Processing Events: Investigating Event Conceptualisation in Aphasia

Volume 1

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In memory of Ray Barratt

Declaration

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Abstract

Some people with aphasia may have difficulty in talking about events because of trouble in processing situations in a language-ready fashion. A number of models of language production include a level at which messages are shaped to the demands of a particular language system. However, the relation between such conceptual processing and production in aphasia has been less fully explored. This study takes an empirical approach, investigating the relationship between the verb and sentence difficulties of six people with aphasia and their conceptualisation of events. Following a range of preparatory assessments, two individuals were hypothesised to have some difficulty in conceptualising events for language. Three novel tests were then devised to explore the skills of these individuals, and in one case, the whole group, in more detail. One test examines participants' focus over pictured situations, through their naming of the people and objects involved. A second probes the adoption of perspective over a particularly problematic situation type, investigating the effect of visual and linguistic cues on verb production. The third test focuses on gesture, exploring the relationship between verbal description and the production of action gestures. One participant's drawing of simple events was also probed using a recently developed assessment (Sacchett, 2005). In each case the results point to some differences between the participants with aphasia and a group of non-brain damaged speakers, thus providing support for the psychological reality of the notion of 'thinking for speaking' (Slobin, 1996) in aphasia. In addition, the test findings bring to light some previously hidden processing strengths. However, they also highlight the difficulty both of designing valid tests in this area and of accurately interpreting their results. The discussion considers the implications of the findings for therapy in aphasia, and for our understanding of the relationship between language loss and event conceptualisation.

Chapter 1 Introduction

Like a large number of previous studies, this one is concerned with talking about events in aphasia. Many people with aphasia have trouble in describing events because of difficulties in processing verbs and sentences (e.g. Byng, 1988; Byng, Nickels and Black, 1994; Mitchum and Berndt, 1994; Berndt, Mitchum, Haendiges and Sandson, 1997b; Breedin, Saffran and Schwartz, 1998; Bastiaanse and Jonkers, 1998; Edwards and Bastiaanse, 1998; Webster, Morris and Franklin, 2005; see also Druks, 2002, for review). Difficulty with verbs has often been associated with the syndrome of 'agrammatism' (for example, by Saffran, Schwartz and Marin, 1980; Zingeser and Berndt, 1990; Thompson, Lange, Schneider and Shapiro, 1997; Kim and Thompson, 2000), but this association is by no means universal (for instance, see Berndt, Haendiges, Mitchum and Sandson, 1997a; Marshall, Chiat and Pring, 1997). One possible cause of verb problems, which has been relatively little investigated, is a difficulty in conceptualising events in the way required for language. Difficulty in organising one's thoughts about events could lead to problems in constructing messages that can be readily expressed by the language system (Dipper, Black and Bryan, 2005). This is the basic hypothesis explored in the present study. Taking a practical, empirical approach, it asks whether the language difficulties of certain individuals with aphasia can be explained by reference to difficulties in processing events in a language-ready fashion.

Two inter-related bodies of literature form the foundation for this proposal. One is the literature relating to the concept of 'thinking for speaking' (Slobin, 1996); the other, the various theoretical accounts of pre-verbal conceptual processing. The following sections (1.1 and 1.2) consider these theories in turn, as groundwork for the investigations of conceptual processing that form the bulk of this study. Section 1.3 discusses some alternative accounts of the relationship between conceptual structure and language, while section 1.4 turns the spotlight more directly on the conceptual processing of entities and relations. This is followed by more detailed discussion of the relation between event conceptualisation and language processing in aphasia. Section 1.5 reviews a number of accounts of individuals with aphasia who have been proposed to have difficulty at the conceptual level, while section 1.6 considers the relation between thinking for speaking difficulties and wider cognitive deficits in aphasia. Section 1.7 introduces the novel tests that were devised for the present study, leading on to more detailed discussion of the theoretical basis underlying each one (sections 1.8 to 1.10). The final section (1.11) provides an overview and links with the chapters that follow.

1.1 Thinking for speaking

Many language processing theorists agree that talking about the world involves a certain amount of 'schematisation' (e.g. Pinker, 1989; Levelt, 1989; Gumperz and Levinson, 1996; Slobin, 1996; Black and Chiat, 2000; Dipper et al, 2005). Our perceptions, feelings and ideas do not map directly onto language. Instead, language expresses a selective version of those mental experiences, one that is moulded to the particular characteristics of the language being spoken. As Slobin (1996) puts it, "Any utterance is a selective schematization of a concept – a schematization that is, in some way, dependent on the grammaticized meanings of the speaker's particular language, recruited for purposes of verbal expression" (pp. 75-6). Take the following scene from the film 'The Life Aquatic with Steve Zissou' (copyright Touchstone pictures, 2004):

http://www.imdb.com/gallery/ss/0362270/003_LAC-9315.jpg

In order to describe this scene, a speaker must make a number of important choices before beginning to frame their message in linguistic terms. At the most fundamental level, they must decide what it is they want to say. For example, a complex scene like this cannot be entirely encapsulated into a description of a single event. Selecting an event for description from the wider situation involves deciding which elements to include and which to omit. For instance, the speaker's attention might be drawn most strongly to the interaction occurring in the centre of the picture. This will lead them to focus on the reporter and the diver, as well as possibly on the microphone, tape recorder and so on. Other entities present in the scene, such as the other human figures, their diving suits and equipment or the glimpsed submarine, will be 'backgrounded' as a result.

Having highlighted a target event for expression, the speaker must then choose from whose viewpoint to describe it. This choice will be partly constrained by perceptual and cognitive factors – for example, which participant is the most perceptually salient? Are they of equal animacy? Is one playing a more obviously causal role? In this case the most obvious perspectives are those of the diver and the reporter, though others would also be possible (for example, the event could conceivably be described from the perspective of the microphone). The choice is also determined by the availability of appropriate verbs in the target language. In English, a number of options are available to describe the situation from the point of view of either of the main participants. For example, it might be described as '*talking*' or '*listening*', '*explaining*' or '*learning*', '*interviewing*' or '*expostulating*'. Without knowledge of the context, however, the scene is less likely to be described in the terms used by the film makers themselves:

'*Oceanographer Steve Zissou demonstrates his in-helmet music system to probing reporter Jane Winslett-Richardson.*'

Talking about things, or states, or events, therefore involves selectively attending to those aspects that either can or must be expressed in the target language. This is the heart of the concept of 'thinking for speaking' (Slobin, 1996).

1.1.1 Evidence for thinking-for-speaking

A number of cross-linguistic studies have demonstrated that speakers of different languages typically attend to subtly different aspects of experience. A well-known example is Slobin's (1996) investigation of the descriptions of a picture story (*Frog, where are you?* - Mayer, 1969) produced by speakers of a range of different languages. One picture shows two separate events. One of these has just occurred: a boy is shown having just fallen out of a tree. The other is ongoing: a dog is shown being chased by some bees. There were clear differences in the descriptions of this picture between speakers of English (a language that requires marking of grammatical aspect) and Hebrew (a language without grammatical aspect, where verbs are simply inflected as past, present or future tense). English-speaking children as young as 3;8 typically marked the temporal difference between the two events, producing descriptions such as:

> '*The boy fell out and the dog was being chased by the bees*'.

Hebrew speakers, on the other hand, tended not to express the temporal difference, instead producing descriptions such as:

> '*He fell and the dog ran away*'.

An obvious explanation is that the differences between the two languages force their speakers to encode the events in different ways. In this case, Hebrew speakers would omit temporal details simply because they are not encoded within Hebrew verbs. However, just under a quarter of the Hebrew speakers used other devices to signal that one of the events was complete and the other was ongoing. A better explanation is therefore that the presence (or otherwise) of aspect in a language has a strong biasing effect on attention. When aspect is available speakers are likely to pay attention to the temporal properties of events, and mark them in their descriptions. Indeed the fact that verbs are necessarily marked for aspect may make it impossible not to express such properties. For example, an English speaker who described the scene as:

> '*The boy fell out of the tree and the dog ran away*'

might be thought to have expressed a different sense from one who made a distinction between the temporal contours of the two events.

