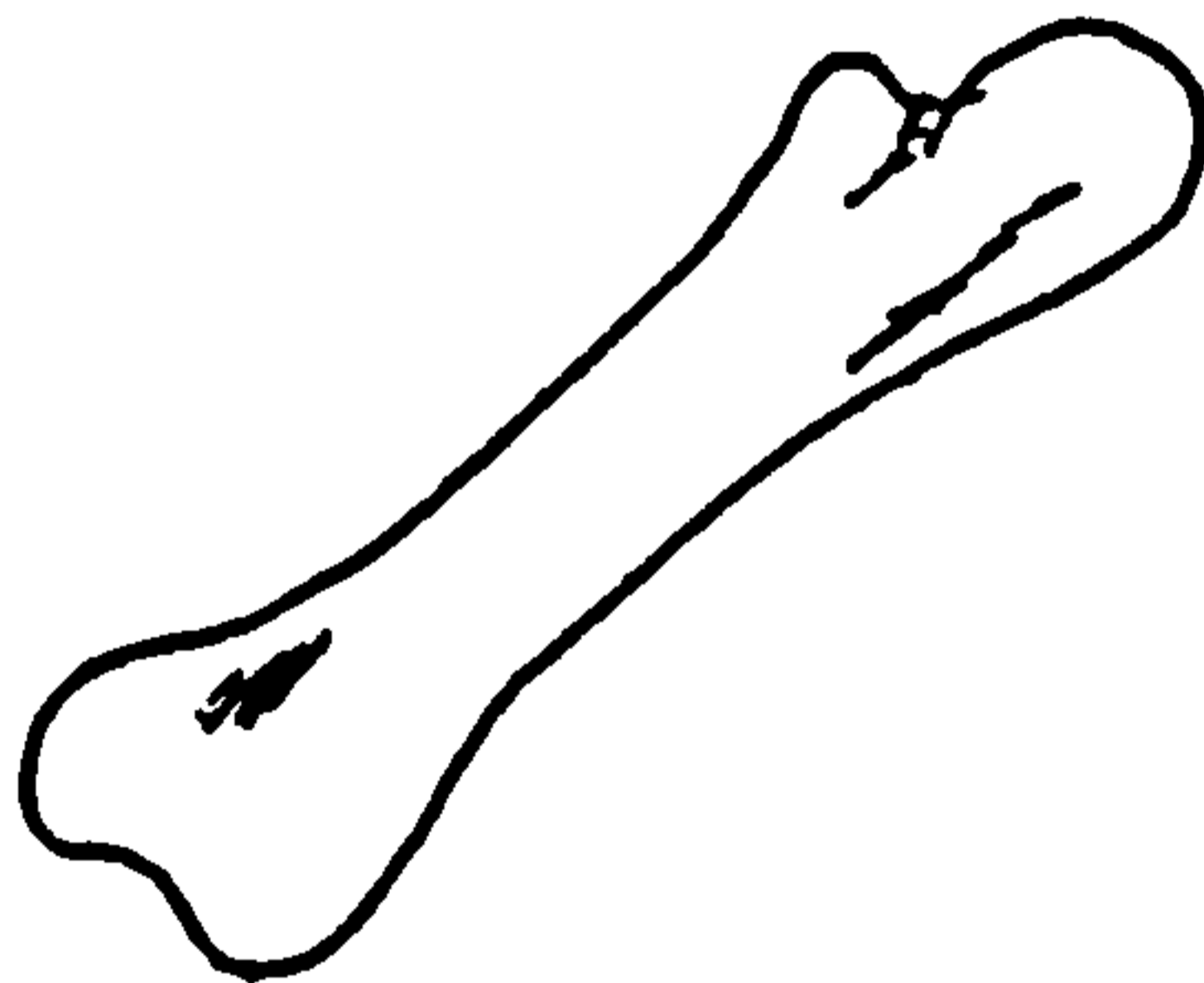
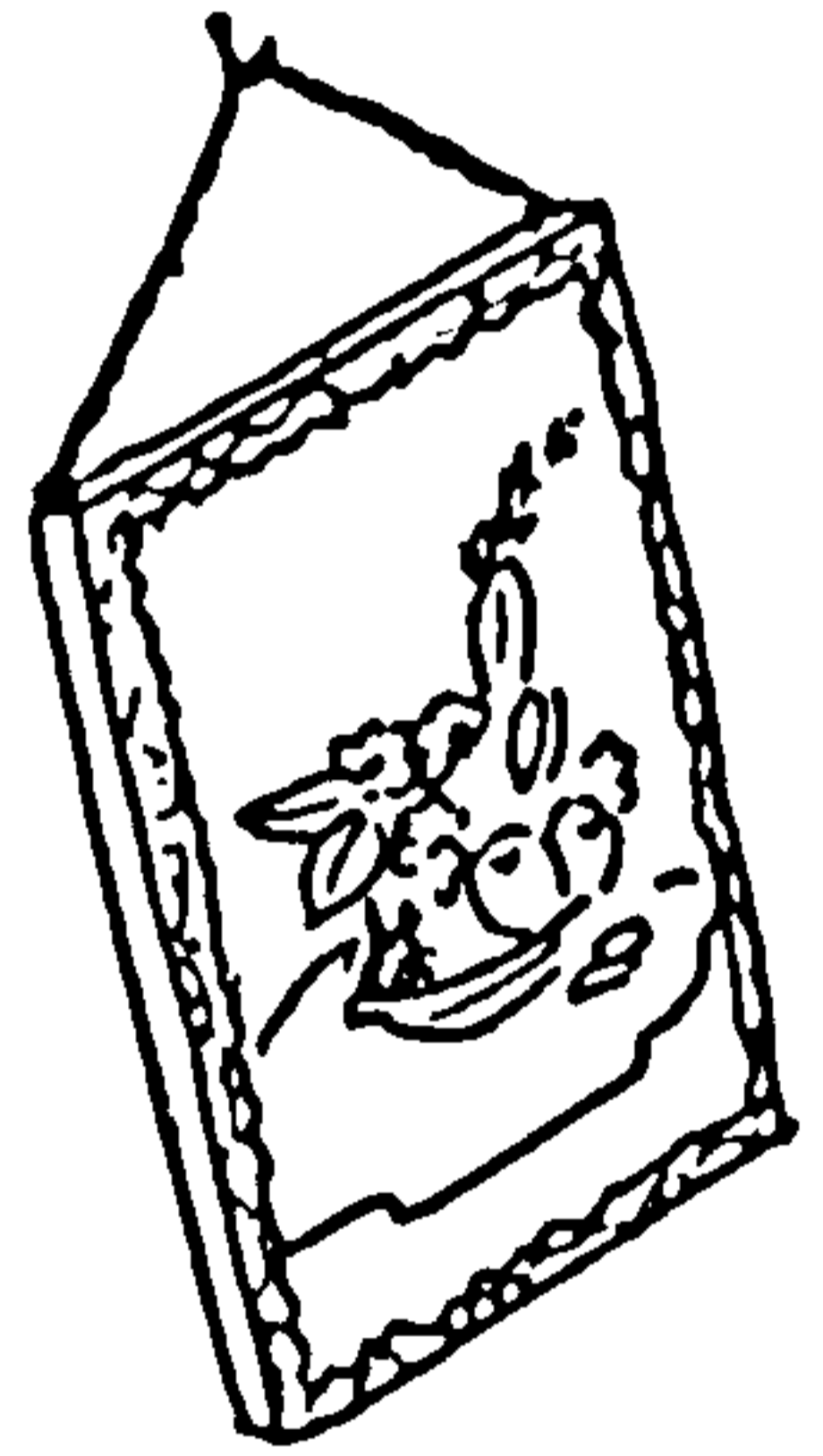
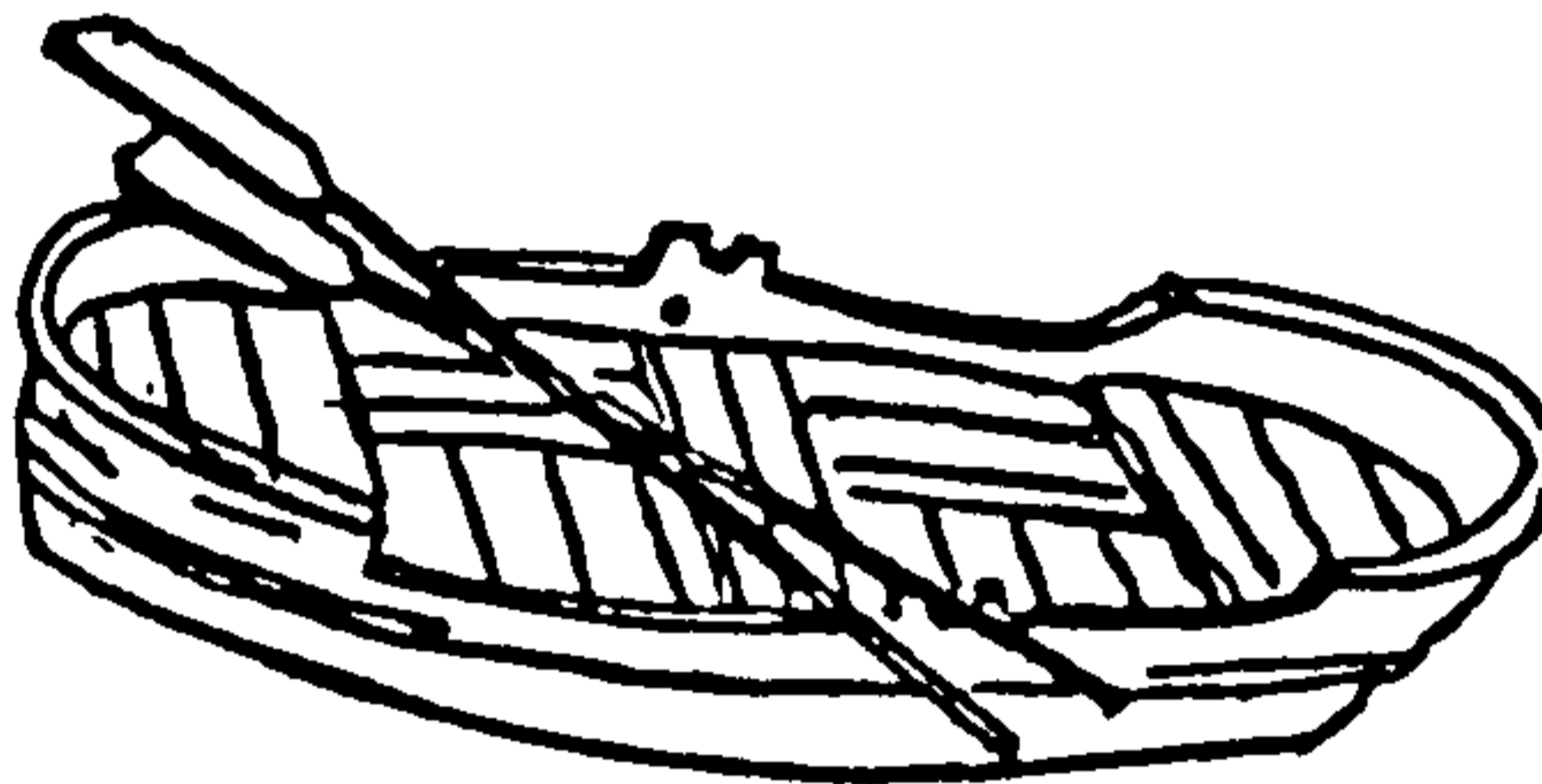
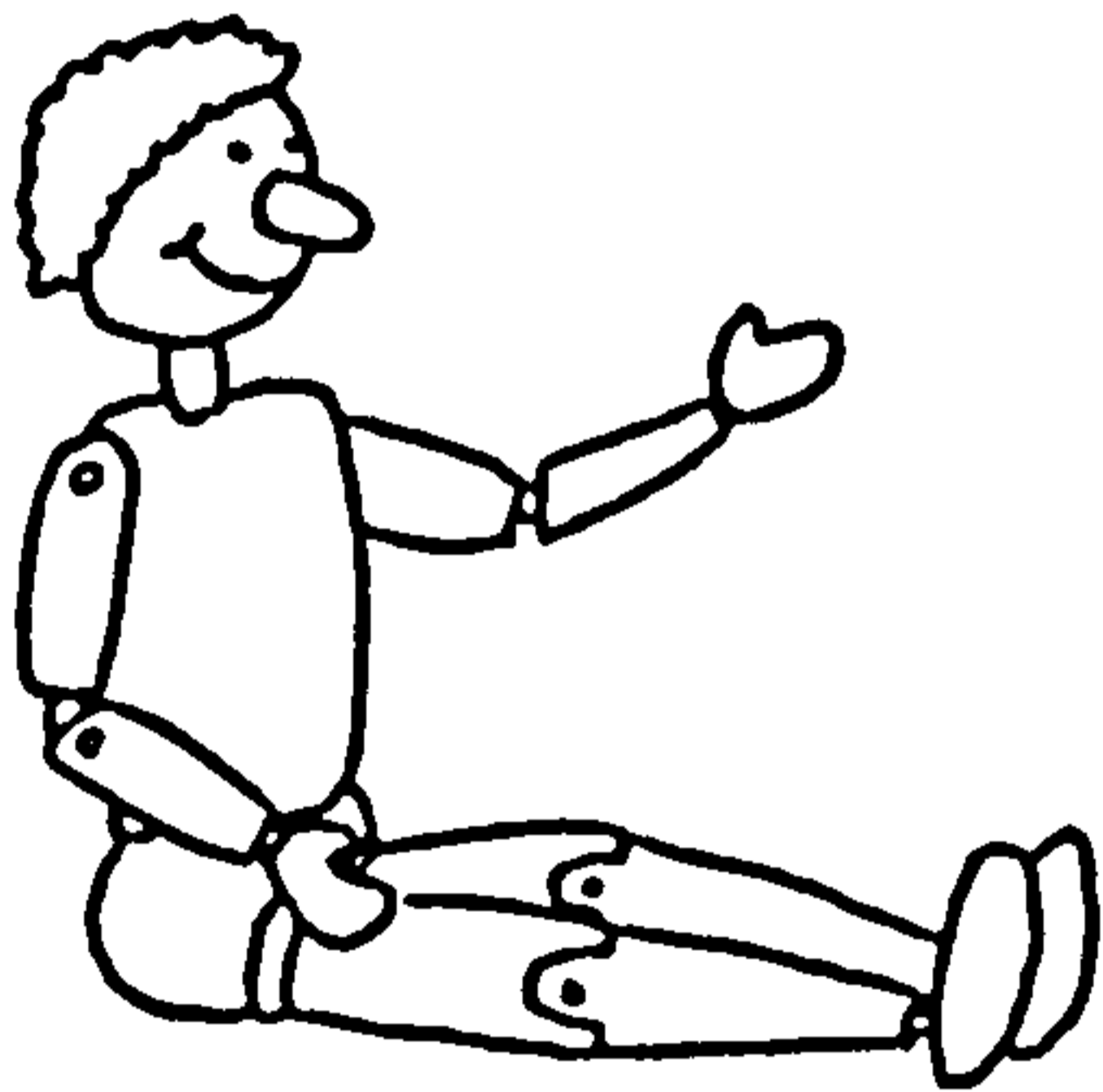
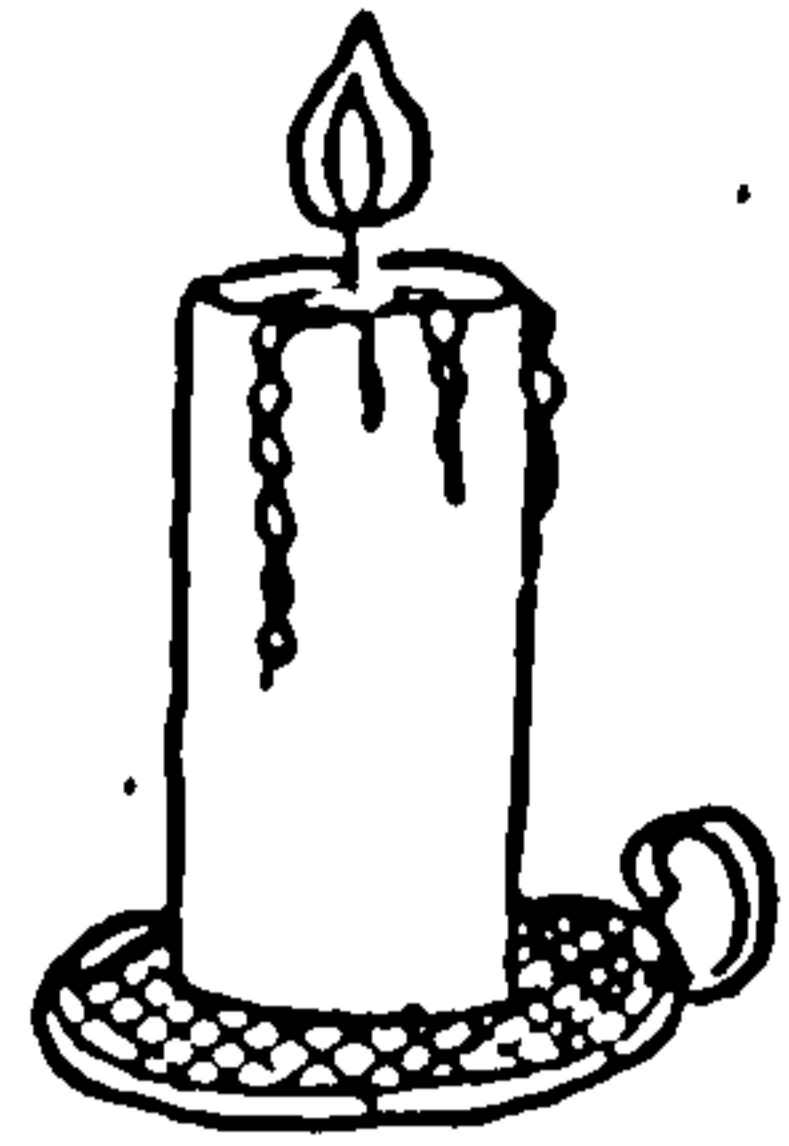
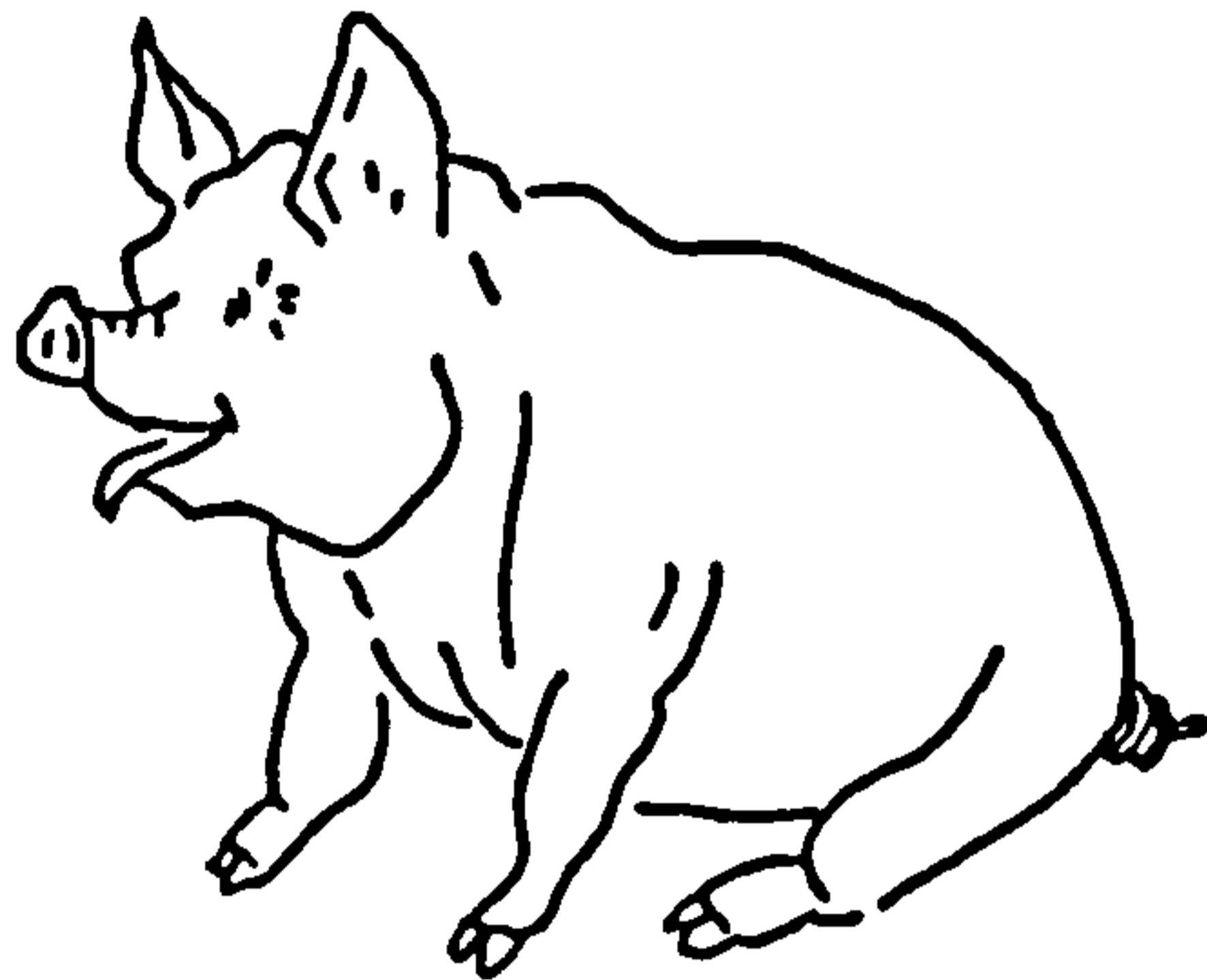
None of these is striking in isolation, nor even particularly so within the context of the rest of the report of that patient. But seen in terms of the discussion in this section there is a possible significance to these slightly unusual replies. The mildness of the effect of the propositional overloading in the left hemisphere would be expected if the patient had had time since the hemispherectomy to allow the left hemisphere to learn new strategies for dealing with the load.