When aspect is not available the specific temporal features are more likely to be neglected, although speakers may still choose to express the same sense by other means. The strength of this argument lies in the fact that, while the language-related patterns were found across speakers of all ages within each language community, there was no language whose speakers were uniformly consistent in the way that they expressed the same events. Instead, what we produce seems to be influenced both by the biasing effects of our particular language and by our own choices as to what is most salient or essential. Slobin (1996) argued that we are unlikely to sense all the possible distinctions that may be demanded by the grammars of every language. For example, it is unlikely that English speakers have in mind the distinction between witnessed and non-witnessed events that is obligatory in Turkish. However, we are able to express such distinctions should this be necessary.

Studies of language development also indicate that children engage in some active thinking for speaking. Language-learning children must achieve more than simple 'word-to-world' mappings, since there is no direct relationship between our bundles of perceptual and conceptual experience and the words available to describe them (e.g. Black and Chiat, 2000). Instead, an important part of learning one's own language is to appreciate the constraints it imposes on the expression of ideas. Cross-linguistic studies highlight this process, since languages differ in the particular constraints they impose; for example by foregrounding or omitting different features, or by 'bundling' features together in different ways.

A number of studies have considered the effects of the different bundling demanded by Korean and English in relation to the description of spatial relations (e.g. Choi and Bowerman, 1991; Bowerman, 1996). English bundles all examples of one object being placed inside another under the umbrella term '*put in*'. Objects placed on top of one another, on the other hand, require a different term: '*put on*'. An English child learning the verb *put* therefore does not have to pay much attention to the nature of the objects involved, but only to the distinction between containment and support. In Korean, these kinds of spatial event are classified differently, with the verb depending on the tightness of fit between the two objects rather than on the direction of movement. So putting a cassette in a case can be described by the same verb ('*kkita*') as putting a tight-fitting lid on a box. Putting an apple in a bowl, however, requires a different verb ('*nehta*'), while putting a cup on a table requires another choice again ('*nohta*'). The fact that Korean and English children learn their respective *put* verbs so efficiently and at much the same rate suggests that they are able to extract these subtle differences of meaning from their languages (Choi and Bowerman, 1991). They can work out the particular construal of the events expressed by the available verbs, and can accurately fit them to the relevant aspects of their experience. They are clearly able to do the necessary thinking for speaking about 'putting' events.

1.1.2 Effects of language on thinking

The thinking for speaking studies are very persuasive. From an early age, the language we speak appears to influence the way in which we package concepts for talking, the features of the world we habitually encode, and those to which we habitually attend. More controversial is the extent to which language influences other aspects of thinking. Pinker, for example, makes a clear distinction between the effect of language on conceptualisation for talking, and the effect on all other aspects of mental experience:

"Whorf was surely wrong when he said that one's language determines how one conceptualizes reality in general. But he was probably correct in a much weaker sense: one's language does determine how one must conceptualize reality when one has to talk about it." (Pinker, 1989, p. 360)

Or (in more relaxed mode, referring to the fact that the word 'bridge' is masculine in Spanish and feminine in German): "Just because a German thinks a bridge is feminine, doesn't mean he's going to ask one out on a date." (Pinker, quoted in Moran, 2003)

Others go further, extending the influence of language beyond thinking-for-speaking, to the processes of encoding certain types of experience. For example, Slobin (1996) proposes that, in preparing to describe the same events, speakers of different languages will experience them in subtly different ways. Gumperz and Levinson (1996) further argue that, in order to be able to describe previously-experienced events, speakers must be guided by the structure of their language in the way in which they encode their experience. In other words, "thinking in a special way for speaking will not be enough: we must mentally encode experiences in such a way that we can describe them later, in the terms required by our language" (Gumperz and Levinson, 1996, p. 27).

Evidence to support this view comes from a comparative study of Indonesian and English speakers' encoding of action events (Boroditsky, Ham and Ramscar, 2002). Unlike English verbs, Indonesian verbs are not marked for tense. Temporal distinctions must be expressed by alternative means, for example by specifying that an event took place 'just now'. Boroditsky et al hypothesised that this difference would affect the way in which speakers of the two languages represent events shown occurring in different time frames. English speakers should think of actions occurring in the same tense as more alike, and of actions occurring in different tenses as more distinct, than Indonesian speakers. Monolingual English and Indonesian speakers were shown pairs of photographs of people performing simple actions. Each pair either showed two different actors doing the same action in the same tense (for example, a man and a woman both about to kick a football), or the same actor doing the same action in different tenses (for instance, a woman about to kick and then kicking a football). Participants were asked to rate how similar the two pictures were in each case.

Sure enough, English speakers rated same-tense pairs as significantly more similar than Indonesian speakers, but rated different-tense pictures as significantly less similar. This suggested that the way in which speakers mentally represent actions is influenced by whether or not their particular language requires the habitual encoding of tense. English speakers appeared to make their judgments on the basis of tense, whereas Indonesian speakers were apparently more influenced by the actor. Even more interestingly, bilingual Indonesian-English speakers performed more like monolingual English speakers when tested in English, rating same-tense pictures as more similar than they did when tested in Indonesian. Simply altering the language in which the test instructions were given, in other words, appeared to have some effect on their responses, although there was little difference between their ratings of different-tense pairs. (See also Vigliocco, Vinson, Woolfe, Dye and Woll, 2005, for evidence of a similar difference in the degree to which users of English and British Sign Language associate lexical items with mental imagery.)

Levinson (1996, 1997) argues for a specific knock-on effect from the structure of a speaker's language to the way in which he or she performs a range of apparently non-verbal cognitive tasks. For example, speakers of languages that differ in their encoding of spatial information are argued to show corresponding differences in their memory for spatial arrays. This claim is considered in more detail within the discussion of perspective taking in section 1.9. However, a second study by Boroditsky et al (2002) offers support for a similar view. Here, Indonesian and English speakers were shown 30 action photographs and asked to remember as much as they could about them. Each picture showed a person either about to perform an action, in the process of performing it, or having just completed it. The participants were subsequently shown photographs of the person performing the action in all three tenses, and asked to say which one they had already seen. While Indonesian speakers performed at chance, English speakers were able to remember the exact version of the action they had seen for 41% of the items. This was not just a facet of different cultural or educational experiences, since Indonesian-English bilingual speakers showed exactly the same pattern when tested in each language. Once again, even though the task itself involved no explicit linguistic encoding, the language in which it was set up appeared to have a significant effect on participants' performance.

The proposed relationship between language and other forms of thinking is not confined to adult language users. A range of evidence points to a degree of interaction between linguistic and cognitive development in children. For instance, the development of certain specific linguistic and conceptual categories goes closely hand in hand. Close relationships have been demonstrated between children's development of words for disappearance (e.g. 'gone') and their understanding of high-level object permanence; between their mastery of words expressing success and failure (e.g. 'there' and 'uh-oh') and their development of means-ends understanding; and between the naming spurt and their development of the ability to classify by categories (Gopnik and Meltzoff, 1997; Gopnik, 2001).

Differences have also been demonstrated in the development of these relationships between children learning different languages. For example, Gopnik and Choi (1995) and Gopnik, Choi and Baumberger (1996) compared the relationship between specific areas of language and cognition in very young children learning English and Korean. Korean has a much richer verb morphology than English, and is a verb-final language, meaning that verbs are prosodically salient within spoken sentences. Nouns, on the other hand, are much less obligatorily expressed than in English, and are frequently omitted where the context is clear. There is a long and ongoing debate, muddied by the use of different data collection methods, over Korean children's relative production of nouns versus verbs, and whether they produce more verbs than their English-speaking peers (e.g. Au, Dapretto and Song, 1994; Choi and Gopnik, 1995; Kim, McGregor and Thompson, 2000). However, Gopnik and colleagues additionally hypothesised that Korean children might show a more advanced understanding of actions, and a less advanced appreciation of object kinds, than English speakers.

Sure enough, Korean speaking children were found to be significantly more advanced than English speakers in their development of success/failure terms, and in their ability to solve means-ends tasks such as using one object to pull another towards them. However, both their naming explosion and their performance on categorisation tasks such as sorting objects into groups were delayed compared to English-speaking peers. These findings do point to a link between the characteristics of each language (as well, perhaps, as the patterns of input offered to children by their mothers) and the children's linguistic and conceptual development. However, Gopnik et al make the point that the difference between the two groups was largely one of timing. By the age of two or three, children in both groups had reached the same developmental level.