"(Using large rectangles and large circles only)

1. Put the red circle on the green rectangle.
2. Put the white rectangle behind the yellow circle.
3. Touch the blue circle with the red rectangle.
4. Touch with the blue circle the red rectangle.
5. Touch the blue circle and the red rectangle.
6. Pick up the blue circle or the red rectangle.
7. Put the green rectangle away from the yellow rectangle.
8. Put the white circle before the blue rectangle.
9. If there is a black circle pick up the red rectangle.
10. Pick up the rectangles except the yellow one.
11. Omitted.
12. When I touch the green circle you take the white rectangle.
13. Put the green rectangle beside the red circle.
14. Touch the rectangles slowly and the circles quickly.
15. Put the red circle between the yellow rectangle and the green rectangle.
16. Except for the green one touch the circles.
17. Pick up the red circle - No! - the white rectangle.
18. Instead of the white rectangle take the yellow circle.
19. Together with the yellow circle take the blue circle.
20. After picking up the green rectangle, touch the white circle.
21. Put the blue circle under the white rectangle.
22. Before touching the yellow circle pick up the red rectangle."

A6:1 Pictures used in Experiment I (reduced size)

←-- -- 3 cm -- --→



1	2	3	4	5	6	7	8	9	10
l.bu	m	5.1	4.09	0.935	0.939	0.937	1.259	1.088	1.055
n.bu	m	5.1	4.09	1.403	1.299	1.413	1.757	1.390	1.545
s.wi	m	5.1	4.11	1.208	1.320	1.420	1.024	1.232	1.237
m.ad	m	5.0	4.08	0.891	0.985	0.909	0.787	0.955	0.879
a.jo	m	5.0	4.01	0.863	0.973	1.030	1.012	1.009	0.994
r.ho	m	6.8	5.08	1.029	1.182	1.097	0.978	1.052	1.024
a.so	m	6.4	5.10	1.196	1.136	1.439	1.301	1.558	1.253
j.co	m	5.5	5.02	0.754	0.882	0.780	0.981	0.911	0.963
j.du	m	5.2	5.02	1.393	1.465	1.452	1.402	1.542	1.024
c.du	m	5.9	5.07	1.144	0.933	1.033	1.081	1.156	1.238
g.bo	m	8.2	6.10	0.818	0.813	0.747	0.800	0.984	0.922
r.bo	m	7.8	6.09	0.976	1.149	0.937	0.984	1.186	1.322
s.le	m	5.3	6.07	2.010	1.725	2.036	2.131	1.830	1.980
n.we	m	6.4	6.10	1.318	1.304	1.686	1.254	1.371	1.495
j.di	m	6.2	6.03	1.181	1.295	1.216	1.163	1.260	1.245
a.br	m	8.9	7.08	0.671	0.721	0.700	0.647	0.765	0.752
p.br	m	9.0	7.08	0.895	0.989	0.956	1.144	1.169	1.101
m.re	m	7.8	7.10	1.171	1.123	1.028	0.963	1.195	1.071
k.ma	m	7.6	7.07	1.145	1.140	1.082	1.001	1.209	1.079
c.be	m	6.2	7.07	1.317	1.012	1.362	1.359	1.605	1.288
s.wa	m	6.9	8.01	1.188	1.162	1.028	1.126	1.107	1.087
p.as	m	11.8	8.02	0.911	0.841	0.823	1.102	0.932	0.933
d.mi	m	9.0	8.10	0.726	0.740	0.604	0.663	0.654	0.708
p.po	m	12.9	8.01	1.093	1.077	1.113	0.926	1.477	1.184
p.co	m	12.4	8.08	0.846	0.814	0.809	0.674	0.746	0.647
k.wa	f	6.9	4.11	0.997	0.912	0.833	0.877	0.900	0.777
l.be	f	5.0	4.04	1.929	2.155	2.002	1.799	1.742	1.884
h.pa	f	5.5	4.10	1.088	1.167	1.609	1.127	1.201	1.256
s.di	f	5.0	4.06	1.127	1.254	1.153	0.924	1.180	0.963
s.mc	f	5.1	4.02	1.056	0.998	1.063	1.193	1.189	1.134
s.be	f	6.1	5.11	1.259	1.402	1.070	1.209	1.152	1.366
d.ma	f	5.6	5.05	1.790	1.808	2.141	1.462	1.666	1.783
r.as	f	5.1	5.03	1.450	1.293	1.431	1.380	1.336	1.341
l.ob	f	5.7	5.09	1.889	1.629	1.895	1.874	1.961	2.234
r.fo	f	5.9	5.08	0.933	1.157	0.948	1.148	1.101	1.315
e.ey	f	5.5	6.11	0.667	0.571	0.399	0.654	0.664	0.508
h.li	f	7.9	6.09	1.006	1.173	1.054	1.040	1.083	1.004
v.ma	f	6.0	6.06	1.067	1.082	1.208	1.263	1.254	1.143
j.li	f	6.2	6.04	1.688	1.702	1.282	1.469	1.544	1.556
d.pa	f	8.8	6.11	1.750	1.700	1.566	1.568	1.648	1.604
e.as	f	9.4	7.09	1.408	1.187	1.185	1.329	1.090	1.250
c.mi	f	10.1	7.00	0.960	1.266	1.133	0.933	1.224	1.050
p.so	f	7.6	7.08	1.425	1.108	1.168	1.388	1.846	1.136
r.va	f	6.8	7.08	1.185	1.103	1.246	1.347	1.212	1.139
h.co	f	9.1	7.02	1.003	0.943	1.052	0.980	1.049	0.832
l.br	f	8.2	8.08	0.884	0.783	0.975	0.803	0.821	0.848
k.at	f	11.2	8.11	0.618	0.684	0.725	0.642	0.750	0.739
k.bo	f	10.6	8.11	0.619	0.697	0.636	0.631	0.660	0.652
c.ey	f	7.2	8.01	1.420	1.479	1.508	1.335	1.146	1.552
n.ho	f	10.1	8.11	0.588	0.645	0.683	0.650	0.609	0.818

A6:i Mean scores for each subject (Experiment I) (Key overleaf)

Key to columns: 1. Subject identifier, 2. sex, 3. reading age, 4. chronological age, 5. Right presentation 'same' trials, 6. Right presentation 'different, rhyme' trials, 7. Right presentation, different, nonrhyme' trials, 8. Left presentation 'same' trials, 9. Left presentation 'different, rhyme' trials, 10. Left presentation, different, nonrhyme' trials.

NON-RHYME

	4	5	6	7	8
male	1.119	1.182	1.292	1.093	0.955
female	1.279	1.451	1.242	1.203	0.827

RHYME

male	1.142	1.130	1.359	1.042	0.894
female	1.267	1.552	1.132	1.119	0.914

TABLE A6:ii (EXPT.I) Values for Figures 6:VI and 6:VII

A6:2 Sentences used in Experiment II (In order of presentation on the tape. Numbers refer to order of presentation on paper)

CITY

LIST A
FOILS

- | | |
|---|---|
| 33. St. William's College is in King's Manor. | F |
| 10. The only three-cinema complex in York is the Odeon. | T |
| 2. York has a MacDonald's hamburger bar. | T |
| 52. York District Hospital has no casualty department. | F |
| 24. When the Romans arrived in York it was already a Viking settlement. | F |
| 55. The Theatre Royal doubles as a cinema complex. | F |
| 44. The Public Library backs onto the Museum Gardens. | T |
| 29. The Shambles was once full of butchers' shops. | T |
| 26. It was the North Transept of the Minster that was damaged by fire. | F |
| 62. York Racecourse is in Fulford. | F |

MAIN LIST

- | | |
|---|---|
| 47. York was a Royalist stronghold in the Civil War. | T |
| 45. The M57 is York's closest motorway. | F |
| 67. There was formerly a market on Parliament Street. | T |
| 15. York does not have a war memorial. | F |
| 39. A line drawn due southwards from York will pass through Portsmouth. | T |
| 16. St. Leonard's Hospice is in St. Leonard's Place. | F |
| 38. York Sixth Form College is next to the Tech. | T |
| 48. There is a self-service restaurant in St. William's College. | T |
| 22. There are no Chinese restaurants inside the city boundaries. | F |
| 32. The National Railway Museum is by Walmgate Bar. | F |
| 50. The York Story is in the Art Gallery. | F |
| 23. Bootham Bar is the only Bar built on the site of a Roman gateway. | T |
| 46. The market is closed on Sundays. | T |
| 72. St. John's College has premises in Heworth Green. | T |
| 37. St. Margaret Clitherow was executed for sheltering Jesuit priests. | T |
| 76. The Viking Hotel is next to the Jorvik Museum. | F |
| 58. There is no museum in the Museum Gardens. | F |
| 75. The Queen Mother was born less than ten miles from York. | F |
| 19. York does not have any Traffic Wardens. | F |
| 42. The Minster took about two hundred and fifty years to build. | T |
| 59. Marks and Spencers is in Coney Street. | F |
| 11. The Royal Mail sorting office is in Leeman Road. | T |
| 78. The Tourist Information Centre is in the De Grey Rooms. | T |
| 28. The heads of traitors used to be displayed on Micklegate Bar. | T |
| 51. The Archbishop of York lives next door to the Minster. | F |