Finally, Chiat (2001) suggests that the effects of *not* developing thinking for speaking skills may be far-reaching: "It may be the packaging of experience by language which allows us to represent, attend to, and manipulate experience in the ways that we do" (p. 127). Children who have difficulty in establishing the rules by which their own languages manage that packaging may as a result demonstrate particular kinds of cognitive deficits. Although not generally cognitively impaired, they may have difficulty in organising mental representations in a way that fits with the structure of language. Rather than having trouble with entirely non-verbal aspects of experience, therefore, their difficulties should relate to the structuring of ideas in areas of thinking that are relatively dominated by language.

The experimental evidence does not universally support the notion of wider-reaching effects from language to other cognitive domains. For example, Gennari, Sloman, Malt and Fitch (2002) investigated the performance of Spanish and English speakers on non-verbal tasks relating to motion events. Spanish and English differ in their encoding of motion (Talmy, 1985). Spanish verbs typically encode the Path of the movement, while Manner is optionally expressed in an adverbial phrase. In English, Manner is typically expressed within the verb and Path outside it. If language influences the conceptualisation of such events, these differences might be expected to affect the way in which speakers think about them even in non-verbal contexts. For example, Spanish speakers might be expected to pay more attention to Path and less to Manner than English speakers, leading them to perform differently on tasks tapping the representation or recall of these features. The effect may also depend on whether or not language was explicitly involved in each event's encoding.

Spanish and English speakers first watched films of 36 motion events. Some were asked to name each event, while others were either given no instruction or were given a distraction task to prevent them from naming. They then saw the films again, this time randomly interspersed with distractor films, and were asked to identify those they had already seen. Each target had two distractors: one showing the same event with a different path and one an event with a different manner of motion. (For example, a film of a man carrying a board into a room was paired with distractors showing him carrying the board out of the room and dragging it in.) In a second task, the targets were shown along with their distractors and participants were asked to judge which of the distractors was more similar to the target.

On the identification task, the only difference between the two language groups was that Spanish speakers who had done the distraction task performed significantly worse than English speakers. There was no evidence that language was mediating their performance, however, in that the overall proportion of Path- and Manner-errors was the same across both groups. In the similarity judgment task, by contrast, there was no difference for those who had not previously named the events, but those who had done so responded in line with the patterns of their respective languages. Gennari et al conclude that the act of linguistic encoding can direct our attention to particular features of events, but that this only affects performance on certain tasks. For the similarity judgment task, the linguistic coding offered an efficient way of categorising the actions. For other tasks, such as those requiring recall, visual representations may offer richer and more detailed information than that provided by inevitably schematised language labels. Linguistic and conceptual representations of such events can, therefore, dissociate. However, in certain circumstances language can influence non-linguistic judgments. The influence of language on a particular task may also reflect the adoption of a conscious or unconscious strategy on the part of the speaker.

Gennari et al's study touches on a central difficulty affecting the design of such non-verbal assessments. Many of the tasks we typically use with people with aphasia are like their similarity judgment task, in that they require people to make judgments on the basis of various forms of categorisation. Without knowing how far and in what ways language may be implicated in people's responses to a task, it is difficult to know whether errors reflect aspects of conceptualisation, or rather reflect the nature of their language difficulties. This issue is discussed further in relation to the interpretation of findings from the Order of Naming Test, described in Chapter 3.

1.1.3 Summary

The concept of thinking for speaking has been immensely influential, resurrecting interest in a 'legitimate' weaker version of the Whorfian hypothesis, and providing a theoretical basis for a range of fascinating cross-linguistic and developmental studies. While the jury is still out on the extent of the influence of a person's language on other aspects of their thinking, it seems much less controversial that languages exert particular constraints on the process of talking itself, requiring speakers to attend to and encode subtly different aspects of their experience. The process has more recently been expressed in terms of the 'paring down' of complex conceptual information into a form that can be expressed by the language system (Dipper et al, 2005). Dipper et al propose that this process is in part driven by the language system itself, so that "'thinking for speaking' is something that happens in the interaction between thought and language" (p. 420). One possible implication of this proposal is that a damaged language system may be unable to drive the paring down process in the normal way. For example, if a person has lost access to the linguistic constraints guiding the expression of motion events, he or she may not be able to form an appropriately schematised representation of a particular event to serve as input to the language system. Similarly, if they have lost access to the full range of verbs available for expressing changes of possession, they may not be able to focus firmly enough on the relevant aspects of a situation to match them to an appropriate option. The implications of this proposal for the language processing of people with aphasia are discussed further in section 1.5. Before that, section 1.2 considers the specific processes of conceptualisation for language in more detail.

1.2 Processing at the conceptual level

It is clear that producing language requires an initial stage of pre-verbal, conceptual processing. At this stage a 'message' is generated, which both specifies the content of what is to be said and shapes it to a form that can be expressed in a particular language. Various different models of language production include such an initial conceptual stage (e.g. Garrett, 1988, 1992; Levelt, 1989, 1999; Thompson and Faroqi-Shah, 2002). Levelt's (1989) model is probably the most clearly articulated psycholinguistic account of the speaking process available, and has a longstanding history within the study of aphasia. One reason for this is that it provides a clear framework against which theoretical proposals about the language processing system may be tested. Levelt's model will therefore be used as the theoretical basis for the investigations in the present study. It is reproduced for reference in Figure 1.2.

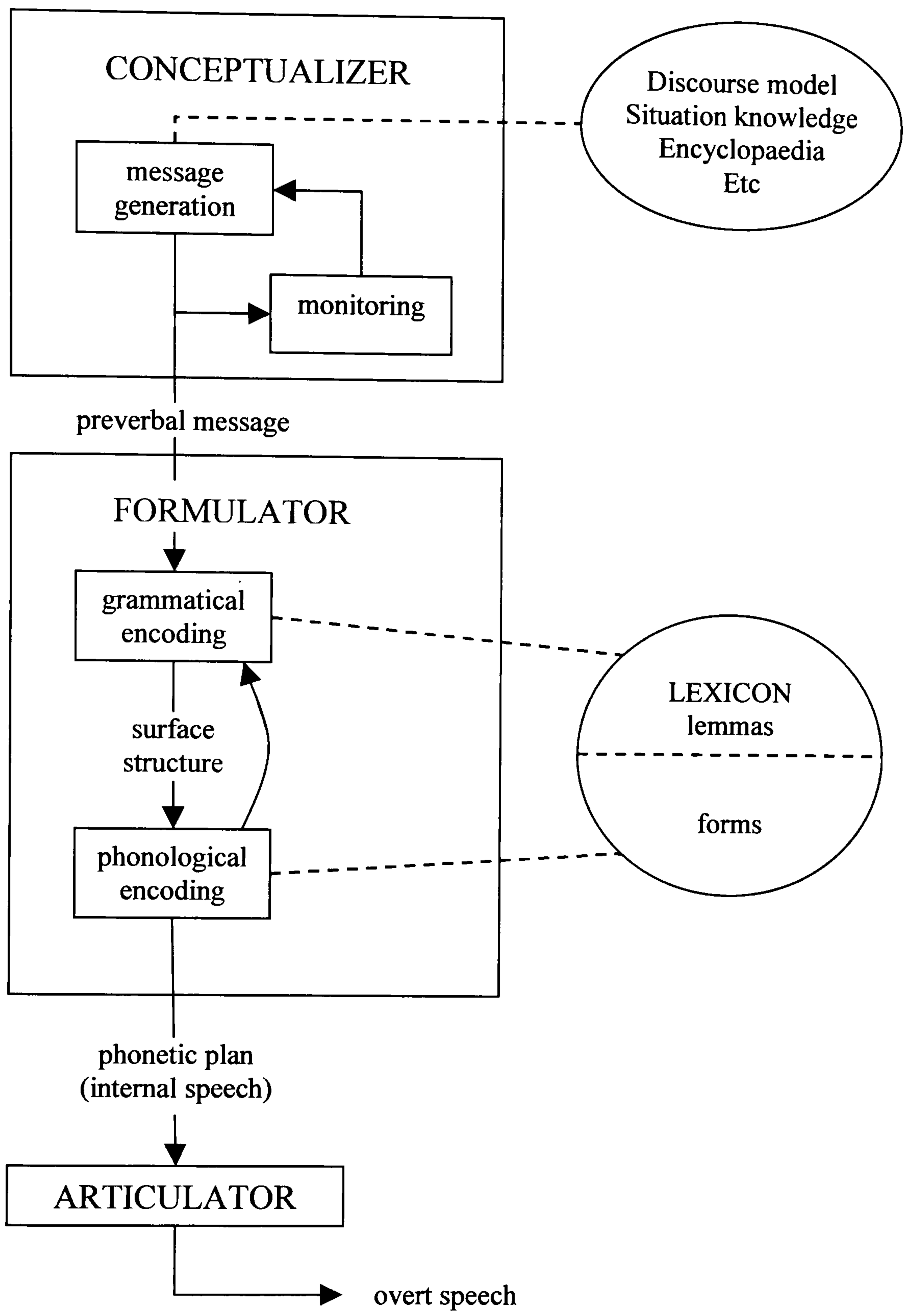

Figure 1.2 Levelt's model of speech production (reproduced in part from Levelt, 1989, p. 9)