- | | |
|---|---|
| 1. The Minster is less than two hundred years old. | F |
| 63. Constantine the Great was in York when he became the Roman Emperor. | T |
| 68. Sainsbury's is built on the site of a Jewish cemetery. | T |
| 36. Taylor's teashop sells specialist coffees. | T |
| 21. York has no branch of Habitat. | F |

LIST B
FOILS

- | | |
|--|---|
| 27. The Lord Mayor's residence is the Mansion House. | T |
| 64. The Salvation Army Hall is in Coppergate. | F |
| 74. Admission to the Jorvik Museum is free for York residents. | F |
| 18. Tesco's is next door to the Merchant Adventurers' Hall. | T |
| 80. British Telecom has a shop on Coney Street. | T |

MAIN LIST

- | | |
|--|---|
| 65. The River Ouse flows under Ouse Bridge before Lendal Bridge. | F |
| 14. There is an admission charge at the Minster. | F |
| 69. The quickest rail journey from York to London is three hours. | F |
| 31. York Station is just outside the City Walls. | T |
| 17. There are roman excavations on show in the Roman Bath pub. | T |
| 9. Betty's teashop is open in the evenings. | T |
| 66. The Treasurer's House is near Presto's. | F |
| 77. York is closer to London than to Edinburgh. | T |
| 79. The pupils of the York Minster Song School wear green blazers. | F |
| 25. There is no police station inside the city walls. | F |
| 4. Godfrey's bookshop sells typewriter ribbons. | F |
| 56. The Arts Centre is in a redundant church. | T |
| 71. There is a car park behind Presto's supermarket. | T |
| 35. Priory Street forms a junction with Bootham. | F |
| 49. It is not possible for organisations to hold public functions in the Assembly Rooms. | F |
| 13. There are two branches of the National Westminster Bank in Parliament Street. | F |
| 61. Woolworths is open every Sunday. | T |
| 53. St. Mary's Abbey was founded by Benedictine monks. | T |
| 5. The riverside pub famous for flooding is called the King's Arms. | T |
| 41. There is a cafeteria in the Minster Undercroft. | F |
| 43. The Foss flows into the Ouse by Clifton Bridge. | F |
| 34. The fire station is in Clifford Street. | T |
| 12. Central Selby is almost exactly due south of York. | T |
| 73. W.P.Brown's is in St. Sampson's Square. | T |
| 7. There is a Lloyds Bank on the corner of Lendal and Museum Street. | F |
| 57. The Duke and Duchess of York are Charles and Diana. | F |
| 54. The Barbican swimming baths is York's only public pool. | F |
| 70. Part of the Castle Museum was a debtors' prison. | T |
| 20. The closest seaside resort to York is Bridlington. | T |

40. York's great Jewish massacre took place in the fourteenth century. F

FOILS

- | | |
|--|---|
| 6. Guy Fawkes was born in the Dean Court Hotel. | F |
| 3. Gillygate Bakery mills its own flour. | T |
| 30. The York Mystery Plays will next be staged in two years' time. | F |
| 8. Terry's chocolate factory is owned by Rowntree's. | F |
| 60. The Pope visited York during his British tour. | T |
-

UNIVERSITY

LIST A

FOILS

- | | |
|--|---|
| 13. St. Lawrence Court has its own squash court. | F |
| 74. Eden's Court only houses male students. | F |
| 2. There is a computer terminal room in Derwent College. | T |
| 10. It is an offence to walk on the grass. | F |
| 55. Smoking is banned on the bridge between Goodricke and Wentworth. | F |
| 44. Kings Manor is by Exhibition Square. | T |
| 26. Derwent College is adjacent to the stationery store. | T |
| 71. There is a Politics Department at York University. | T |
| 56. The nearest University town to York is Hull. | F |
| 47. Bleachfield only accommodates undergraduate students. | F |

MAIN LIST

- | | |
|---|---|
| 40. The Music Department has its own building. | T |
| 38. Alcuin's dining room is not on the ground floor. | T |
| 69. Students are permitted to buy meals only in their own college. | F |
| 21. There is a Henry Moore sculpture between Langwith College and the lake. | F |
| 25. The University is built on marshland. | T |
| 29. Plastic photocopying cards for the Library cost one pound to buy. | T |
| 63. The Education Department has its own separate building. | F |
| 54. North Yorkshire Student Travel has a sales office in Vanbrugh. | T |
| 11. The University's year has four terms of eight weeks. | F |
| 78. Goodricke bar is next to the Porters' Lodge. | F |
| 6. Food and drink may be consumed on the top floor of the main Library. | F |
| 28. The Campus does not have a separate Students' Union building. | T |
| 52. There is a branch of Barclay's Bank in Heslington Village. | T |
| 46. The nearest post office to the Campus is on the Fulford Road. | F |
| 72. The Psychology Department is based in Wentworth College. | T |

- | | |
|---|---|
| 36. The central sorting office for internal mail is in Wentworth College. | F |
| 49. U.R.Y. is a student radio station. | T |
| 31. Undergraduates are allowed to borrow library books for up to fourteen days. | F |
| 23. The Morrell Library is closed on Sundays. | T |
| 4. Goodricke College has squash courts. | T |
| | |
| 75. The Campus Medical Centre is in Alcuin College. | F |
| 18. There is a drinks vending machine in the Morrell Library foyer. | F |
| 20. There are tennis courts next to Heslington Parish Church. | F |
| 70. There is a swimming pool in the Sports Centre. | F |
| 59. The Sports Centre has a sauna bath. | T |
| | |
| 42. Only postgraduates may use the computer terminals. | F |
| 7. The University Bookshop is owned by Blackwells. | T |
| 30. Vanbrugh College does not have a 'D' Block. | T |
| 34. Derwent was one of the first two colleges to be officially opened. | T |
| 73. The water tower was once a medieval fortress. | F |

LIST B
FOILS

- | | |
|--|---|
| 32. The University of York has a Geography Department. | F |
| 22. University accommodation is used by conference delegates in the vacations. | T |
| 12. The University lake is an artificial construction. | T |
| 16. The Vice-Chancellor lives on Bishopthorpe Road. | F |
| 24. It is an offence to cycle along the covered walkways. | T |

MAIN LIST

- | | |
|---|---|
| 27. The University bursar's office is in Heslington Hall. | T |
| 60. Wentworth bar does not sell alcoholic drinks on Thursdays. | F |
| 41. The University of York has a Medical School. | F |
| 66. The closest supermarket to the University Campus is Hillards. | T |
| 35. Catherine House is situated on the Hull Road. | F |
| | |
| 67. The University year begins in November. | F |
| 45. The Sports Centre runs aerobics sessions. | T |
| 8. Different M.P.s serve the University and the City. | T |
| 39. The University Bookshop sells birthday cards. | T |
| 15. Heslington Church is shared by clergy of three denominations. | T |
| | |
| 33. Langwith College library is in Derwent. | F |
| 64. Students resident on the Campus have to wash their own bed linen. | F |
| 48. Wentworth is the most recently built college. | T |
| 68. It is illegal to smoke marijuana on the Campus. | T |
| 1. The Vice-Chancellor's name is Professor Laurie Taylor. | F |

57. It is possible to have your hair cut in Vanbrugh College. T
62. It is not possible to study philosophy at undergraduate level. F
51. The Library Snackbar opens at nine o'clock on Tuesday mornings. F
3. The name 'Sir Jack Lyons' is affixed to the side of the Biology Department. F
53. Alcuin College is named after an 8th century scholar. T
14. Central Hall is the largest auditorium on the Campus. T
50. The University porters wear uniforms. T
61. The University Book Mart can be found in Wentworth College. T
19. Students resident on the Campus may not keep cats. T
37. The Library plastic photocopying cards are revalued using 50 pence pieces. F
77. Smoking is permitted on the first floor of the Morrell Library. F
43. The English Department is located in Derwent College. F
9. The Department of Electronics is based in Heslington Village. F
80. The bridge between Vanbrugh and Goodricke has no roof. F
79. The building work opposite Derwent is an extension to the Chemistry Department. F

FOILS

65. The current Students' Union president is a woman. T
76. Undergraduate students may not use the University car parking facilities. F
58. The Gilbert & Sullivan Society shows take place in Central Hall. T
17. A footpedal operates the Morrell Library exit turnstile. T
5. Alcuin has an 'E' Block. F

A6:3 Instructions for experiment II

a) GENERAL INSTRUCTIONS (WRITTEN)

This experiment is to find out how good you are at concentrating on how sentences SOUND while ignoring their MEANING.

In a moment you will hear some sentences on tape and you will be asked to list in reverse order the last three words in each one. For example, in the sentence "The cat sat on the mat" you would say "MAT THE ON" because you have to identify the last three words ("on the mat") and list them, beginning with the last one and working backwards.

To make the test harder, the recording is quite quiet and you'll only hear it in one ear at a time.

There are two tasks on the tape: the one I have just described and a Quiz. The quiz functions as a 'control condition' and gives me a baseline against which to compare your performance in the experimental test.

I have prepared two sets of statements suitable for the quiz. One set is about the University and the other is about the City of York. You may choose which set to use for the quiz (choose the subject you know more about). The other set will be used for the experimental test, where you just listen for the sounds occurring in the statements.

Please raise your hand and tell me which subject you would like to do the quiz on: the University or the City.

* * *

Ensure that the microphone is always near your mouth, so that your responses are picked up when you record.

When you are ready to begin, press the SPEAK button (not the LISTEN one). This will enable you to hear the pre-recorded tape AND record your responses.

Please speak up clearly and confidently. Do not be distracted by others around you: different people have been given slightly different things to do.

You are being asked to do the experimental (word listing) test first and the Quiz afterwards².

b) INSTRUCTIONS FOR NONPROPOSITIONAL TASK (WRITTEN)

On the tape is a set of statements about the University of York/ City of York (whichever you did not choose for the quiz). All of them are either true or false. However, you are not required to judge this. Instead, you must listen to the words and when the statement has finished, list IN REVERSE ORDER the last three words. For example, in the statement "Cardiff is the capital of Great Britain", your response will be "Britain Great of" because the last three words are "of Great Britain" and you have to name them beginning with the last and working backwards.

You can tell when a statement has finished because you will hear a bell.

The statements will be presented quite fast, so you will need to

2. Reversed for half the subjects.

respond quickly if you are to avoid masking the next statement with your answer to the previous one.

If you realise that you have responded incorrectly, do not let this distract you from the remainder of the task. However, there will NOT be any opportunity to improve your score afterwards, so the response you give must be as accurate as possible.

Halfway through the test you will be asked to stop the tape and change your headphones round. You should do this without undue delay and then switch the tape back on by pressing SPEAK as before.

Please put the working earpiece (i.e. with the microphone attached to it) on your LEFT³ ear.

You may begin (press SPEAK).

c) INSTRUCTIONS FOR THE NONPROPOSITIONAL TASK (SPOKEN)

This task requires you to list, in reverse order, the last three words in each statement. You may adjust the volume as you wish. Ensure that you have depressed the SPEAK button and not the LISTEN button. Please speak confidently and clearly at all times. Answer these preliminary questions by speaking into the microphone. What is your name? What is the reference number at the top of your instruction sheet? The task now follows. Do not stop the tape until you are instructed to do so. Give the last word first, then the one which preceded it and then the one before that.

[LIST A (40 sentences)]

Now you must change your headphones round so that the sound enters the other ear. Stop the tape now. You should now have changed your headphones round. The sound should now be entering the other ear. Adjust the volume if you need to. The task now continues exactly as before.

[LIST B (40 sentences)]

Please stop the tape and raise your hand.

d) INSTRUCTIONS FOR THE PROPOSITIONAL TASK (WRITTEN)

On the tape is a set of statements about the University of York/ City of York (you have chosen which). All of them are either true or false. When you have heard each statement respond by saying the word TRUE, FALSE or DON'T KNOW into the microphone as appropriate.

You can tell when a statement has finished because you will hear a bell. I have tried to avoid any ambiguous or complicated statements.

The statements will be presented quite fast, so you will need to respond quickly if you are to avoid masking the next statement with your answer to the previous one. You are not permitted to stop the tape until you are instructed to. There is a prize for the highest number of points scored. Try not to guess randomly. A "don't know" is worth more than a wrong answer. But a right answer is worth most.

If you realise that you have responded incorrectly, do not let this distract you from the remainder of the task. There will be an opportunity to improve your score afterwards, though a correct answer first time through is worth more points.

Halfway through the test you will be asked to stop the tape and change your headphones round. You should do this without undue delay and then switch the tape back on by pressing SPEAK as before.

3. RIGHT for half the subjects.

Please put the working earpiece (i.e. with the microphone attached to it) on your LEFT⁴ ear.
You may begin (press SPEAK).

e) INSTRUCTIONS FOR THE PROPOSITIONAL TASK (SPOKEN)

This task requires the answers TRUE, FALSE and DON'T KNOW. You may adjust the volume as you wish. Ensure that you have depressed the SPEAK button and not the LISTEN button. Please speak confidently and clearly at all times. Answer these preliminary questions by speaking into the microphone. What is your name? What is the reference number at the top of your instruction sheet? The task now follows. Do not stop the tape until you are instructed to do so. Answer with the words TRUE, FALSE and DON'T KNOW.

[LIST A (40 sentences)]

Now you must change your headphones round so that the sound enters the other ear. Stop the tape now. You should now have changed your headphones round. The sound should now be entering the other ear. Adjust the volume if you need to. The task now continues exactly as before.

[LIST B (40 sentences)]

Please stop the tape and raise your hand.