Amongst other things, Levelt's model specifies two important tasks that must be achieved at the level of the pre-verbal Conceptualizer. 'Macroplanning' refers to the way in which speakers achieve their communicative intentions, by choosing and ordering the information to be expressed in such a way as to guide the focus of the listener over the developing discourse. 'Microplanning', on the other hand, covers the more finely-tuned processes by which a message is shaped to the requirements of the next level of production (the language

Formulator). It also includes the various ways in which messages are fitted to the particular demands of the target language. Choices made at the level of Microplanning also guide the listener's attention, for example by marking new information as it is introduced.

In order to be acceptable to the language Formulator, messages must meet certain criteria. First, they must be propositional. This means, essentially, that they must be *about* some proposition that can be expressed semantically. Messages can be generated from all kinds of non-linguistic information (for example, encyclopaedic and situational knowledge, as well as spatial, kinaesthetic or musical perceptions). As Levelt (1989) puts it: "There is more than a single 'language of thought'" (p. 71). However, in order to reach linguistic expression they must be cast in a propositional form. Most importantly, they need to be formed of concepts that can be expressed in the speaker's language ('lexical concepts'). They must also specify their referents, which must be linked to some kind of thematic structure, and may be further quantified or modified (for example, as 'tall' or 'dark'). Finally, the mood of the message (declarative, imperative or interrogative) must be specified.

Secondly, messages need to adopt a clear perspective on their subject matter. This means that they must specify details of the topic (the referent the message is about), the focus to be adopted, and the foregrounding or backgrounding of the various entities. Indeed, the language Formulator is unable to accept perspective-free information as input.

Finally, as suggested by the thinking for speaking studies, languages make different demands on speakers at the conceptual level, requiring them to take account of different conceptual features in the process of message-formation. Levelt offers the example of the deictic systems used by different languages for marking distances from the speaker. English and Dutch divide space up in a bipartite way, making a distinction only between '*here*' and '*there*'. Spanish and Japanese, on the other hand, distinguish three categories of distance: proximal, medial and distal. In Spanish these are encoded as '*aqui*', '*ahi*' and '*alli*'. When speakers of each of these languages prepare messages about the distance of particular objects, those messages must mark the information according to the specific conceptual scheme habitual to each language.

1.3 Relationship between conceptual structure and language

Although most psycholinguistic models of language production include a stage at which pre-verbal messages of this kind are generated, the nature of the relationship between the conceptual and the semantic or syntactic levels is more controversial. Most theorists agree on the need for some mechanism whereby wider conceptual representations can be filtered into a language-tailored form. However they differ in their understanding of the nature of that mechanism and in the terms they use to describe it.

One psycholinguistic model that is very close to that of Levelt (1989) is the model proposed by Bierwisch and Schreuder (1992). Here, as in Levelt, pre-verbal messages do not correspond directly to lexical structures. Instead, the conceptual representational system ('conceptual structure') is regarded as largely language-independent and distinct from the representational system of linguistic meanings ('semantic form'). Conceptual structure is much richer than semantic form, including a host of contextual, encyclopaedic and situational knowledge. In order to translate from conceptual structure into language, the system therefore requires an intermediary verbalisation mapping process (termed 'Vbl'). This knows which semantic representations correspond to lemmas in a particular language, and can select and organise 'chunks' of conceptual representations in a language-appropriate way. The essential difference between this model and Levelt's is that, for Bierwisch and Schreuder, the Conceptualizer and language Formulator are regarded as acting independently. For Levelt, the Conceptualizer itself knows the specific mapping requirements relating to a particular language. For Bierwisch and Schreuder, the Conceptualizer does not need direct access to knowledge about language, since all the language-specific mapping is achieved by the 'Vbl' mechanism. Bierwisch and Schreuder also propose a separate interpretative mapping process (termed 'Int') which works in a reverse direction in language comprehension, though not as an exact mirror of the 'Vbl' process.

Some theorists arguing from a linguistic perspective have suggested that there is no distinction between conceptual structure and semantic structure (e.g. Fodor, 1975; Jackendoff, 1983; Langacker, 1987). For example, Langacker's theory of cognitive grammar proposes that a single system at the conceptual level is responsible for processing both meaning and syntax. Jackendoff (1983, 1997) proposes a rather different model. He argues that there is no separate level of *linguistic* semantics. In other words, there is no separate store of specifically linguistic meaning that is distinct from general conceptual knowledge. Instead, the conceptual and semantic levels are said to 'coincide'. This means that conceptual representations include key components of linguistic meaning, such as notions of categorisation, perspective and salience. However, although conceptual and semantic representations coincide, not all aspects of conceptual structure are relevant to language.

According to Jackendoff, semantic structures represent a subset of conceptual structures – more precisely, they are those that can be expressed in language.

In Jackendoff's framework, conceptual structure is further seen as essentially language-independent, since there is no precise correspondence between it and syntax. For example, syntactic categories do not exactly match conceptual categories. Syntax is oblivious to the non-structural information contained within lexical items, such as the difference between 'dog' and 'cat'. Different syntactic structures can express the same conceptual relation, while a single syntactic structure can express a number of different conceptual relations:

"... although conceptual structure is what language *expresses*, it is not strictly speaking a part of the language faculty; it is language independent and can be expressed in a variety of ways, partly depending on the syntax of the language in question." (Jackendoff, 1997, p. 33)

Conceptual structure and syntactic structure are therefore seen as forming 'distinct modules', linked by 'correspondence rules'. This allows for a variety of different mappings between conceptual representations and syntax. The distinction between the conceptual and the syntactic levels means that, for Jackendoff, it is possible for speakers of different languages to share a universal underlying conceptual structure despite their linguistic differences. (See Gennari et al, 2002, for discussion.)

Certain elements of conceptual/semantic structure are particularly important to the process of expressing ideas in language because they are especially relevant to syntax. In Jackendoff's model, these key elements are components of conceptual structure. For Pinker (1989), on the other hand, they are components of a semantic structure that is distinct from conceptualisation. For example, according to Pinker it is semantic knowledge that allows us to distinguish verb pairs that encode similar meanings but that do not behave in the same way syntactically. For instance, the causative alternation distinguishes motion verbs that can be causativised from those that cannot, such as *roll* and *fall*. Both of these verbs may be used to describe the motion of an object:

The barrel rolled down the hill
The barrel fell down the hill

However, although there are similarities between the situations encoded by these verbs, which are perceivable at a conceptual level, for Pinker the verbs themselves are differently represented within semantic structure. It is therefore our knowledge of semantic structure, rather than different conceptualisations of the relevant situations, that additionally allows us to use *roll* but not *fall* causatively:

Fred rolled the barrel
but not
**Fred fell the barrel*

According to Pinker, language production essentially involves understanding the processes that link events to the semantic and syntactic structures of particular verbs. Knowledge of a verb's meaning includes knowledge of the role and syntactic structure(s) it commands. Pinker's proposal is discussed further in relation to the literature on perspective taking (section 1.9.3).

There are good reasons for arguing against the view that conceptual and semantic structure are identical. These are succinctly summarised by Levinson (1997). For one thing, as suggested by Bierwisch and Schreuder (above), our mental experience is much richer than the linguistic representations we use to express it, and includes essentially non-propositional representations such as visual images. Secondly, languages have lexical 'gaps'. For example, in English the word *aunt* does not specify whether a woman is my mother's or my father's sister, or whether a relative by marriage. On the other hand, our mental concept of people to whom this term applies includes exactly this kind of unexpressed detail, along with a wealth of other personal information associated with individual aunts. Moreover, speakers do not always specify the full detail of what they intend. For example, if I state that '*Some of my books are missing*', I do not specify whether I am referring to the books I own, those I wrote, or those on my bookshelf (some of which belong to other people). In order to understand my full meaning, a listener must use 'rich interpretative principles' (Levinson, 1997, p. 19) involving pragmatic and contextual knowledge. There is the related problem of indexicals, which highlight the distinction between thought and words. For example, the thought behind my statement that, '*I will catch the train tomorrow*' may be very different from that behind another person's identical statement on a different day and in relation to a different train. Finally, thought cannot be directly expressed in language but must first be 'filtered' into a linear form. In other words, we have to think-for-speaking. The precise form into which thought is filtered also depends, as already discussed, on the constraints of the particular language being spoken.

Research from the field of gesture provides a nice example of the distinction between conceptual and semantic structure in practice. Kita and Özyürek (2003) studied the gestures produced by speakers of Japanese, Turkish and English as they described a cartoon film. One scene showed a cat crossing a street by means of a suspended rope. This was almost unanimously described by the English speakers as 'swinging'. Turkish and Japanese do not have a readily accessible equivalent of the English verb *swing*. Speakers of these languages instead used verbs such as 'go', 'jump' or 'fly' to describe the same action. The participants' gestures were found to reflect the characteristics of their respective languages, and at the same time to include information that they had not encoded verbally. So the English speakers were more likely than either of the other groups to gesture the cat's arc-like trajectory. On the other hand, speakers of all three languages gestured aspects of the scene that were not included in their descriptions, such as the direction of the cat's movement.

The relationship between language and conceptualisation, or between conceptual structure and semantic structure, is clearly very complex and far from unanimously agreed upon. However, while the differences between the various models are clearly significant, the present study does not primarily aim to shed light on the precise nature of this relationship. Instead, it takes its cue from Levinson's (1997) call for an empirical approach as the only sensible way out of the theoretical quagmire:

"Very clever scholars have gone round and round in very different circles on the abstract question of the relation between semantics and cognition. But if we could find a way of turning the issues into a matter for empirical investigation we might get a lot further a lot faster and escape the circles." (Levinson, 1997, p. 29)

The basic question asked in this study is whether the verb production difficulties of certain people with aphasia can be explained by reference to processing at the conceptual level. Unlike the psycholinguistic models of Garrett and Levelt, the various linguistic theories described above do not furnish a clear enough 'model' of the relevant processes to be useful as the basis for testing the impairments of people with aphasia. Rather than keep re-entering the debate on the specific nature of the relationship between semantics and cognition, therefore, the study situates itself within the psycholinguistic territory outlined by Levelt (1989). The novel tasks it describes aim to probe aspects of conceptualisation that are at least consistent with the processes of Microplanning outlined in Levelt's model. They are also related to Dipper et al's (2005) notion of the 'paring down' of conceptual information into a form that is well matched to the demands of a particular language system. The Order of

Naming Test (described in Chapter 3) investigates the way in which speakers adopt a focus over situations, through their selection of referents and the order in which they name participant entities. The Sharon and Paul Test (Chapter 4) explores the process of perspective taking, probing some of the factors that help people to adopt a perspective over more complex situations. Finally the Action Gesture Test (Chapter 5) focuses on the non-verbal communication of events, exploring the relationship between action naming and the production of action gestures. Although this test is not directly related to Levelt's model, it is based on a model of gesture production (de Ruiter, 2000) that is very closely related to Levelt's account (see section 1.10.).

The following sections turn more specifically to the empirical investigation of conceptual-level processing. Section 1.4 first introduces some general issues about the processing of entities and relations, before existing investigations of conceptual processing in people with aphasia are considered in section 1.5.

1.4 Investigating conceptual processing: entities and relations

Most studies that have specifically considered the nature of language processing at the conceptual level have investigated the processing of events and states. There is a good theoretical foundation for this bias, since thinking for speaking difficulties are likely to be more clearly manifested in the encoding of relations than in that of entities. Black and Chiat (2003b) suggest that the essential difference concerns the relative tightness of fit between the underlying conceptual and semantic representations: the mapping between relational concepts and word meanings is even less direct than it is for entities. Entities are relatively clearly demarcated, typically persist over time, and are likely to be easier to identify by reference to their perceptual or sensory properties. "Relations, on the other hand, even quite basic and sense-based ones, are less exhaustively defined by sensory properties, are encoded by a greater variety of syntactic categories and vary much more drastically from language to language" (Black and Chiat, 2003b, p. 240). Gentner (1982) and Gentner and Boroditsky (2001) similarly argue that both perceptual/cognitive experience and language influence how we organise concepts, but that the extent of their influence varies between different kinds of words. At one extreme are concrete nouns, which can be largely conceptualised from perceptual experience. At the other are closed class terms, such as determiners and conjunctions, whose meanings only exist within language. Relational terms such as verbs and prepositions lie between the two, requiring some knowledge of the target language to be learnt and understood. As a result, the thinking for speaking dilemma facing the language-learning child should be more apparent in the conceptualisation of relations than of entities.

A range of experimental evidence supports this argument by suggesting that it is more difficult to identify the precise meaning of a verb, particularly an abstract verb, from a stream of speech than it is to pick out the referent of a noun. For example, Gleitman and Gillette (1995) and Gillette, Gleitman, Gleitman and Lederer (1999) report well-known experiments in which adult participants saw silent films of mothers playing with their children. They were asked to identify the meaning of the word being uttered whenever a beep sounded, having first been primed as to whether the target was a noun or a verb. Targets were all of high frequency, although the mean frequency of the nouns (22.9) was lower than that of the verbs (35.3). All but two of the nouns referred either to visible objects or to familiar people (e.g. Daddy, Mommy).

The participants were able to identify 45% of the nouns used by the mothers, but fewer than 15% of the verbs. Moreover, at least one participant identified each of the nouns, whereas a third of the verbs was identified by none. In general, verbs that referred to concrete physical actions (e.g. *push*) were much more readily identified than those referring to mental states (e.g. *want*, *love*, *think*). However, when participants were given the nouns that the mothers had used in the context of the same verbs, their success in identifying the verbs almost doubled (29%). When nonsense syntactic frames were provided for each verb (e.g. '*Gorp the fendex*'), their score rose to 90%. Clearly, the relative difficulty of picking out the conceptual referent of a verb means that the language learner is more reliant on structural features. The nature of the language input to the child is also influential – both in terms of the particular features of the target language (for example, its word order and morphology), and the way in which parents typically use it when talking to their children (Gentner, 1982).

All of this suggests that, for the language-learning child, the thinking for speaking dilemma is likely to be especially marked in relation to the expression of relational information. Although the evidence about children's development of verbs versus nouns is hotly debated, a number of reviews conclude that there is indeed an early advantage for nouns cross-linguistically (e.g. Gentner, 1982; Black and Chiat, 2003b; Gentner and Boroditsky, 2001). This is true even of speakers of languages such as Korean and Mandarin, where verbs are more prominent than nouns in adult speech, and where children typically learn verbs sooner than, for example, English-speaking peers. The relatively greater difficulty of thinking for relational meaning is also reflected in the particular problems with verbs and verb structure demonstrated by many children with developmental language impairments (e.g. Watkins, Rice and Moltz, 1993; Conti-Ramsden and Jones, 1997; Leonard, 1998; Black and Chiat, 2000).

1.5 Investigating conceptual processing in aphasia

A central question in relation to the processing of conceptual representations in aphasia is whether the process is the same as for the language-developing child. Assuming that they were not previously language-impaired, adults with aphasia have a language system that was fully developed before the onset of aphasia. This means that they had presumably long established relationships between conceptual and semantic or syntactic representations. In other words, their thinking for speaking was probably automatic and trouble-free. Indeed Levelt suggests that, for an adult speaker, the language-specific requirements imposed by the Formulator become part of the Conceptualiser's procedural knowledge base. This means that "it is no longer necessary for the Conceptualizer to ask the Formulator at each occasion what it likes as input" (Levelt, 1989, p. 105). Adult speakers just know how to think for speaking.