A6:4 Contents of tapes A - D

TAPE A: Instructions for propositional task
University of York Group A
Interim instructions
University of York Group B
Final instructions
Gap
Instructions for non-propositional task
City of York Group A
Interim instructions
City of York Group B
Final instructions

TAPE B: Instructions for propositional task
City of York Group A
Interim instructions
City of York Group B
Final instructions
Gap
Instructions for non-propositional task
University of York Group A
Interim instructions
University of York Group B
Final instructions

4. RIGHT for half the subjects.

TAPE C: Instructions for non-propositional task
University of York Group A
Interim instructions
University of York Group B
Final instructions
Gap
Instructions for propositional task
City of York Group A
Interim instructions
City of York Group B
Final instructions

TAPE D: Instructions for non-propositional task
City of York Group A
Interim instructions
City of York Group B
Final instructions
Gap
Instructions for propositional task
University of York Group A
Interim instructions
University of York Group B
Final instructions

A6: Table iii

1	2	3	4	5	6	7	8	9	10
8	gp	m	prtb	76.47	15	19	132	125	1
9	dm	m	nrtc	80.00	3	7	180	174	2
12	cp	m	nltc	84.62	1	1	93	88	2
13	al	m	qlta	95.00	5	2	109	98	2
14	mm	m	nrtc	86.67	12	8	141	153	2
17	ts	m	prtb	100.00	1	9	95	123	1
22	pb	m	plta	92.31	10	10	131	121	1
28	aw	m	nrtcd	90.00	9	4	101	85	1
29	sg	m	plta	76.47	3	4	98	107	2
30	cw	m	nltc	92.86	5	10	126	138	1
32	rb	m	prta	84.62	7	4	33	70	2
36	gg	m	nltc	92.31	6	7	145	133	2
37	rm	m	plta	100.00	5	12	97	42	1
39	ks	m	plta	95.45	4	6	46	54	1
40	bs	m	nrtcd	78.57	2	2	121	129	2
41	jg	m	prta	61.54	8	6	110	104	1
43	dc	m	nltcd	94.74	2	6	106	113	2
1	hd	f	prtb	66.67	5	8	56	63	1
2	fc	f	nltcd	100.00	5	4	138	148	1
3	sf	f	plta	90.00	4	2	144	142	1
4	ct	f	plta	94.44	5	6	170	164	1
6	jc	f	nltc	90.91	8	4	90	101	1
7	jd	f	prta	88.24	3	4	112	145	1
10	ab	f	nrtcd	100.00	4	6	145	142	2
11	sp	f	prta	87.50	1	2	133	125	1
15	cb	f	nltc	83.33	7	7	124	92	1
16	hb	f	plta	80.00	4	5	126	133	1
19	ss	f	prta	84.62	9	14	144	154	1
20	ns	f	nrtcd	92.31	11	9	67	74	1
21	bw	f	nltcd	88.24	2	13	169	166	1
24	lb	f	prta	92.31	8	5	116	113	1
25	jk	f	prta	76.47	4	10	143	154	1
26	gp	f	pltb	88.89	3	2	127	127	1
27	cr	f	nltcd	80.00	3	6	157	150	1
31	sh	f	pltb	100.00	5	15	56	77	2
38	cj	f	nltcd	93.33	1	4	105	101	1
42	gl	f	nrtc	94.12	5	3	121	141	1

A6:iii (EXPT.2) Total scores for each subject

Key to columns: 1. Subject number (order of testing), 2. subject identifier, 3. sex, 4. presentation order group: n/p = first task (nonpropositional/propositional), r/l = first ear (right/left), ta/tb/tc/td = tape a/b/c/d), 5. handedness score, 6. propositional task, right ear score (= no. of mistakes), 7. propositional task, left ear score, 8. nonpropositional task, right ear score (= no. of words & positions correct), 9. nonpropositional task, left ear score, 10. A-level subjects groups (1 = humanities, 2 = sciences)

REFERENCES

(NB: Asterisk (*) denotes a secondary reference)

A

* ABRAMS, K. & BEVER, T.G. 1969 "Syntactic structure modifies attention during speech perception & recognition" Quarterly Journal of Experimental Psychology 21:280-90

* ALAJOUANINE, T.H. & L'HERMITTE, F. 1965 "Acquired aphasia in children" Brain 88:653-62

ALBERT, M.L. & OBLER, L.K. 1978 "The bilingual brain" Academic Press

* ANDREWSKY, E. & SERON, X. 1975 "Implicit processing of grammatical rules in a case of agrammatism" Cortex 11:379-90

ANNETT, M. 1964 "A model of the inheritance of handedness & cerebral dominance" Nature 204 (4953) 3rd Oct., p.59-60

B

BACH, M.J. & UNDERWOOD, B.J. 1970 "Developmental changes in memory attributes" Journal of Educational Psychology 61 (4):292-6

* BAKKER, D.J. 1967 "Left-right differences in auditory perception of verbal & non-verbal material by children" Quarterly Journal of Psychology 19:334-6

* BAKKER, D.J. 1968 "Ear asymmetry with monaural stimulation" Psychon. Sci. 12:62

* BAKKER, D.J. 1969 "Ear asymmetry with monaural stimulation: task influences" Cortex 5:36-42

* BAKKER, D.J. 1970 "Ear asymmetry with monaural stimulation: relations to lateral dominance & lateral awareness influences" Neuropsychologia 8:103-17

BAKKER, D., SMINK, T. & REITSMAN, P. 1973 "Ear dominance and reading ability" Cortex 9:301-312

* BARTON, M., GOODGLASS, H. & SHAI 1965 "Differential recognition of tachistoscopically presented English and Hebrew words in the right and left visual fields" Perceptual & Motor Skills 21:431-437

BASSER, L.S. 1962 "Hemiplegia of early onset and the faculty of speech with special reference to the effects of hemispherectomy" Brain 85 (3): 427-60

* BECKER, W., FELLMAN, A. & R SSIG, H. 1974 "Neuropsychologische und linguistische Untersuchungsergebnisse bei linksseitiger (dominant) Hemi-

sphärektomie" Fortschritte der Medizin 92:525-8

* BELLISLE, F. 1975 "Early Bilingualism and cerebral dominance" Unpublished manuscript, McGill University

* BENTIN, S. 1981 "On the representation of a second language in the cerebral hemispheres of right handed people" Neuropsychologia 19:599-603

* BENTON, A.L. 1965 "The problem of cerebral dominance" Canadian Psychologist 6:332-48

BENTON, A.L. & JOYNT, R.J. 1960 "Early descriptions of Aphasia" Archives of Neurology 3:205-222 (109-126)

* BERLIN, C. HUGHES, L., LOWE-BELL, S. & BERLIN, H. 1973 "Dichotic right ear advantage in children from 5 to 13" Cortex 9:394-402

BERLIN, C., LOWE-BELL, S., HUGHES, L. & BERLIN, H. 1973 "Dichotic right ear advantage in males and females - ages 5 to 13" Journal of the Acoustical Society of America 53:368 (Abstract)

BERINGER, K. & STEIN, J. 1930 "Analyse eines Falles von 'Reiner' Alexie" Zeitschrift für Gesamte Neurologie u. Psychiatrie 123:472-8

* BERRY, J.W. 1966 "Temne and Eskimo perceptual skills" International Journal of Psychology 1:207-229

* BEST, C.T. & GLANVILLE, B. 1976 "A cardiac measure of cerebral asymmetry in infant auditory perception" Paper read at the 48th meeting of the Midwest Psychology Association, Chicago, Illinois

BESTIC, A. 1985 "On the other hand..." Radio Times 2-8th Feb., p.11

* BEVER, T.G. 1971 "The nature of cerebral dominance in speech behavior of the child and adult" in Huxley, R. & Ingram, E. (eds) "Language acquisition: models and methods" Academic Press, N.Y.

* BEVER, T.G. 1974 "The relation of language development to cognitive development" in Lenneberg, E. (ed) "Language and brain: developmental aspects" Jamaica Plain, MA: Neurosciences Research Program bulletin.

BEVER, T.G. 1983 "Cerebral lateralization, cognitive asymmetry & human consciousness" in Perecman, E. (ed) "Cognitive processing in the right hemisphere" Academic Press, p.19-39

BEVER, T.G. & CHIARELLO, R.J. 1974 "Cerebral dominance in musicians & non-musicians" Science 185:537-9

BEVER, T.G., GARRETT, M.F. & HURTIG, R. 1973 "The interaction of perceptual processes and ambiguous sentences" Memory & Cognition 1(3):277-286

BIERWISCH, M. 1967 "Grammatik des deutschen Verbs" in "Studia Grammatica II" (5th Edition) Berlin, p.30-7

* BISHOP, N. 1967 "Speech in the hemiplegic child" Proceedings of the 8th Medical & Educational Conference of the Australian Cerebral Palsy Association Melbourne, Victoria: Tooronga Press p.141-53

BLASS, R. 1987 "The grammaticalisation of interpretative use: the case of re in Sissala" Paper presented at the meeting of the L.A.G.B., Westfield College, University of London, April 1987.

BLOM, J.P. & GUMPERZ, J.J. 1986 "Social meaning in linguistic structure: code-switching in Norway" in Gumperz, J.J. & Hymes, D. (eds) Directions in Sociolinguistics Blackwell (2nd Edition).

BLOOM, L. 1976 "One word at a time" Mouton, The Hague

BLOOMFIELD, L. 1964 "Literate & illiterate speech" in Hymes, D. (ed) "Language in culture & society" Harper & Row, New York, p.391-6

BLUMSTEIN, S. & COOPER, W.E. 1974 "Hemispheric processing of intonation contours" Cortex 10 (2):146-58

* BOCK, R.D. 1967 "A family study of spatial visualizing ability" Paper presented at the meeting of the American Psychological Association, Washington D.C., September 1967

* BOGEN, J.E. 1969 "The other side of the brain II: An appositional mind" Bulletin of the Los Angeles Neurological Societies 34,4:135-162

* BOGEN, J.E. & BOGEN, G.M. 1969 "The other side of the brain III" Bulletin of the Los Angeles Neurological Societies 34,4:191-219

BOLINGER, D. 1975 "Aspects of Language" Harcourt Brace Jovanovich (2nd edition)

* BOLLER, F. & VIGNOLO, L.A. 1966 "Latent sensory aphasia in hemisphere damaged patients: an experimental study with the Token Test" Brain 89: 815-30

* BOOKBINDER, G.E. 1970 "Variations in reading test norms" Educational Research 12 (2):99-105

* BOROWBY, T. & GOEBEL, R. 1976 "Cerebral lateralization of speech: the effects of age, sex, race & socio-economic class" Neuropsychologia 14: 363-70

BRANCH, C., MILNER, B. & RASMUSSEN, T. 1964 "Intracarotid Sodium Amytal for the lateralization of cerebral speech dominance" Journal of Neurosurgery 21:399-405

* BRIGGS, G.G. 1973 "The effects of cerebral organization on the control of fine movements" Unpublished Doctoral dissertation, Duke University

* BRIGGS, G.G. 1975 "A comparison of attentional and control shift models of the performance of concurrent tasks" Acta Psychologica 39:183-191

- BROADBENT, D.E. 1954 "The rôle of auditory localization in attention & memory span" Journal of Experimental Psychology 47 (3):191-6
- * BROOKS, N. 1964 "Language & language learning" Brace & World, New York (2nd Edition)
- BROWN, J.W. 1983 "Rethinking the right hemisphere" in Perecman, E. (ed) "Cognitive processing in the right hemisphere" Academic Press, p.41-53
- BROWN, R. 1973a "Development of the first language in the human species" American Psychologist Feb.1973:97-106
- BROWN, R. 1973b "A first language" Harvard University Press, Camb., MA.
- BROWN, R. CAZDEN, C. & BELLUGI, U. 1973 "The child's grammar from I to III" in Ferguson, C.A. & Slobin, D.I. "Studies of child language development" Holt, Rinehart & Winston:175-208
- * BRYDEN, M.P. 1960 "Tachistoscopic recognition of non-alphabetic material" Canadian Journal of Psychology 14:78-86 & 209-211
- * BRYDEN, M.P. 1962 "Order of report in dichotic listening" Canadian Journal of Psychology 16:291-299
- * BRYDEN, M.P. 1966 "Results of testing at the 1965 Canadian National Exhibition 1: Dichotic Listening" Unpublished Manuscript, University of Waterloo
- * BRYDEN, M.P. 1967 "An evaluation of some models of laterality effects in dichotic listening" Acta Oto-Laryngol. 63:595-604
- * BRYDEN, M.P. 1970 "Laterality effects in dichotic listening: Relations with handedness & reading ability in children" Neuropsychologia 8:443-50
- BRYDEN, M.P. 1975 "Speech lateralization in families: A preliminary study using dichotic listening" Brain and Language 2:201-11
- * BRYDEN, M.P. & ALLARD, F. 1976 "Visual hemifield differences depend on typeface" Brain & Language 3:191-200
- BRYDEN, M.P. & ALLARD, F. 1978 "Dichotic listening and the development of linguistic processes" in Kinsbourne, M. (ed) "Hemispheric Asymmetry of Function" New York CUP
- * BRYDEN, M.P., ALLARD, F. & SCARPINO, F. 1973 "The development of language lateralisation and speech perception" Unpublished Manuscript, University of Waterloo
- BUFFERY, A.W.H. 1971 "Sex differences in the development of hemispheric asymmetry of function in the human brain" Brain Research 31:364-5
- BUFFERY, A.W.H. 1974 "Asymmetrical lateralisation of cerebral functions

& the effects of unilateral brain surgery in epileptic patients" in Dimond, S.J. & Beaumont, J.G. (eds) "Hemisphere function in the human brain" Wiley Halsted Press, N.Y., p204-34

* BUFFERY, A.W.H. & GRAY, J.A. 1972 "Sex differences in the development of perceptual and linguistic skills" in Ounsted, C. & Taylor, D.C. (eds) "Gender differences: their ontogeny and significance" Churchill, London

* BYCHOWSKI, Z. 1919 "Über die Restitution der nach einem Schädelschuss verlorengegangenen Sprachen bei einem Polyglotten" Monatschrift der Psychiatrie und der Neurologie 45:184-201

C

* CALDERON, M. 1976 Doctoral dissertation at Boston University

* CAREY, P., MEHLER, J. & BEVER, T.G. 1970 "Judging the veracity of ambiguous sentences" Journal of Verbal Learning & Verbal Behaviour 9:243-54

CARROLL, F.W. 1980 "Neurolinguistic processing of a second language: experimental evidence" in Scarcella, R. & Krashen, S.D. (eds) "Research in second language acquisition: selected papers of the Los Angeles Second Language Acquisition Research Forum" Newbury House, Rowley, MA. p.81-86

* CHANEY, R.E. & WEBSTER, J.C. 1966 "Information in certain multidimensional sounds" Journal of the Acoustical Society of America 40:447-55

CHARLTON, M.H. 1964 "Aphasia in bilingual & polyglot patients - neurological & psychological study" Journal of Speech & Hearing Disorders 29 (3):307-311

CHERNIGOVSKAYA, T.V., BALONOV, L.J. & DEGLIN, V.L. 1983 "Bilingualism & brain functional asymmetry" Brain & Language 20:195-216

CHOMSKY, N. 1968 "Noam Chomsky's view of language" by Alistair MacIntyre & "Noam Chomsky & Stuart Hampshire discuss the study of language" The Listener 79, No.2044 (30th May 1968) p.685-691

CODE, C. 1982 "On the origins of recurrent utterances in aphasia" Cortex 18:161-4

CODE, C. 1983 "Hemispheric specialization retraining in aphasia: possibilities & problems" in Code, C. & Müller, D.J. (eds) "Aphasia therapy" Edward Arnold, p.42-59

CODE, C. 1987 "Language, aphasia & the right hemisphere" Wiley

* COHEN, G. 1977 "The psychology of cognition" Academic Press, London

COLE, R.A. & CUMMINGS, N. 1977 "Bilateral alpha rhythm in children during listening and looking" in Segalowitz, S.J. & Gruber, F.A. (eds) "Language development and neurological theory" Academic Press p.37-45

COLTHEART, M., PATTERSON, K. & MARSHALL, J.C. (eds) 1980 "Deep Dyslexia"
Routledge & Kegan Paul

COLTHEART, M. 1980 "Deep dyslexia: a right hemisphere hypothesis" in
Coltheart, M., Patterson, K. & Marshall, J.C. (eds) 1980 "Deep Dyslexia"
Routledge & Kegan Paul, Chapter 16

* CONRAD, C. 1974 "Context effects in sentence comprehension: a study of
the subjective lexicon" Memory & Cognition 2:130-38

COOPER, R.L. & GREENFIELD, L. 1968 "Word frequency estimation as a mea-
sure of degree of bilingualism" in Fishman, J.A., Cooper, R.L., Ma, R.
(and others) "Bilingualism in the Barrio" N.Y. Yeshiva University. Fi-
nal report, contract no. OEC-1-7-062817-0297 US Dept. of Health, Educ-
ation & Welfare, Office of Education, Bureau of Research, 2:475-84

COOPER, W.E. & PACCIA-COOPER, J. 1980 "Syntax & Speech" Harvard Universi-
ty press, Cambridge, MA

CRAMER, P. 1976 "Changes from visual to verbal memory organization as a
function of age" Journal of Experimental Child Psychology 22:50-57

* CROVITZ, H.F. & SCHIFFMAN, H.R. 1965 "Visual field & the letter span"
Journal of Experimental Psychology 70:218-223

D

DABBS, J.M. 1980 "Left-right differences in cerebral bloodflow & cogni-
tion" Psychophysiology 17:548-51

* DARWIN, C.J. 1971 "Ear differences in the recall of fricatives & vow-
els" Quarterly Journal of Experimental Psychology 23:46-62

DENÈS, P. 1914 "Contributions to the study of some aphasic phenomena" in
Paradis, M. (ed) 1983 "Readings in aphasia in bilinguals & polyglots" Di-
dier, Canada p.108-117

DENNIS, M. 1980(a) "Capacity & strategy for syntactic competition after
left hemisphere decortication" Brain & Language 10(2):287-317

DENNIS, M. 1980(b) "Language acquisition in a single hemisphere: semant-
ic organization" in Caplan, D. (ed) "Biological studies of mental pro-
cesses" MIT Press, Cambridge, MA, p.159-85

DENNIS, M. & KOHN, B. 1975 "Comprehension of syntax in infantile hemiple-
gics after cerebral hemidecortication: left hemisphere superiority"
Brain & Language 2:472-482

DENNIS, M. & WHITAKER, H. 1977 "Hemispheric equipotentiality and language
acquisition" in Segalowitz, S.J. & Gruber, F.A. (eds) "Language develop-
ment and neurological theory" Academic Press, N.Y. p.93-106

DE RENZI, E. & VIGNOLO, L.A. 1962 "The Token Test: a sensitive test to

detect receptive disturbances in aphasics" Brain 85:665-78

DILLER, K.C. 1970 "'Compound' & 'coordinate' bilingualism: a conceptual artifact" Word 26:254-61

DIMOND, S. 1972 "The double brain" Churchill Livingstone

* DOERHING, D.G. 1972 "Ear asymmetry in the discrimination of monaural tonal sequences" Canadian Journal of Psychology 26:106-110

* DORNBUSH, R.L. & WINNICK, W.A. 1965 "Right-left differences in tachistoscopic identification of paralogues as a function of order of approximation to English letter sequences" Perception & Motor Skills 20:1222-1224

DOWNING, B.T. 1978 "Some universals of relative clause structure" in Greenberg, J.H. (ed) "Universals of human language: vol 4 (Syntax)" Stanford University Press, p.375-418

DOYLE, A., CHAMPAGNE, M. & SEGALOWITZ, N. 1978 "Some issues in the assessment of linguistic consequences of early bilingualism" in Paradis, M. (ed) "Aspects of bilingualism" Hornbeam Press, Columbia SC., p.13-20

* DULAY, H. & BURT, M. 1974 "A new perspective on the creative construction process in child second language acquisition" Language Learning 24:253-78

DULAY, H., BURT, M. & KRASHEN, S.D. 1982 "Language two" Oxford University Press

E

ECHEVERRIA, M.S. 1974 "On needed research in second language learning in the light of contemporary developments in linguistic theory" IRAL 12 (1):69-77

EIMAS, P.D., SIQUELAND, E.R., JUSCZYK, P. & VIGORITO, J. 1971 "Speech perception in infants" Science 171:304-6

ELLIOT, A.J. 1981 "Child language" C.U.P.

EDMUNDS, F. 1975 "Rudolf Steiner's gift to education - The Waldorf Schools" Rudolf Steiner Press, London

ENDO, H., OIKAWA, T., SOH, K., OHUCHI, T. & KANAYA, H. 1979 "RCBF pattern during talking, naming & listening tests in aphasia" Acta Neuropsychologica Scandinavica Supplement 72, vol. 60:18-19

ENTUS, A.K. 1977 "Hemispheric asymmetry in processing of dichotically presented speech and nonspeech stimuli by infants" in Segalowitz, S.J. & Gruber, F.A. (eds) "Language development and neurological theory" Academic Press p.64-73

ERVIN, S. & OSGOOD, C.E. 1954 "Second language learning & bilingualism"

in Osgood, C.E. & Sebeok 1965 "Psycholinguistics: a survey of theory & research problems" Social Science Research Council, Indiana University Press, Bloomington & London, p.139-46

ERVIN-TRIPP, S. 1974 "Is second language learning like the first?" TESOL Quarterly 8 (2):111-127

F

FAZIO, F. FIESCHI, C., NARDINI, M., COLLICE, M. & POSSA, M. 1979 "Assessment of regional cerebral blood flow by continuous infusion of Krypton-81m & emission computerized tomography" Acta Neurologica Scandinavica Supplement 72, Vol. 60:192-3

FEDIO, P. & VAN BUREN, J.M. 1974 "Memory deficits during electrical stimulation of the speech cortex in conscious man" Brain & Language 1: 29-42

* FODOR, J.A., BEVER, T.G. & GARRETT, M.F. 1974 "The psychology of language: An introduction to psycholinguistics and generative grammar" McGraw Hill, New York

* FORD, M., BRESNAN, J.W. & KAPLAN, R.M. 1982 "A competence based theory of syntactic closure" in Bresnan, J.W. (ed) "The mental representation of grammatical relations" MIT Press, Cambridge MA.

FOSS, D.J. 1970 "Some effects of ambiguity upon sentence comprehension" Journal of Verbal Learning and Verbal Behavior 9:699-706

* FOSS, D.J., BEVER, T.G. & SILVER, M. 1968 "The comprehension & verification of ambiguous sentences" Perception & Psychophysics 4:304-6

* FOSS, D.J. & JENKINS, C.M. 1973 "Some effects of context on the comprehension of ambiguous sentences" Journal of Verbal Learning & Verbal Behavior 12:577-89

FREUD, S. 1891 "On aphasia" (excerpt) in Paradis, M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada, p.24

FROMKIN, V., KRASHEN, S.D., CURTISS, S., RIGLER, D. & RIGLER, M. 1974 "The development of language in Genie: a case of language acquisition beyond the 'critical period'" Brain & Language 1:81-108, reprinted in Clark, V.P., Eschholz, P.A. & Rosa, A.F. "Language" St. Martin's Press (4th Edition), p.112-133

G

GAINOTTI, G., CALTAGIRONE, C. & MICELI, G. 1983 "Selective impairment of semantic-lexical discrimination of right-brain-damaged patients" in Perecman, E. (ed) "Cognitive processing in the right hemisphere" Academic Press, p.149-67

GALLOWAY, L.M. 1978 "Language impairment & recovery in polyglot aphasia: a case study of a heptalingual" in Paradis, M. (ed) "Aspects of bilin-

gualism" Hornbeam Press, Columbia,S.C.

GALLOWAY,L.M. 1981 "Contributions of the right cerebral hemisphere to language and communication: issues in cerebral dominance with special emphasis on bilingualism, second language acquisition, sex differences and certain ethnic groups" D.Phil Thesis, U.C.L.A.

GALLOWAY,L.M. & KRASHEN,S.D. 1980 "Cerebral organization in bilingualism and second language" in Scarcella,R.C. & Krashen,S.D. (eds) "Research in second language acquisition" Selected papers of the Los Angeles 2nd Language Acquisition Research Forum" Newbury Ho., Rowley,M.A. p.74-79

* GALLOWAY,L.M. & SCARCELLA,R. 1982 "Cerebral organization in bilingualism and second language acquisition: is the right hemisphere more involved?" Brain & Language 16:56-60

* GANS,A. 1914 "Über einen im Anfang des 18.Jahrhunderts von Dr.Peter Rommel klassisch beschriebenen Fall von transcorticaler motorischer Aphasie" Zeitschrift ges. Neurol. u. Psychiat. 24:480-2

GARDNER,H., BROWNELL,H., WAPNER,W. & MICHELOW,D. 1983 "Missing the point: the rôle of the right hemisphere in the processing of complex linguistic materials" in Perecman,E. (ed) "Cognitive processing in the right hemisphere" Academic Press, New York p.169-191

GARNHAM,A. 1985 "Psycholinguistics: central topics" Methuen, London

GARRON,D.C. 1970 "Sex-linked, recessive inheritance of spatial and numerical abilities, and Turner's Syndrome" Psychological Review 77 (2): 147-152

GAZIEL,T., OBLER,L.K. & ALBERT,M.L. 1978 "A tachistoscopic study of Hebrew-English bilinguals" in Albert,M.L. & Obler,L.K. "The bilingual brain" Academic Press, p.167-193

GAZZANIGA,M.S. 1967 "The split brain in man" Scientific American 217 (2)(August):24-9

GAZZANIGA,M.S. 1977 "Consistency & diversity in brain organization" Annals of the New York Academy of Sciences 299:415-23

GAZZANIGA,M.S. & HILLYARD,S.A. 1971 "Language & speech capacity of the right hemisphere" Neuropsychologia 9:273-280

GEFFNER,D.S. & HOCHBERG,I. 1971 "Ear laterality performance of children from low & middle socioeconomic levels on a verbal dichotic listening task" Cortex 7:193-203

GENESEEE,F. 1982 "Experimental neuropsychological research on second language processing" TESOL Quarterly 16 (3):315-22

GENESEEE,F. HAMERS,J., LAMBERT,W.E., MONONEN,L., SEITZ,M. & STARCK,R. 1978 "Language processing in bilinguals" Brain & Language 5:1-12

* GESCHWIND,N. 1965 "Disconnection syndromes in animals and man: Parts I & II" Brain 88:237-294 & 585-646

GESCHWIND,N. 1974 "The anatomical basis of hemispheric differentiation" in Dimond,S.J. & Beaumont,J.G. 1974 "Hemisphere function in the human brain" Wiley Halsted Press, New York, p.7-24

GESCHWIND,N. 1979 "Specializations of the human brain" Scientific American Sept.1979:158-167

GESCHWIND,N. 1983 "Biological Associations of left-handedness" Annals of Dyslexia 33:29-40

GESCHWIND,N. 1985 "Mystery of the left hand" BBCTV "Horizon", BBC2 Monday 4th February (see also Bestic 1985)

GESCHWIND,N. & LEVITSKY,W. 1968 "Human brain: left-right asymmetries in temporal speech region" Science 161(12th July):186-7

GIBBS,R.W. 1986 "Skating on thin ice: literal meaning and understanding idioms in conversation" Discourse Processes 9:17-30

* GILBERT,J.H.V. & CLIMAN,I. 1974 "Dichotic studies in 20 three year olds: a preliminary report" Paper presented at the Speech Communications Seminar, Stockholm

GLONING,I. & GLONING,K. 1965 "Aphasia in polyglots: contribution to the dynamics of language disintegration as well as to the question of localization of these impairments" in Paradis,M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada, p.710-6

GOLDSTEIN,K.1933 "The analysis of aphasia & the essence of language" (excerpt) in Paradis,M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada, p.350

* GORDON,H.W. 1973 "Verbal & nonverbal cerebral processing in man for audition" Doctoral dissertation, California Institute of Technology

GORDON,H.W. 1980 "Cerebral organization in bilinguals" Brain & Language 9:255-68

* GRACE,G.W. 1978-9 "Ethnolinguistic notes" New Series. Mimeographed. University of Hawaii

GREENFIELD,P.M. & SMITH,J.H. 1976 "The structure of communication in early language development" Academic Press, New York

GUR,R.C., PACKER,I.K., HUNGERBUHLER,J.P., AMARNEK,W., OBRIST,W. & REIVICH,M. 1979 "Hemispheric differences in gray & white matter distribution in man: a neurophysiological basis of functional asymmetry" Acta Neurologica Scandinavica Supplement 72, vol 60:24-5

GUR,R.C., PACKER,I.K., REIVICH,M., HUNGERBUHLER,J.P., GOLDBERG,H & OB-

RIST,W. 1979 "Regional cerebral blood flow and cognitive activity" Acta Neurologica Scandinavica Supplement 72, vol 60:4-5

GUR,R.E., GUR,R.C. & HARRIS,L.J. 1975 "Cerebral activation, as measured by subjects' lateral eye movements, is influenced by experimenter location" Neuropsychologia 13:35-44

GURNEY,R. 1973 "Language, brain & interactive processes" Edward Arnold

GUYTON,A.C. 1981 "Basic human neurophysiology" Saunders (3rd Edition)

H

HAGGARD,M.P. & PARKINSON,A.M. 1971 "Stimulus & task factors as determinants of ear advantages" Quarterly Journal of Experimental Psychology 23:168-177

* HALPERN,L. 1949 "Hebrew in recovery from sensory aphasia in polyglots" in Paradis,M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada

HAMERS,J.F. & LAMBERT,W.A. 1977 "Visual field and cerebral hemisphere preferences in bilinguals" in Segalowitz,S.J. & Gruber,F.A. (eds) "Language development & neurological theory" Academic Press, p.57-62

* HANCOCK,P.A. & DIRKIN,G.R. 1982 "Central & peripheral visual choice-reaction time under conditions of induced cortical hyperthermia" Perceptual & Motor Skills 54:395-402

HARCUM,E.R. 1978 "Lateral dominance as a determinant of temporal order of responding" in Kinsbourne,M. "Asymmetrical function of the brain" C.U.P., p.141-266

* HARCUM,E.R. & FINKEL,M.E. 1963 "Explanation of Miskin & Forgays' results as a directional-reading conflict" Canadian Journal of Psychology 17:224-34

* HARCUM,E.R. & JONES,M.L. 1962 "Letter recognition within words flashed left & right of fixation" Science 138:444-445

* HARDYCK,C. 1980 "Hemispheric differences and language ability" Paper presented at the Symposium on Neurolinguistics & Bilingualism: The question of individual differences, Albuquerque, New Mexico

* HARDYCK,C., TZENG,O. & WANG,W. 1978 "Cerebral lateralization of function & bilingual decision processes: is thinking lateralized?" Brain & Language 5:56-71

HARRIS,L.J. 1978 "Sex differences in spatial ability: possible environmental, genetic and neurological factors" in Kinsbourne,M. (ed) "Asymmetrical function of the brain" C.U.P. p.405-522

HARSHMAN,R. & KRASHEN,S.D. 1972 "'Unbiased' procedure for comparing degree of lateralization of dichotically presented stimuli" Journal of

the Acoustical Society of America 52:174. Abstract no.LL2

* HARSHMAN,R.A. & REMINGTON,R. 1975 "Sex, language & the brain 2: Adult sex differences in lateralisation" Mimeographed

* HARTNETT,D. 1974 "The relation of cognitive style & hemispheric preference to deductive & inductive second language learning" Masters thesis, University of California, L.A.