However, it is not clear how vulnerable these habitual processes are to damage to the language system. One suggestion, as outlined above (e.g. Dipper, 1999; Black and Chiat, 2000; Dipper et al, 2005), is that the loss of linguistic information is itself likely to affect the thinking for speaking process, by lessening the constraints on the links between conceptualisation and language. This may lead people with aphasia to construct messages that are less well matched to the demands of their language system. This is likely to be particularly marked for concepts that are more dependent on language, rather than for those that may be more fully conceptualised by reference to non-linguistic, perceptual or cognitive features. As with children learning language, therefore, expressing relational information is in general likely to be more vulnerable than talking about entities. However the distinction is not absolute. As Black and Chiat (2000) point out, once the relevant representations are established, verbs and nouns will be processed differently, but their relative degree of difficulty may differ for different individuals. While verbs are more problematic for many people with aphasia, therefore, the reverse pattern also occurs (e.g. RG: Marshall, Chiat, Robson and Pring, 1996).

The suggestion that damage to the language system affects the processes of conceptualisation is not uncontroversial. For example, Levelt's model acknowledges the possibility of feedback from language to the conceptual level, but argues that it is not supported by empirical evidence. The proposal is also very difficult to test, since both the processes under consideration and the constraints that are hypothesised to work upon them are hidden from experimental view. Conceptualisation is only observable through the behavioural systems, such as language, that interact with it (Pederson and Nuyts, 1997). It is also not immediately clear why, if losing language affects the constraint processes in this way, some people with aphasia appear to have trouble in the mapping of conceptual and linguistic relations, and others with similar language impairments do not. However, with these provisos, the following sections move on to consider the small number of people with aphasia who have been specifically hypothesised to have difficulty in conceptualising events. In doing so they also introduce some of the methods that have previously been used to explore this area.

1.5.1 LC (Byng et al, 1994)

LC was a 62-year old woman who had had aphasia for 18 years at the time of investigation. Her aphasia was described as agrammatic, with good functional comprehension but very limited production. Her output consisted almost entirely of single words, with very little evidence of combined phrases. When she was asked to name pictures of objects and action homonyms (e.g. '*paint*'/'*paint*'), LC was significantly more successful at producing nouns than verbs. Her comprehension of reversible sentences was also impaired, with a large proportion of reverse role errors. Importantly for the event processing hypothesis, LC also performed at a chance level on a test in which she was asked to distinguish pictures of events and non-events. For example, a picture of a car driving down a road had to be distinguished from a street scene where nothing was happening. LC's performance on other tests suggested that she did not have a basic impairment in deriving information from pictures. Instead, she seemed to have a significant difficulty in conceptualising events.

LC took part in a therapy programme that replicated an earlier successful intervention for individuals with mapping impairments (Byng, 1988). This aimed to improve the participants' understanding of event structure by helping them focus on the nature of the action and on the roles played by event participants. One way in which this was achieved was by asking them to identify the salient difference between pictures of two otherwise identical situations - for example, a different agent. This conceptual element was linked to the production of more structured output by asking the participants to match the relevant actions and entities to written phrases. The final stage of the therapy encouraged carry-over to spontaneous communication, using a range of less controlled stimuli.

LC did not respond as well to this therapy as the other study participants. Her ability to name verbs in isolation improved significantly, and she produced fewer single phrase utterances, but her production of combined verb-argument structures did not change. Interestingly, she fared much better when re-tested on the event/non-event task. However this was entirely thanks to an improvement in her ability to identify pictures of events with animate agents. The authors suggest that therapy helped LC to conceptualise events from pictures, specifically by helping her to perceive when an event was occurring, involving particular participant entities. However this improvement was limited to events in which the agent was an animate entity. In addition, LC still had trouble in distinguishing events and identifying their participants if the stimulus showed more than one event occurring at once. For example, one of the therapy stimuli showed a boy reading a book while a woman listened. This was presented alongside a picture of a woman reading with a boy in the background. LC was not able to distinguish the different roles of the participant entities in this kind of scene. She could not identify the person participating in the event labelled by a particular verb (in this case, '*reading*') from another person who was present in the scene but not directly participating in the named event.

1.5.2 MM (Marshall, Pring and Chiat, 1993; Marshall, 1994)

MM was a 64-year old woman who had longstanding aphasia of 14 years. Her aphasia was severe and non-fluent, with very limited verb production, almost no sentence-level output, and evidence of mapping difficulties. MM's verb difficulty clearly went deeper than a problem of access. She had great difficulty in naming action pictures, and even when given the target verb, produced only six out of ten responses that included the verb, and only two in which it was appropriately combined with an agent or theme. MM also produced a large number of nouns in place of verbs, including 'pseudo-verbs' such as '*chipping*' and '*carroting*' in place of '*eating*'. Her descriptions of event pictures appeared to be less directly focused on key arguments than those of non-brain damaged speakers, often including objects that were peripheral to the main event. For example, describing a picture of a woman driving a car, she said:

'my car ... Ford Escort ... blue (writes '*mirror*') .. and er Ford'

When describing 50 event pictures, MM named a total of 34 optional nouns and adjectives that would typically appear within modifying phrases. Non-brain damaged controls on average included just 20.6 (range = 8–28).

MM also made errors on two new tests of event conceptualisation that required no verbal output. The first was the Event Perception Test (Marshall, Chiat and Pring, 1999). This assesses the ability to pick out the features of events that drive verb selection. In each item, two representations of a single verb must be identified from either a semantically related or an unrelated distractor. For example, one item requires identification of the distinction in manner between *pouring* and *dripping* events. Many of the distractors are also visually similar to the targets. MM made errors on ten out of the 60 items in this test, while non-brain damaged controls made no more than three. Eight of MM's errors were semantically related to the targets.

The second event processing test was the Role Video. This assesses a person's ability to analyse an event's role structure. MM was asked to watch 32 filmed events, 16 of which were reversible and 16 non reversible. After the first presentation she was given three photographs showing possible outcomes, and after a second viewing she was asked to select the correct one. In each case, one distractor shows the outcome of the same action but with participants playing different roles, while the other shows the outcome of a different event. For example, a reversible event in which a woman shoots a man is presented with photographs of the man dead (the target), the woman dead (the role distractor) and the man wearing a coat (the event distractor). In the case of the non-reversible items, the role distractor replaces one of the participants with an entity that was present in the original film but not a participant in the target event. For example, a non-reversible item in which a woman burns a newspaper is presented with photographs of the burnt newspaper (the target), a burnt box (the role distractor) and a torn newspaper (the event distractor).

Control data for this task is limited, but suggests that non-brain damaged speakers had no difficulty in selecting the correct outcome. MM similarly had no trouble on the non-reversible events, showing that she understood the task and was not hampered by its format. However, she made five errors on the reversible items, selecting the role distractor in each case. This suggested that she had some difficulty in analysing the role structure of these events. It seemed unlikely that this reflected a problem in distinguishing the two animate participants, since she knew both of the actors and frequently named them in the course of the task.

MM's thinking about events appeared to be off beam. Unlike LC, she was clearly able to identify that an event was happening, and could conceptualise its core nature, since she never picked event distractors. She could also understand basic cause and effect sequences, since she was able to identify appropriate outcomes for non-reversible events. The fact that she never picked role distractors for the non-reversible events also suggested that she knew who or what was involved. Her difficulty appeared to lie in conceptualising the key protagonists within reversible events, and in identifying their roles. Marshall et al therefore designed a therapy programme that aimed to help MM think about events in a more structured fashion, and specifically to improve her focus on their role structure. The therapy was entirely at this 'thinking' level, without any explicit emphasis on sentence production.

MM was once again asked to watch filmed events. She was then asked to identify the agent from distractor photographs. For example, after seeing a film of a man ironing a shirt she was asked to pick the man from distractor photographs of a woman, the shirt and the iron. Therapy then moved on to selection of the theme, with prompt questions that focused MM's thinking on the nature of the change that had taken place (e.g. '*Which one ends up ironed?*'). Finally MM was asked to think more explicitly about the nature of the action. Given pictures showing different possible outcomes (for example, an ironed shirt and a torn shirt), she was again asked to select the appropriate outcome, with encouragement to describe or gesture the action that had taken place.

MM was also asked to describe 50 event pictures pre- and post-therapy. Of these, 20 represented treated verbs, 30 untreated, including ten three-argument verbs (e.g. a woman selling a car to a man). Post-therapy, MM's descriptions of both the treated and untreated two-argument items included more verbs and better structure. They were also significantly more comprehensible to observers. However, there was no difference in her descriptions of less constrained events involving three participants, or in her production of more open narratives. An additional task provided support for the suggestion that the degree of constraint was the key stumbling block preventing improvements in spontaneous communication. Here, MM was asked to describe 50 filmed events (devised by Byng and Black, unpublished). These included single events (e.g. a man playing the piano), multiple events (e.g. a woman kissing a man while he eats a biscuit), and single events with multiple perspectives (e.g. a woman feeding a child / the child eating). Each description was scored for the completeness of its verb-argument structure. MM's descriptions demonstrated clear difficulties with the relatively less constrained multiple-event and multiple-perspective items. While she achieved almost 60% of the maximum possible score for her descriptions of single events, this fell close to 40% for the multiple events and below 30% for the multiple-perspective events. This finding suggested that, though MM's skills in event analysis and description had improved, the changes still depended upon the degree of constraint offered by the stimulus. The greater thinking for speaking demands of more open contexts, such as describing complex and unconstrained situations, were still very problematic for her.

1.5.3 EM (Dean and Black, 2005)

This study took a rather different tack from the previous investigations of event processing in aphasia. Rather than concentrate on the potential effects of event processing difficulty on verb production, it also considered their effects on the production of noun phrases within event descriptions. The investigation was based on the hypothesis that difficulties in event conceptualisation would cause trouble in identifying the entities that are central to each event, leading either to omission of key participants or to naming of peripheral entities. A similar effect had already been observed in relation to MM (above), who typically named a larger number of peripheral or optional items than non-brain damaged speakers. Kemmerer and Tranel (2000) also reported similar results in relation to an action naming task. Participants with verb impairments in their study produced a number of nouns in place of the verb targets, including names of both participant and non-participant entities. Dean and Black's study therefore investigated both verb and noun production in two people with aphasia. One (EM) was hypothesised to have difficulty in processing events, while the other (MH) was thought to have a later stage difficulty in accessing (orthographic) output forms.

EM was a 24-year old woman who had acquired aphasia following a horse-riding accident. Her output was non-fluent, mainly consisting of single words and two-word combinations, and with a disproportionate verb deficit. She also made a large number of role-related errors on a test of reversible sentence comprehension (the Reversible Sentence Comprehension Test - Byng and Black, 1999). EM additionally completed the two event processing tests devised for MM (above), making errors on the Event Perception Test but not on the Role Video. This suggested that she had trouble in identifying and comparing the core semantic features of events (those that drive the selection of a verb label), but could process role information so long as no language was involved. However, her semantic deficit was not confined specifically to the processing of events, since she also made errors on a test targeting access to the semantic features of objects (the Pyramids and Palm Trees Test - Howard and Patterson, 1992).

EM and MH were asked to 'describe the main thing that is happening' in 33 pictured scenes. These were selected from a larger set on the grounds that they elicited the highest degree of verb and noun naming agreement from non-brain damaged controls. EM's and MH's descriptions were compared to the modal descriptions of the controls, in terms of both verb production and production of extraneous noun phrases. Two stimulus variables were manipulated, on the grounds that they were likely to affect production for people with event processing difficulties, but not for those with later-stage impairments. The first was the format of the stimulus: each situation was presented in the form of a photograph and a line drawing. While the photographs included a certain amount of peripheral detail, the line drawings were deliberately pared down so as only to include the entities mentioned in the controls' modal descriptions. The second variable was the situation type depicted. These were divided according to the type of verb represented[1]. *Narrow* situations represented verbs that describe a single Act or Process (for example, *pray*), while *wide* situations encapsulated a more complex combination of Acts, Processes and States (for example, *paint*). The line drawings and the *narrow* situations were predicted to elicit descriptions from EM that were closer to those of the controls, on the grounds that they would exert lesser demands on her thinking for speaking skills.

Interestingly, neither stimulus manipulation had a significant effect on EM's verb production. However, she did produce significantly fewer non-target nouns to both line drawings and *narrow* focus situations. Neither manipulation had any effect on MH's output. Dean and Black argue that the difference in EM's noun phrase production in response to the different stimulus types supports the hypothesis of an event processing impairment. However, it is possible to imagine other underlying reasons for the same naming pattern. For instance, her response could reflect the adoption of a deliberate or unconscious naming strategy: faced with the difficulty of describing event pictures, she may have naturally fallen back on her much stronger access to nouns than to verbs. Complex photographs, containing a large amount of peripheral detail and a number of extraneous objects, would naturally encourage this more than pared down line drawings, where only the key participants were depicted. Similarly, it is possible that wider-focus situations, where more elements have to be encapsulated within a single verb, may involve more objects that could potentially be named. At any rate, it is not clear whether the number of objects depicted was explicitly controlled across situation types in the design of the test materials.

[1] This manipulation is based upon the system of classification described in Black and Chiat (2003a).

It is also interesting that the stimuli that were hypothesised to support EM's thinking for speaking did not in fact elicit significantly more verbs. As Dean and Black argue, this may be a facet of the number of items involved (particularly in terms of situation type, where only 12 narrow-focus situations were included). However, the hypothesis that these items imposed lesser thinking for speaking demands than the others might also be questioned. For example, by removing all peripheral details the line drawings might be expected to induce more constrained object naming than the photographs. However, their essential verb-related thinking for speaking demands may have been the same, since each item represented only a single salient event, which was depicted in exactly the same way in both formats. For example, in order to access a verb to describe a picture of a woman feeding a baby, the speaker must make the same decisions about the focus of the feeding/eating event, the perspective from which it should be described and so on, regardless of whether the picture is a photograph or a line drawing. Narrow focus situations, on the other hand, should involve less 'encapsulation' than wide. The fact that they did not elicit better verb production suggests either that, despite this, they may not in fact impose lesser thinking for speaking demands, or that EM did not have the kind of difficulty hypothesised.

In general, EM illustrates the difficulty of testing in this area. The primary hypothesis about her verb production was not upheld. Her noun production behaved in the way predicted, but it is not clear that this was entirely owing to conceptual factors. It proved difficult to design stimuli that were not open to other potential influences. It is also difficult to isolate EM's hypothesised event processing difficulties from other factors, such as a general semantic deficit. The effect of various stimulus manipulations on event conceptualisation for verb naming is further considered in relation to one of the tests devised for the current study (the Sharon and Paul Test, Chapter 4).

1.5.4 Dipper (1999)

Dipper (1999) devised a number of new tests to assess the event processing skills of a group of six people with non-fluent aphasia. Her tasks had a different basic motivation from those in the present study, since their main aim was to distinguish the various component processes within event conceptualisation. Their design was as a result more strongly influenced by the theoretical models of conceptualisation than by the individual profiles of the participants. Responses were hypothesised to concur with a proposed hierarchy of processing complexity.

One novel assessment was the Event Video. This was an extension of the event/non-event test used with LC (Byng et al, 1994, above). Dipper's version presented filmed scenes for classification as either events or non-events, requiring scanning of their temporal profiles. This task was also used in the present study, and is described in more detail in Chapter 2. A second assessment (the Event Photographs) was an odd-one-out task in which participants were asked to distinguish photographs of events and states on the basis of the situation type represented. Situation types were broken down according to a set of basic conceptual categories: HAVE, BE, ACT and GO. A third task focused on perspective taking. Filmed situations were presented in a way that was biased as to perspective, and the matching verb had to be selected from distractors. For example, a *pulling/pushing* scene was shown with the 'pusher' highlighted, alongside the options *pull*, *push* and *lift*. This task is discussed in more detail in relation to the design of the Sharon and Paul Test (Chapter 4). Dipper's assessment battery also included the Role Video (Marshall et al, 1993, above).

Of the six participants in Dipper's study, two were unimpaired across the range of event processing tasks. One (LS) demonstrated some difficulty on all tasks, while two others (RB and RK) made significant errors on some tasks but not others, in line with the proposed hierarchy of processing complexity. The final participant (JD) also made errors on certain tasks, but these did not concur with the proposed hierarchy. These results are rather difficult to interpret collectively. The differences between the participants' performance suggested that the tasks tapped different skills. However, the participants' responses did not unanimously support the proposed processing hierarchy. Only one person made errors across the board, suggesting that the hypothesis of an event processing difficulty was very plausible in his case. However even he did not score at a chance level on any task. JD's responses went against the proposed hierarchy, suggesting either that the hierarchy was flawed in some way, or that another explanation must be sought in his case. Nor could any task really be considered 'diagnostic' of event processing difficulty, in that it consistently elicited poor performances from every participant for whom an event processing deficit was hypothesised. The task that came closest was in fact the Role Video, on which three out of the six participants made a significant number of errors, though none performed at a chance level. Overall, while it provides useful insights into the nature of event conceptualisation, Dipper's study also demonstrates the difficulty of designing really robust, valid tests to tap such a covert level of processing.