* HARTNETT,D. 1976 "The relation of cognitive style and hemispheric preference to deductive and inductive second language learning" Conference on cerebral dominance (Brain Information Service Report no.42) Los Angeles, University of California Press,41

HARWOOD,A.C. 1940 "The way of a child" Anthroposophical Publishing Co., London

* HATTA,T. 1978 "Recognition of Japanese kanji & hirakana in the left & right visual fields" Japanese Psychological Research 20:51-59

HAYDON,S.P. & SPELLACY,F.J. 1974 "Monaural reaction time asymmetries for speech & non-speech sounds" Cortex 9:288-94

HÉCAEN,H. 1976 "Acquired aphasia & the ontogenesis of hemispheric functional specialization" Brain & Language 3:114-34

HÉCAEN,H. & ALBERT,M.L. 1978 "Human neuropsychology" Wiley

HÉCAEN,H. & MARCIE,P. 1974 "Disorders of written language following right hemisphere lesions: spatial dysgraphia" in Dimond,S.J. & Beaumont,J.G. (eds) "Hemisphere function in the human brain" Wiley Halsted Press, N.Y., p.345-366

HENY,J. 1985 "Brain & language" in Clark,V.P., Eschholz,P.A. & Rosa, A.F. (eds) "Language" St. Martin's Press, N.Y. (4th Edition)

* HICKS,R.E. 1973 "Rôle of cerebral hemispheric lateralization of function in concurrent verbal & unimanual performance" Unpublished PhD Dissertation, University of Texas at Austin

* HICKS,R.E. 1975 "Intrahemispheric response competition between vocal & unimanual performance in normal adult human males" Journal of Comparative & Physiological Psychology 89:50-60

* HICKS,R.E., BRADSHAW,G.J., KINSBOURNE,M. & GFEIGIN,D.S. 1977 "Vocal-manual trade-offs in hemispheric sharing of performance control in normal adult humans" Journal of Motor Behaviour 10 (1):1-6

* HICKS,R.E., PROVENZANO,F.J. & RYBSTEIN,E.D. 1975 "Generalized & lateralized effects of concurrent verbal rehearsal upon performance of sequential movements of the fingers by the left & right hands" Acta Psychologica 39:119-130

* HILLIER,W.F. 1954 "Total left hemispherectomy for malignant glioma"

Neurology 4:718-21

* HIRATA, K. & OSAKA, R. 1967 "Tachistoscopic recognition of Japanese letter materials in left & right visual fields" Psychologia 10:7-18

HOGABOAM, T.W. & PERFETTI, C.A. 1975 "Lexical ambiguity & sentence comprehension" Journal of Verbal Learning & Verbal Behavior 14:265-74

HOLMES, V.M. 1979 "Assessing ambiguous words during sentence comprehension" Quarterly Journal of Experimental Psychology 31:569-89

* HOLT, W.R. & BRAINARD, E.C. 1976 "Selective hyperthermia & reaction time" Perceptual & Motor Skills 43:375-82

HUGHLINGS-JACKSON, J. 1866 'Notes on the physiology & pathology of language' in Taylor, J. 1958 "Selected Writings of John Hughlings Jackson Vol 2" Staples Press, London, p.121-128

HUGHLINGS-JACKSON, J. 1874 "On the nature of the duality of the brain" in Taylor, J. 1958 "Selected Writings of John Hughlings Jackson Vol 2" Staples Press, London, p.129-145

* HYND, G.W. & SCOTT, G.A. 1980 "Propositional & appositional modes of thought & differential cerebral speech lateralization in Navajo Indian & Anglo children" Child Development 51:909-11

HYND, G.W., TEETER, A. & STEWART, J. 1980 "Acculturation & the lateralization of speech in the bilingual native American" International Journal of Neuroscience 11:1-7

I

INGLIS, J. & SYKES, D.H. 1967 "Some sources of variation in dichotic listening performance in children" Journal of Experimental Child Psychology 55:480-488

ISARD, S. 1975 "Changing the context" in Keenan, E.L. (ed) "Formal semantics of natural language" C.U.P., Cambridge, p.287-96

J

* JAFFE, J. 1976 "Parliamentary procedure & the brain" in Seigman, A.W. & Feldstein, S. (eds) "Nonverbal behavior & communication" Lawrence Erlbaum, Hillsdale, N.J.

* JESPERSEN, O. 1965 "The philosophy of grammar" Norton, N.Y. (first published 1925)

K

KANTOWITZ, B.H. & KNIGHT, J.L. 1974 "Testing tapping time-sharing" Journal of Experimental Psychology 130 (2):331-6

* KIMURA, D. 1961 "Cerebral dominance & the perception of verbal stimu-

li" Canadian Journal of Psychology 15:166-71

KIMURA, D. 1963 "Speech lateralization in young children as determined by an auditory test" Journal of Comparative & Physiological Psychology 56:899-902

KIMURA, D. 1964 "Left-right differences in the perception of melodies" Quarterly Journal of Experimental Psychology 16:355-8

KIMURA, D. 1966 "Dual functional asymmetry in the brain in visual perception" Neuropsychologia 4:275-85

KIMURA, D. 1967 "Functional asymmetry of the brain in dichotic listening" Cortex 3:163-78

* KIMURA, D. 1969 "Spatial localization in left & right visual fields" Canadian Journal of Psychology 23:445-58

* KIMURA, D. 1970 Talk given to the International Neuropsychological Symposium, Cambridge

KIMURA, D. & DURNFORD, M. 1974 "Normal studies on the function of the right hemisphere in vision" in Dimond, S.J. & Beaumont, J.G. "Hemisphere function in the human brain" Wiley Halsted Press, N.Y. p.25-47

* KIMURA, D. & FOLB, S. 1968 "Neural processing of backwards speech sounds" Science 161:395-6

* KINSBOURNE, M. 1970 "Cerebral basis of asymmetries in attention" Acta Psychologica 33:193-201

* KINSBOURNE, M. 1971 "The minor cerebral hemisphere as a source of aphasic speech" Archives of Neurology 25:302-6

KINSBOURNE, M. 1972 "Eye & head turning indicates cerebral lateralization" Science 176:539-41

KINSBOURNE, M. 1978 "Evolution of language in relation to lateral action" in Kinsbourne, M. (ed) "Asymmetrical function of the brain" C.U.P. p.553-565

KINSBOURNE, M. & COOK, J. 1971 "Generalized & lateralized effects of concurrent verbalization on a unimanual skill" Quarterly Journal of Experimental Psychology 23:341-5

KINSBOURNE, M. & HICKS, R.E. 1978 "Mapping cerebral functional space: competition & collaboration in human performance" in Kinsbourne, M. (ed) "Asymmetrical function of the brain" C.U.P. p.267-73

KINSBOURNE, M. & HISCOCK, M. 1977 "Does cerebral dominance develop?" in Segalowitz, S.J. & Gruber, F. (eds) "Language development & neurological theory" Academic Press, N.Y. p.171-91

KINSBOURNE, M. & McMURRAY, J. 1975 "The effects of cerebral dominance on

time sharing between speaking & tapping by preschool children" Child Development 46:240-2

KINTSCH,W. & VAN DIJK,T.A. 1978 "Toward a model of text comprehension and production" Psychological Review 85 (5):363-394

KNOX,C. & KIMURA,D. 1970 "Cerebral processing of non-verbal sounds in boys & girls" Neuropsychologia 8:227-37

* KOTIK,B.S. 1975 "Investigation of speech lateralization in multilinguals" Unpublished PhD Thesis, Moscow State University

* KOTIK,B.S. 1981 "An evoked potential study of Polish-Russian bilinguals" Unpublished manuscript, Rostov State University

KOTIK,B.S. 1984 "On the rôle of the right cerebral hemisphere in the speech of bilinguals" in Ardila,A. & Ostrosky-Solis,F.(eds) "The right hemisphere: Neurology & neuropsychology" Gordon & Breach, p.227-40

KRASHEN,S.D. 1974 "Lateralization, language learning & the critical period: some new evidence" Language Learning 23 (1):63-74

KRASHEN,S.D. 1976 "Formal & informal linguistic environments in language acquisition & language learning" TESOL Quarterly 10 (2):157-68

KRASHEN,S.D. 1978 "Individual variation in the use of the Monitor" in Ritchie,W.C. "Second language acquisition research" Academic Press, p.175-183

* KRASHEN,S.D. & GALLOWAY,L.M. 1978 "The neurological correlates of language acquisition" Paper presented at the 6th Annual Conference of La Société pour la Promotion de l'Enseignement de l'Anglais, Langue Second, au Quebec, Quebec City, June 1978

KRASHEN,S.D. & HARSHMAN,R. 1972 "Lateralization and the critical period" Journal of the Acoustical Society of America 52:174 Abstract no.LL3

KRASHEN,S.D. & TERRELL,T. 1983 "The natural approach" Pergamon/Alemany

* KREUTER,C., KINSBOURNE,M. & TREVARTHEN,C. 1972 "Are disconnected hemispheres independent channels? A preliminary study of the effect of unilateral loading on bilateral finger-tapping" Neuropsychologia 10:453-61

L

LACKNER,J.R. & GARRETT,M.F. 1972 "Resolving ambiguity: effects of biasing context in the unattended ear" Cognition 1 (4):359-72

LAKE,D.A. & BRYDEN,M.P. 1976 "Handedness & sex differences in hemispheric asymmetry" Brain & Language 8:266-82

* LAMBERT,W.E. 1961 "Behavioral evidence for contrasting forms of bilingualism" in Zarechnak,M. (ed) "Report of the Twelfth Annual Round Table Meeting on Linguistics & Language Studies" Monograph Series on

Languages & Linguistics, Georgetown University, no.14 (Washington D.C.)

* LAMBERT, W.E. 1966 "Psychological studies of the interdependence of the bilingual's two languages" Paper presented to the Linguistic Institute of the Linguistic Society of America. Mimeographed, p.14

LAMBERT, W.E. 1969 "Psychological studies of the interdependence of the bilingual's two languages" in Puhvel, J. (ed) "Substance & structure of language" University of California Press, Berkeley & Los Angeles, p.99-126; reprinted in Lambert, W.E. 1972 "Language, Psychology & Culture" Stanford University Press, p.300-330

* LAMBERT, W.E. & FILLENBAUM, S. 1959 "A pilot study of aphasia among bilinguals" (abstract) in Paradis, M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada, p.626

LAMBERT, W.E. & RAWLINGS, C. 1969 "Bilingual processing of mixed-language associative networks" Journal of Verbal Learning & Verbal Behavior 8: 604-9

* LAMENDELLA, J.T. 1977 "General principles of neurofunctional organization in primary & nonprimary language acquisition" Language Learning 27:155-95

LARSEN, B., SKINHØJ, E. & LASSEN, N.A. 1978 "Variations in regional cortical blood flow in the right and left hemispheres during automatic speech" Brain 101:193-209

LARSEN, B., SKINHØJ, E. & LASSEN, N.A. 1979 "Cortical activity of left and right hemisphere provoked by reading and visual naming. A rCBF study" Acta Neurologica Scandinavica Supplement 72, 60:6-7

LASSEN, N.A., INGVAR, D.H. & SKINHØJ, E. 1978 "Brain function & blood flow" Scientific American 239 (4) Oct.:50-59

LEBRUN, Y. & PARADIS, M. 1984a "To be or not to be an early bilingual" in Paradis, M. & Lebrun, Y. (eds) "Early bilingualism & child development" Neurolinguistics 13, Swets & Zeitlinger BV, Lisse, p.9-18

LEBRUN, Y. & PARADIS, M. 1984b "Yes, but..." in Paradis, M. & Lebrun, Y. (eds) "Early bilingualism & child development" Neurolinguistics 13, Swets & Zeitlinger BV, Lisse, p.213-7

LEHMANN, W.P. 1971 "On the rise of SOV patterns in New High German" in "Grammatik, Kybernetik und Kommunikation" Festschrift for A. Hoppe, p.19-24

* LEISCHNER, A. 1948 "Über die Aphasie der Mehrsprachigen" Archiv für Psychiatrie Und Nervenkrankheiten 180:731-775

LENNEBERG, E. 1967. "Biological foundations of language" Wiley & Son, New York

LENNEBERG, E. 1974 "Language & brain: developmental aspects" Neuroscien-

- LESSER, R. 1978 "Linguistic investigations of aphasia" Edward Arnold, London
- LEVINE, S.C. & BANICH, M.T. 1982 "Lateral asymmetries in the naming of words and corresponding line drawings" Brain & Language 17:34-45
- LEVINSON, S.C. 1983 "Pragmatics" C.U.P., Cambridge
- LEVY, J. 1969 "Possible basis for the evolution of lateral specialization of the human brain" Nature 224 (Nov.8th):614-5
- LEVY, J. 1974 "Psychobiological implications of bilateral asymmetry" in Dimond, S.J. & Beaumont, J.G. "Hemisphere function in the human brain" Wiley Halsted Press, N.Y. p.121-83
- * LEVY, J. & TREVARTHEN, C. 1977 "Perceptual, semantic & phonetic aspects of elementary language processes in split brain patients" Brain 100: 105-118
- * LEVY, J., TREVARTHEN, C. & SPERRY, R.W. 1972 "Perception of bilateral chimeric figures following hemispheric deconnection" Brain 95:61-78
- L'HERMITTE, R., H CAEN, H., DUBOIS, J. CULIOLI, A & TABOURET-KELLER, A. 1966 "The problem of polyglot aphasia: comments & a few observations" in Paradis, M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada, p.727-43
- * LIBERMAN, A.M., COOPER, F.S., SHANKWEILER, D. & STUDDERT-KENNEDY, M. 1967 "Perception of the speech code" Psychological Review 74:431-461
- * LING, A.H. 1971 "Dichotic listening in hearing-impaired children" Journal of Speech & Hearing Research 14:793-803
- LIPSKY, J.M. 1978 "Code-switching & the problem of bilingual competence" in Paradis, M. (ed) "Aspects of bilingualism" Hornbeam Press, Columbia SC, p.250-64
- * LOEWE, R. 1888 "Die Dialektmischung im magdeburgischen Gebiete" Jahrbuch des Vereins für niederdeutsche Sprachforschung XIV:14-52
- LOTT, B. 1981 "Dysarthria - a case study" Journal of the International Phonetic Association 9 (1):31-8
- * LOUNSBURY, F.G. 1963 "Linguistics & Psychology" in S.Koch (ed) "Psychology: study of a science" McGraw-Hill, N.Y.
- * LURIA, A.R. 1970 "Traumatic aphasia" Mouton, The Hague
- LURIA, A.R. 1974 "Language & Brain: towards the basic problems of neuro-linguistics" Brain & Language 1:1-14
- LURIA, A.R. & TSVETKOVA, L.S. 1970 "The mechanism of 'dynamic aphasia'"

in Bierwisch, M. & Heidolph, K.E. (eds) "Progress in linguistics - a collection of papers" Mouton, The Hague, p.187-97

* LYONS, J. 1968 "Introduction to theoretical linguistics" C.U.P.

LYONS, J. 1977 "Semantics" C.U.P.

LYONS, J. 1982 "Deixis & Subjectivity: Loquor ergo sum?" in Jarvella, R.J. & Klein, W. (eds) "Speech, place & action" Wiley, p.101-124

M

McALISTER, J.M. 1979 "Radionuclide techniques in medicine" in "Techniques of measurement in medicine 3" C.U.P., Chapter 7, p.85ff

McCawley, J.D. 1970 "English as a VSO language" Language 46 (2):286-99

* McFIE, J.J. 1961 "Intellectual impairment in children with localized post-infantile cerebral lesions" Journal of Neurology, Neurosurgery & Psychiatry 24:361-5

McGLONE, J. & DAVIDSON, W. 1973 "The relation between cerebral speech laterality & spatial ability with special reference to sex & hand preference" Neuropsychologia 11:105-113

McGLONE, J. & KERTESZ, A. 1973 "Sex differences in cerebral processing of visuospatial tasks" Cortex 9:313-20

* MacKAY, D.G. 1966 "To end ambiguous sentences" Perception & Psychophysics 1:426-36

MacKAY, D.G. 1973 "Aspects of the theory of comprehension, memory and attention" Quarterly Journal of Experimental Psychology 25:40

McKEEVER, W.F., HOEMANN, H.W., FLORIAN, V. & VAN DEVENTER, A.D. 1976 "Evidence of minimal cerebral asymmetries from the processing of English words and American Sign Language in the congenitally deaf" Neuropsychologia 14:413-24

McLAUGHLIN, B. 1984 "Early bilingualism: methodological & theoretical issues" in Paradis, M. & Lebrun, Y. (eds) "Early bilingualism & child development" Neurolinguistics 13, Swets & Zeitlinger BV.:Lisse, p.19-45

* MAITRE, S. 1974 "On the representation of second language in the brain" Unpublished MA Thesis, U.C.L.A.

MARCEL, T. 1980 "Surface dyslexia & beginning reading: a revised hypothesis of the pronunciation of print & its impairments" in Coltheart, M., Patterson, K. & Marshall, J.C. (eds) "Deep dyslexia" Routledge & Kegan Paul, London

MARIE, P. 1922 "Existe-t-il chez l'homme des centres préformés ou innés du langage?" in "Questions Neurologiques d'Actualité" Massion et Cie, Paris, p.527-51

- MARSLEN-WILSON, W.D. 1973 "Linguistic structures & speech shadowing at very short latencies" Nature 244:522-3
- MARSLEN-WILSON, W.D. 1975 "Sentence perception as an interactive parallel process" Science 189:226-7
- * MARSLEN-WILSON, W.D. & TYLER, L.K. 1980 "The temporal structure of spoken language understanding" Cognition 8:1-71
- * MARSLEN-WILSON, W.D. & WELSH, A. 1978 "Processing interactions & lexical access during word-recognition in continuous speech" Cognitive Psychology 10:29-63
- MARSH, G.R. 1978 "Asymmetry of electrophysiological phenomena and its relation to behavior in humans" in Kinsbourne, M. (ed) "Asymmetrical function of the brain" C.U.P., p.292-317
- MARSHALL, J.C. 1981 "Hemispheric specialization: What, how and why" The Behavioural & Brain Sciences 4 (1):72-3
- MARSHALL, J.C. & NEWCOMBE, F. 1966 "Syntactic and semantic errors in paralexia" Neuropsychologia 4:169-76
- MARSHALL, J.C. & NEWCOMBE, F. 1981 "Lexical access: a perspective from pathology" Cognition 10:209-14
- MARSHALL, J.C. & PATTERSON, K.E. 1983 "Semantic paralexia & the wrong hemisphere: a note on Landis, Regard, Graves & Goodglass (1983)" Neuropsychologia 21 (4):425-7
- MEHLER, J., SEGUI, J. & CAREY, P. 1978 "Tails of words: monitoring ambiguity" Journal of Verbal Learning and Verbal Behavior 17:29-35
- * MILLAR, J.M. & WHITAKER, H.A. 1983 "The right hemisphere's contribution to language: a review of the evidence from brain-damaged subjects" in Segalowitz, S.J. (ed) "Language functions & brain organization" Academic Press, London
- MILLER, G. 1956 "The magical number seven, plus or minus two: some limits on our capacity for processing information" Psychological Review 63:81-97
- * MILNER, B. 1973 "Human brain function" Press conference, APA, Montreal, Aug. 26th 1973
- * MINKOWSKY, M. 1928 "Sur un cas d'aphasie chez un polyglotte" Revue Neurologique 35:361-6
- * MINKOWSKY, M. 1963 "On aphasia in polyglots" in Halpern, L. (ed) "Problems of dynamic neurology" Jerusalem Post Press, Jerusalem, p.119-61
- * MISHKIN, M. & FORGAYS, D.G. 1952 "Word recognition as a function of retinal focus" Journal of Experimental Psychology 43:43-58

* MISTLER-LACHMANN, J.L. 1972 "Levels of comprehension in processing of normal & ambiguous sentences" Journal of Verbal Learning & Verbal Behavior 11:614-23

MITCHELL, D.C. & HOLMES, V.M. 1985 "The rôle of specific information about the verb in parsing sentences with local structural ambiguity" Journal of Memory and Language 24:542-559

MOLFESE, D.L. 1977 "The ontogeny of cerebral asymmetry in man: Auditory Evoked Potentials to linguistic & non-linguistic stimuli in infants & children" in Desmedt, J. (ed) "Language & hemispheric specialization in man: cerebral ERPs" Progress in Clinical Neurophysiology, vol.3 Karger, Basel, p.188-204

* MORGAN, A.H., McDONALD, P.J. & MacDONALD, H. 1971 "Differences in bilateral alpha activity as a function of experimental task, with a note on lateral eye movements and hypnotizability" Neuropsychologia 9:459-69

MOSCOVITCH, M. 1977 "The development of lateralization of language functions & its relation to cognitive & linguistic development: a review & some theoretical speculations" in Segalowitz, S.J. & Gruber, F. "Language development & neurological theory" Academic Press, N.Y.

MOSCOVITCH, M. 1983 "The linguistic & emotional functions of the normal right hemisphere" in Perecman, E. (ed) "Cognitive processing in the right hemisphere" Academic Press, p.57-82

MOSCOVITCH, M & OLDS, J. 1982 "Asymmetries in spontaneous facial expressions & their possible relation to hemispheric specialization" Neuropsychologia 20 (1):71-81

MOSKOWITZ, B.A. 1985 "The acquisition of language" in Clark, V.P., Eschholz, P.A. & Rosa, A.F. "Language" St. Martin's Press, N.Y. (4th Edition)

* MURPHY, E.H. & VENABLES, P.H. 1970 "Ear asymmetry in the threshold of fusion of two clicks: a signal detection analysis" Quarterly Journal of Experimental Psychology 21:288-300

N

NAIR, K.R. & VIRMANI, V. 1973 "Speech & language disturbances in hemiplegics" Indian Journal of Medical Research 61:1395-1403

NEBES, R.D. 1978 "Direct examination of cognitive function in the right & left hemispheres" in Kinsbourne, M. (ed) "Asymmetrical function of the brain" C.U.P., p.99-137

* NEELY, J.H. 1977 "Semantic priming & retrieval from lexical memory: rôles of inhibitionless spreading activation & limited-capacity attention" Journal of Experimental Psychology: General 106:226-254

NETLEY, C. 1977 "Dichotic listening of Callosal Agenesis & Turner's Syndrome patients" in Segalowitz, S.J. & Gruber, F. "Language development &

neurological theory" Academic Press. N.Y., p.133-43

NEVILLE, H. 1977 "Electro-encephalographic testing of cerebral specialization in normal & congenitally deaf children: a preliminary report" in Segalowitz, S.J. & Gruber, F. "Language development & neurological theory" Academic Press. N.Y.

NEWCOMBE, F. & MARSHALL, J., C. 1981 "On psycholinguistic classification of the acquired dyslexias" Bulletin of the Orton Society 31:29-46

* NGUY, T.V.H., ALLARD, F.A. & BRYDEN, M.P. 1980 "Laterality effects for Chinese characters: differences between pictorial & nonpictorial characters" Manuscript, University of Waterloo

O

* OBLER, L.K. 1977 "Right hemisphere participation in second language acquisition" Paper presented at the Conference of Individual Differences & Universals in Language Learning Aptitude, Durham, New Hampshire

OBLER, L.K. 1984 "The neuropsychology of bilingualism" in Caplan, D., Lecours, A.R. & Smith, A. (eds) "Biological perspectives on language" MIT Press, Cambridge, MA., p.194-210

* OBLER, L.K., ALBERT, M. & GORDON, H. 1975 "Asymmetry of cerebral dominance in Hebrew-English bilinguals" Paper presented at the 13th Annual Meeting of the Academy of Aphasia, Victoria, British Columbia

* ODEN, G.C. & SPIRA, J.L. 1978 "Influence of context on the activation & selection of ambiguous word senses" Wisconsin Human Information Processing Program No.6, Aug. 1978

OLDFIELD, R.C. 1971 "The assessment & analysis of handedness: The Edinburgh Inventory" Neuropsychologia 9:97-113

O'LEARY, D.S. 1982 "Cerebral specialization and cognitive mode: a developmental perspective" in St.Clair, R.N. & Von Raffler-Engel, W. (eds) "Language & cognitive styles" Neurolinguistics no.11, Swets & Zeitlinger BV., Lisse, p.51-73

* OUNSTED, C. & TAYLOR, D.C. 1972 "The Y chromosome message: a point of view" in Ounsted, C. & Taylor, D.C. (eds) "Gender differences: their ontogeny & significance" Churchill Livingstone, London

OYAMA, S. 1978 "The sensitive period & comprehension of speech" Working Papers on Bilingualism 1:35-65

P

PAPÇUN, G., KRASHEN, S.D., TERBEEK, D., REMINGTON, R. & HARSHMAN, R. 1974 "Is the left hemisphere specialized for speech, language and/or something else?" Journal of the Acoustical Society of America 55 (2):319-27

- PARADIS, M. 1978 "The stratification of bilingualism" in Paradis, M. (ed) "Aspects of bilingualism" Hornbeam Press, Columbia SC., p.165-75
- * PARADIS, M., GOLDBLUM, M.C. & ABIDI, R. 1982 "Alternate antagonism with paradoxical translation behavior in two bilingual aphasic patients" Brain & Language 15:55-69
- PATTERSON, K. 1978 "Phonemic dyslexia: errors of meaning and the meaning of errors" Quarterly Journal of Experimental Psychology 30:587-606
- PATTERSON, K. 1979 "What is right with 'deep' dyslexic patients?" Brain & Language 8:111-29
- PATTERSON, K. & MARCEL, A.J. 1977 "Aphasia, dyslexia & the phonological coding of written words" Quarterly Journal of Experimental Psychology 29:307-18
- PAWLEY, A. & SYDER, F.H. 1980 "Two puzzles for linguistic theory: native-like selection and native-like fluency" in Richards, J.C. & Schmidt, R. (eds) "Communicative competence" Longman, London, p.191-227
- * PENFIELD, W. & RASMUSSEN, T. 1949 "Vocalization & arrest of speech" Archives of Neurology & Psychiatry 61:21-7
- PENFIELD, W. & ROBERTS, L. 1959 "Speech & brain mechanisms" O.U.P., London
- PERECMAN, E. (ed) 1983 "Cognitive Processing in the Right Hemisphere" Academic Press
- PERERA, K. 1986 "Language acquisition & writing" in Fletcher, P. & Garman, M. (eds) "Language acquisition" C.U.P., Cambridge, p.494-518
- * PIAGET, J. 1962a "The stages of intellectual development" Bulletin of the Meuniger Clinic 26:120-8
- * PIAGET, J. 1962b "Play, dreams & imitation" Norton, New York
- * PIAGET, J. 1964 "Judgement & reasoning in the child" Littlefield, Adams & Co., Paterson, NJ.
- * PIAGET, J. 1972 "The origins of intelligence in children" Norton, New York
- * PIAZZA, D.M. & ZATORRE, R.J. 1981 "A right ear advantage for dichotic listening in bilingual children" Brain & Language 13 (2):389-96
- PICK, A. 1921 "Concerning the explanation of certain exceptions to the so-called rule of Ribot" in Paradis, M. (ed) 1983 "Readings in aphasia in bilinguals & polyglots" Didier, Canada p.156-68
- PITRES, A. 1895 "Aphasia in polyglots" in Paradis, M. (ed) 1983 "Readings in aphasia in bilinguals & polyglots" Didier, Canada p.26-49
- PIZZAMIGLIO, L. & CECCHINI, M. 1971 "Development of the hemispheric domi-

nance in children from 5 to 10 years of age & their relations with the development of cognitive processes" Brain Research 31:363 (abstract)

POETZL, O. 1925 "On aphasia of parallel origin & its influence on the speaking of several languages" in Paradis, M. (ed) 1983 "Readings in aphasia in bilinguals & polyglots" Didier, Canada p.176-98

POPPER, K.R. & ECCLES, J.C. 1977 "The self & its brain" Springer International

* PORTER, R.J. & BERLIN, C.I. 1975 "On interpreting developmental changes in the dichotic right ear advantage" Brain & Language 2:186-200

PULLUM, G.K. 1974 "A note on co-ordination reduction and word order in Hindi" Working Papers on Language University of Stanford

PUMFREY, P.D. 1976 "Reading: tests and assessment techniques" Hodder & Stoughton

PUMFREY, P.D. 1977 "Measuring reading abilities: concepts, sources and applications" Hodder & Stoughton

PURTILL, R.L. 1972 "Logical thinking" Harper & Row

R

RADFORD, A. 1981 "Transformational syntax" C.U.P.

* RAMÍREZ, M & CASTAÑEDA, A. 1974 "Cultural democracy, bicognitive development & education" Academic Press, N.Y.

* RASMUSSEN, K. & MILNER, B. 1975 "Clinical & surgical studies of the cerebral speech areas in man" in Zulch, K., Creutzfeldt, O. & Galbraith, G. (eds) "Otfrid Foerster Symposium on cerebral localization" Springer, Heidelberg

REIVICH, M. GREENBERG, J., ALVAVI, A., CHRISTMAN, D., FOWLER, J., HAND, P., ROSENQUIST, A., RINTELMANN, W. & WOLF, A. 1979 "The use of the 18-F-Fluorodeoxyglucose technique for the mapping of functional neural pathways in man" Acta Neurologica Scandinavica Supplement 72 60:198-9

RICHARDSON, J.T.E. 1975 "The effect of word imageability in acquired dyslexia" Neuropsychologia 13:281-88

* RIESBECK, C.K. & SCHANK, R.C. 1978 "Comprehension by computer: expectation-based analysis of sentences in context" in Levelt, W.J.M. & Flores D'Arcais, G.B. (eds) "Studies in the perception of language" Wiley, Chichester

* ROBERTS, M.H. 1939 "The problem of the hybrid language" Journal of English & Germanic Philology 38:23-41

ROEMER, R.A. & TEYLER, T.J. 1977 "Auditory evoked potential asymmetries related to word meanings" in Desmedt, J.E. (ed) "Language and hemispher-

ic specialization in man: cerebral ERPs" Progress in Clinical Neuropsychology no.3 Karger, Basel p.48-59

* RÖSSIG,H. 1975 "Zur sprachlichen Leistung der rechten (nicht-dominanten) Hemisphäre" Zeitschrift für Dialektologie und Linguistik 13: 172-197

* ROGERS,L., TEN HOUTEN,W., KAPLAN,C.D. & GARDINER,M. 1976 "Hemispheric specialization of language: an EEG study of bilingual Hopi children" International Journal of Neuroscience 8:1-6

ROSANSKY,E. 1975 "The critical period for the acquisition of language" Working Papers in Bilingualism 6:92-102

ROSS,J.R. 1970 "Gapping & order constituents" in Bierwisch,M. & Heider, K.E. (eds) Progress in linguistics Mouton, The Hague, p.249-59

RUPP,J.H. 1980 "Cerebral language dominance in Vietnamese-English bilingual children" Unpublished D.Phil Thesis, University of New Mexico, Albuquerque

* RUSSELL,B. 1940 "An inquiry into meaning & truth" Allen & Unwin, London

S

SACHS,J.A. 1974 "Memory in reading & listening to discourse" Memory & Cognition 2 (1a):95-100

SAFFRAN,E.M. & MARIN,O.S.M. 1977 "Reading without phonology: evidence from aphasia" Quarterly Journal of Experimental Psychology 29:515-25

SAFFRAN,E.M., SCHWARTZ,M.F. & MARIN,O.S.M. 1976 "Semantic mechanisms in paralexia" Brain & Language 3:255-65

SASANUMA,S. 1980 "Acquired dyslexia in Japanese: clinical features & underlying mechanisms" in Coltheart,M., Patterson,K. & Marshall,J.C. (eds) Déep Dyslexia Routledge & Kegan Paul, London

* SASANUMA,W., ITAH,M., MORI,K. & KABAYASHI,Y 1977 "Tachistoscopic recognition of kana & kanji words" Neuropsychologia 15:547-53

* SATZ,P. 1979 "A test of some models of hemispheric speech organization in the left & right handed" Science 203:1131-3

SATZ,P. & BULLARD-BATES,C 1981 "Acquired aphasia in children" in Sarno, M.T. (ed) Acquired Aphasia Academic Press, New York

* SATZ,P., RARDIN,D. & ROSS,J. 1971 "An evaluation of a theory of specific developmental dyslexia" Child Development 42:2009-2021

* ŠČERBA,LV. 1945 "Očerednyje problemy jazykovedemja" USSR Academy of Sciences, Izvestija, Section of Literature & Language IV (5):173-86

- * SCHNEIDERMAN, E. & WESCHE, M. 1980 "Right hemisphere participation in 2nd language acquisition" in Bailey, K., Long, M. & Peck, S. "Issues in 2nd language acquisition: selected papers of the L.A. 2nd language forum" Newbury Ho., Rowley, MA.
- * SCHÖNLE, P. & BREUNIGER, H. 1977 "Untersuchungen mit dichotischen Hörtesten bei Zweisprachigkeit" Archiv für Ohren-, Nasen- und Kehlkopfheilkunde 216:574
- SCHONELL, F.J. & SCHONELL, F.E. 1960 "Diagnostic and attainment testing" Oliver & Boyd, Edinburgh, 4th Edition
- SCORESBY-JACKSON, R.E. 1867 "A case of aphasia with right hemiplegia" Edinburgh Medical Journal February 1867, p.696-706
- SCOTT, S., HYND, G.W., HUNT, L. & WEED, W. 1979 "Cerebral speech lateralization in the native American Navajo" Neuropsychologia 17:89-92
- SCOVEL, T. 1969 "Foreign accents, language acquisition & cerebral dominance" Language Learning 19 (384):245-53
- * SEGALOWITZ, N. 1977 "Psychological perspectives on bilingual education" in Spolsky, B. & Cooper, R. (eds) "Frontiers in bilingual education" Newbury House, Rowley, MA., p.119-58
- SELIGER, H.W. 1978 "Implications of a multiple critical periods hypothesis for second language learning" in Ritchie, W.C. (ed) "Second language acquisition research" Academic Press
- SELIGER, H.W. 1982 "On the possible rôle of the right hemisphere in second language acquisition" TESOL Quarterly 16 (3):307-14
- * SEMMES, J. 1968 "Hemispheric specialization: a possible clue to mechanism" Neuropsychologia 6:11-26
- SHADDEN, B.B. & PETERSON, H.A. 1981 "Ear differences in simple reaction time: the influence of attentional factors" Brain & Language 14:181-189
- SHALLICE, T. & COUGHLAN, A.K. 1980 "Modality specific word comprehension deficits in deep dyslexia" Journal of Neurology, Neurosurgery & Psychiatry 43:866-72
- * SHANKWEILER, D. & STUDDERT-KENNEDY, M. 1967 "Identification of consonants and vowels presented to left & right ears" Quarterly Journal of Psychology 19:59-63
- * SHEARER, E. 1974 "Reading - two new words" Times Educational Supplement 24th May, no.3078:34; also published by NFER, Test information sheet no.4501
- SHEDLETSKY, L.J. 1981 "Cerebral asymmetry for aspects of sentence processing" Communication Quarterly 29 (1) Winter:3-11
- * SHIFFRIN, R.M. & SCHNEIDER, W. 1977 "Controlled & automatic human in-

formation processing: II. Perceptual learning, automatic attending & a general theory" Psychological review 84:127-90

SHIMADA, M. 1981 "Kana & kanji processing in Japanese with special reference to functional hemisphere specialization" Tokuho Psychologia Folia 40 (1-4):24-34

SIBATANI, A. 1980 "Inscrutable epigenetics of the Japanese brain: a book review" (review of Tsunoda 1978) Journal of Social Biological Structure 3:255-66

SILVERBERG, R. BENTIN, S., GAZIEL, T. OBLER, L.K. & ALBERT, M.L. 1979 "Shift of visual field preference for English words in native Hebrew speakers" Brain & Language 8:184-90

SLOBIN, D.A. 1979 "Psycholinguistics" Scott, Foresman & Co. (2nd Edition)

* SMITH, A.J. 1966 "Speech & other functions after left (dominant) hemispherectomy" Journal of Neurology, Neurosurgery & Psychiatry 29:467-71

* SMITH, A. 1972 "Dominant & nondominant hemispherectomy" in Smith, L. (ed) "Drugs, development & cerebral function" Thomas, Springfield, Illinois, p.36-68

SOARES, C. & GROSJEAN, F. 1981 "Left hemisphere language lateralization in bilinguals & monolinguals" Perception & Psychophysics 28 (6):599-604

* SOMMERS, R.K. & TAYLOR, M.L. 1972 "Cerebral speech dominance in language-disordered & normal children" Cortex 8:224-232

* SPERRY, R. 1984 "Consciousness, personal identity & the divided brain" Neuropsychologia 22:661-73

* SPERRY, R., GAZZANIGA, M.S. & BOGEN, J.E. 1969 "Interhemispheric relationships: the neocortical commissures; syndromes of hemisphere disconnection" in Vinken, P.J. & Bruyn, G.W. (eds) "Handbook of clinical neurology vol IV", North-Holland Publ. Co., Amsterdam

* SPREEN, O. & BENTON, A.L. 1969 "Neurosensory center comprehensive examination for aphasia" Edition A. Manual for instructions, Neuropsychology laboratory, University of Victoria

STAFFORD, R.E. 1961 "Sex differences in spatial visualization as evidence of sex-linked inheritance" Perceptual & Motor Skills 13:428

STARCK, R., GENESEE, F., LAMBERT, W.E. & SEITZ, M. 1977 "Multiple language experience & the development of cerebral dominance" in Segalowitz, S.J. & Gruber, F. (eds) "Language development & neurological theory" Academic Press, p.47-55

STRAWSON, P.F. 1963 "Introduction to logical theory" Methuen, London

* STUDDERT-KENNEDY, M. 1975 "Dichotic studies II: two questions" Brain & Language 2:123-30

STUDDERT-KENNEDY, M. & SHANKWEILER, D. 1969 (and 1970) "Hemispheric specialization for speech perception" Journal of the Acoustical Society of America 48 (2):579-94

SUBBARAO, K.V. 1974 "Is Hindi a VSO language?" Papers in Linguistics 7: 325-50

SUSSMAN, H.M., FRANKLIN, P. & SIMON, T. 1982 "Bilingual speech: bilateral control" Brain & Language 15:125-42

* SWAIN, M. 1972 "Bilingualism as a first language" Unpublished PhD thesis, Dept. of Psychology, University of California, Irvine

SWIFT, A.B. & PERLMAN, M.B. 1985 "A non-invasive index of hemispheric activity" Perceptual & Motor Skills 60:515-24

T

TANENHAUS, M.K., LEIMAN, J.M. & SEIDENBERG, M.S. 1979 "Evidence for multiple stages in the processing of ambiguous words in syntactic contexts" Journal of Verbal Learning & Verbal Behavior 18:427-40

TEN HOUTEN, W.D. 1982 "Social correlates of cerebral lateralization: a neurosociological approach" in St.Clair, R.N. & Von Raffler-Engels, W. (eds) "Language & cognitive styles" Neurolinguistics no. 11, Swets & Zeitlinger B.V., Lisse, p.21-50

TESZNER, D., TZAVARAS, A., GRUNER, J. & HÉCAEN, H. 1972 "L'asymétrie droite-gauche du planum temporale; à propos de l'étude anatomique de 100 cerveaux" Revue Neurologique 126:444-9

TREISMAN, A. & GEFFEN, G. 1968 "Selective attention in perceiving & responding to speech messages" Quarterly Journal of Experimental Psychology 20:139-49

*TSUNODA, T. 1969 "An audiological approach to speech disorders due to cortical lesion" Practica Otologica Kyoto, Supplement 66:1296-1316

TSUNODA, T. 1975 "Functional differences between right- and left-cerebral hemispheres detected by the key-tapping method" Brain & Language 2:152-170

*TSUNODA, T. 1978 "Nipponjin no No: No no Hataraki to Tozai no Bunka" Taishukan Shoten, Tokyo (reviewed in Sibatani 1980, q.v.)

TYLER, L.K. 1984 "The structure of the initial cohort: evidence from gating" Perception & Psychophysics 36 (5):417-27

TYLER, L.K. 1985 "Real-time comprehension processes in agrammaticism: a case study" Brain & Language 26:259-75

TYLER, L.K. & MARSLEN-WILSON, W.D. 1977 "The on-line effects of semantic context on syntactic processing" Journal of Verbal Learning & Verbal

TYLER, L.K. & MARSLEN-WILSON, W.D. 1982 "Speech comprehension processes" in Mehler, J., Walker, E.C.T. & Garrett, M.F. "Perspectives in mental representation" L. Erlbaum, Hillsdale NJ. p.169-222

TYLER, L.K. & WESSELS, J. 1985 "Is gating an on-line task? Evidence from naming latency data" Perception & Psychophysics 38 (3):217-22

U

UNDERWOOD, B.J. 1969 "Attributes of memory" Psychological Review 76 (6): 559-573

V

VAID, J. 1983 "Bilingualism & brain lateralization" in Segalowitz, S.J. (ed) "Language functions & brain organization" Academic Press, p.315-39

VAID, J. 1984 "Visual, phonetic & semantic processing in early & late bilinguals" in Paradis, M. & Lebrun, Y. "Early bilingualism & child development" Neurolinguistics 13, Swets & Zeitlinger BV, Lisse. p.175-91

VAID, J. & GENESEE, F. 1980 "Neuropsychological approaches to bilingualism: a critical review" Canadian Journal of Psychology 34 (4):417-45

VAN LANCKER, D. 1972 "Language processing in the brain" Paper presented at the California Linguistics Conference, May 1972

VAN LANCKER, D. 1987 "Non-propositional speech: neurolinguistic studies" in Ellis, A.W. (ed) "Progress in the psychology of language: vol 3" Erlbaum, p.49-118

* VAN LANCKER, D., CANTER, G.J. & TERBEEK, D. 1981 "Disambiguation of ditrophic sentences: acoustic & phonetic cues" Journal of Speech & Hearing Research 24:330-5

* VAN LANCKER, D. & FROMKIN, V. 1973 "Hemispheric specialization for pitch & 'tone': evidence from Thai" Journal of Phonetics 1:101-9

* VAN LANCKER, D. & FROMKIN, V. 1978 "Cerebral dominance for pitch contrasts in tone language speakers and in musically untrained & trained English speakers" Journal of Phonetics 6:16-23

VENNEMANN, T. 1974 "Words & syllables in natural generative grammar" in Bruck, A., Fox, R.A. & La Galy, M.W. (eds) "Natural Phonology" Chicago Linguistic Society, p.346-74

VEYRAC, G. 1931 "A study of aphasia in polyglot subjects" in Paradis, M. (ed) 1983 "Readings on aphasia in bilinguals & polyglots" Didier, Canada, p.320-38

VINCENT, D., GREEN, L., FRANCIS, J. & POWNEY, J. 1983 "A review of reading tests" NFER-Nelson, Windsor

W

- WADA, J.A. 1974 "Morphologic asymmetry of human cerebral hemispheres: temporal & frontal speech zones in 100 adult & infant brains" Neurology 24:349
- WADA, J.A., CLARKE, R. & HAMM, A. 1975 "Cerebral hemispheric asymmetry in humans - cortical speech zones in 100 adults & 100 infant brains" Archives of Neurology 32, April:239-46
- WADA, J.A. & RASMUSSEN, T. 1960 "Intracarotid injection of sodium amytal for the lateralization of speech dominance: experimental & clinical observations" Journal of Neurosurgery 17:266-82
- WALTERS, J. & ZATORRE, R.J. 1978 "Laterality differences for word identification in bilinguals" Brain & Language 6:158-67
- * WATAMORI, T.S. & SASANUMA, S. 1978 "The recovery of processes of two English-Japanese bilingual aphasics" Brain & Language 6:127-40
- WEINREICH, U. 1953 "Languages in contact" Mouton & Co. 3rd printing:1964
- * WEINREICH, U. 1969 "Problems in the analysis of idioms" in Puhvel, J. (ed) "Substance & Structure of language" University of California Press, L.A.
- WEINSTEIN, S. 1978 "Functional cerebral hemispheric asymmetry" in Kinsbourne, M. (ed) "Asymmetrical function of the brain" Cambridge University Press; p.17-48
- WERNER, H. & KAPLAN, B 1963 "Symbol Formation" Wiley
- WHITAKER, H. 1978 "Bilingualism: a neurolinguistics perspective" in Ritchie, W.C. (ed) "Second language acquisition research" Academic Press, p.21-32
- WHITAKER, H. & NOLL, D. 1972 "Some linguistic parameters of the Token Test" Neuropsychologia 10:395-404
- * WITELSON, S.F. 1962 "Perception of auditory stimuli in children with learning problems" Unpublished manuscript, McGill University
- WITELSON, S.F. 1977 "Early hemisphere specialization & left hemisphere plasticity: an empirical & theoretical review" in Segalowitz, S.J. & Gruber, F. "Language development & neurological theory" Academic Press, p.213-87
- WITELSON, S.F. & PALLIE, W. 1973 "Left hemisphere specialization for language in the new born" Brain 96:641-6
- * WUNDT, W. 1897 "Grundriss der Psychologie" Engelmann, Leipzig, p.291-2
- WRAY, A.M. 1982 "Object language referents, quotations & concept names"

Unpublished manuscript, University of York

* YOUNG, A.W. & RATCLIFF, G. 1983 "Visuospatial abilities of the right hemisphere" in Young, A.W. (ed) "Functions of the right cerebral hemisphere" Academic Press, London

Z

* ZAIDEL, E. 1973 "Linguistic competence & related functions in the right cerebral hemisphere of man following commissurotomy & hemispherectomy" PhD dissertation, California Institute of Technology

ZAIDEL, E. 1977 "Unilateral auditory language comprehension on the token test following cerebral commissurotomy & hemispherectomy" Neuropsychologia 15:1-13

* ZAIDEL, E. 1978 "Lexical organization in the right hemisphere" in Buser, P.A. & Rougel-Buser, A. (eds) "Cerebral correlates of conscious experience" Elsevier/North Holland Press, New York & Amsterdam, p.177-97

* ZAIDEL, E. & SCHWEIGER, A. 1984 "On wrong hypotheses about the right hemisphere: commentary on K. Patterson & D. Besner "Is the right hemisphere literate?" Cognitive Neuropsychology 1:351-64

ZANGWILL, O.L. 1974 "Consciousness & the cerebral hemispheres" in Diamond, S.J. & Beaumont, J.G. "Hemispheric function in the human brain" Halsted Press, Wiley, New York, p.264-78

* ZURIF, E.B. & CARSON, C. 1970 "Dyslexia in relation to cerebral dominance & temporal analysis" Neuropsychologia 8:351-61

* ZURIF, E.B. & SAIT, P.E. 1970 "The rôle of syntax in dichotic listening" Neuropsychologia 8:239-44