One of the six participants (RB) also took part in the present study. Here he is known as 'Ron'. Despite the fact that in Dipper's study he only performed at a significantly impaired level on the Role Video, it was felt that he may have particular event processing difficulties that were not fully tapped by that study's tests. With more closely-targeted assessments, a number of differences between Ron's processing of events and that of non-brain damaged control participants came to light. These are discussed in detail in chapters 2 to 5.

A small amount of evidence further suggests that therapy based on bolstering a person's event processing skills may be helpful, even for individuals whose primary impairment is not at the conceptual level. One further case study will be discussed as an example. Unlike most of the mapping therapy studies, many of which also include some element of event analysis, this study explicitly considered the role of event processing in the design of its intervention.

1.5.5 EM (2) (Marshall, Pring and Chiat, 1998; Marshall, 1999)

EM (not the same as the EM discussed by Dean and Black, above) had non-fluent, agrammatic speech, with severe difficulties in verb production and very little sentence structure. Her spontaneous speech contained almost no verbs, and consisted mostly of isolated noun phrases. She could also access nouns much more successfully than verbs in picture naming tests. On the other hand, EM could write, read aloud and understand verbs. Her verb difficulties therefore seemed to arise in the process of accessing phonology from semantics. This also affected her sentence production. When she was given a verb, 84% of the sentences she constructed were semantically and syntactically acceptable.

EM took part in two therapy programmes. The first aimed to help her access a corpus of 35 verbs. This led to an improvement both in her verb production and in her production of argument structure when describing pictures of the treated verb set. However, there was no improvement in her production of untreated verbs. Nor was there any change in her spontaneous speech or narrative, even when the narrative stimulus was constructed so as to target treated verbs. Therapy seemed to have improved EM's ability to access a limited set of verbs but, just as with MM (above), her success depended on the degree of constraint present. In describing pictures, verbs could be achieved; in open narrative, they could not. Once EM had accessed a verb, she was able to build an argument structure from it.

The second therapy programme included two strands. One aimed to facilitate EM's access to a small group of fairly general verbs (*go*, *come*, *leave*, *give*, *get*, *put*, *take*, *bring*, *make* and *change*), since these are relevant to a wide range of situations. The second addressed EM's difficulty in describing complex or unconstrained situations by helping her break them down into a series of focused, unitary concepts. EM was asked to retell the content of unconstrained film clips, supported by reminders to use her general verbs and conscious strategies such as focusing on one event at a time and concentrating on the main action shown. She was also encouraged to gesture each main action and to use her gesture as a means of holding onto the concept while she tried to access an appropriate verb. This led to further improvement in EM's verb naming and in her narrative production, where she was able to signal more verb-argument structures. Her narratives were also significantly more comprehensible to observers. Interestingly, the general verbs played little part in this improvement, since EM hardly used them in her narratives. On the other hand, 65% of the verb phrases produced in her post-therapy narratives were supported by gestures. Moreover, EM sometimes refined her gestures until she could access an appropriate verb. The success of the gestural element of the therapy supports the suggestion that it was the thinking aspect that was particularly useful, helping EM to focus on single event concepts at a time. Despite the fact that EM's event conceptualisation was not out of kilter in the way that LC's or MM's appeared to be, therapy still needed to support her processing of complex or unconstrained situations in a similar way.

1.5.6 Summary of studies of event conceptualisation

Taken together, the existing event processing studies suggest that the concept of event conceptualisation has 'psychological reality'. At any rate, the difficulties of the individuals described could not be fully explained by reference to the 'later' stages of language production models such as those of Garrett and Levelt discussed earlier. For example, although LC and MM both had great difficulty in forming predicate-argument structures, their difficulties were not fully explained by reference to hypotheses of impairments in the mapping between thematic and syntactic structure. Mapping-based therapy was also less helpful for LC than for other participants in the same study who had more clear-cut mapping deficits. On the other hand, therapy that specifically targeted the analysis of events had some effect on LC's and especially MM's production, even if gains were limited to certain more constrained contexts. Even for someone like EM (2), whose primary impairment was not in the processes of event conceptualisation, therapy targeting her focus on events proved helpful in structuring her event descriptions.

To return to the question raised before the discussion of these studies, can the studies of event conceptualisation in aphasia shed any more light on the way in which damage to the language system affects thinking for speaking skills? Marshall et al (1993) suggest two possible views of the relationship between event conceptualisation and verb production. In one, event conceptualisation is an independent stage in sentence production, occurring before verb selection and the creation of a predicate-argument structure. This means that we should be able to find people with aphasia who have intact event conceptualisation but disordered verb retrieval. The opposite dissociation would not be expected, since verb retrieval would depend on event conceptualisation. Therapy based on event analysis might then be useful both for people with specific event processing difficulties, and for people with 'later' verb retrieval or mapping deficits like EM (2). However, disordered event processing would definitely require therapy directly addressing this level, since there would not be any feedback from therapy targeting later stages to the processes of conceptualisation themselves.

In some ways, this model is appealing, since it fits with the small amount of evidence available from the reported single cases. However, it is much less well aligned with the literature on thinking for speaking in other populations, or with the proposals about conceptual processing in aphasia made by, for example, Dipper et al (2005). In the second proposed view, the relationship between event processing and verb access is more interactive. Here, the way in which a situation is conceptualised for talking is in part shaped by the range of verbs available to describe it. Marshall et al (1993) suggest that, if this view is correct, every individual with verb retrieval or mapping difficulties will also have trouble in conceptualising events. From the small amount of evidence available, this seems unlikely to be the case. For example, EM (2) had difficulties with verb access whose root cause was not a difficulty in processing events, as did MH in Dean and Black's (2005) study. One of the questions addressed in the present study is whether, given a group of individuals with verb problems, it is possible to distinguish those who have difficulty in conceptualising events from those who do not. Marshall et al (1993) additionally argue that, under the second view, impairments in either event processing or verb retrieval should respond to therapy targeting the other. Again, the evidence relating to therapy from the present studies is limited, but LC's response suggests that her difficulties in conceptualising different types of events needed to be addressed more directly.

Perhaps a midway solution is required. This might argue, for example, that the conceptual and linguistic levels indeed interact in the way suggested by the second view, but to different degrees for different individuals with aphasia. For some people, for whom the habitual links between conceptualisation and language are very strongly established, damaged access to verbs will not seriously dent their ability to conceptualise events in a language-relevant way.

At least, they will be able to do the rather crude tasks that we can devise to test this level of processing. For example, years of familiarity with the mappings between change of possession events and the verbs in their own language may mean that they are still able to judge a particular event's core nature, even when their access to the range of verb options is limited. They may still know, for example, that a particular event represents a free, one-way and permanent change of possession, even if they cannot label it as 'giving' rather than 'lending'. For other individuals, for whom the links are perhaps less strongly established, or for whom the basic processes of conceptualisation are themselves damaged in some way, both their ability to make such judgements and their access to relevant verbs may be impaired. Black and Chiat (2003b) similarly suggest that different individuals may be influenced to different degrees by conceptual and linguistic constraints, or that they may interact in ways that are as yet unspecified. A further possibility is that the loosening of the habitual links between concepts and language is a chronic process, so that thinking for speaking becomes gradually less automatic as time passes. It is striking that several of the people who have been described as having difficulty at the conceptual level have had very longstanding aphasia (though of course this may simply reflect the practicalities of recruitment).

While the present study does not aim to answer the question of how language loss affects event conceptualisation definitively, the more empirical approach adopted should provide some additional evidence. The study investigates a group of six individuals who all have difficulties in producing verbs and sentences, and asks which of them, if any, additionally shows evidence of event processing difficulties. If we find that some individuals appear to have difficulty in conceptualising events, but others do not, this would either support the 'separatist' view, or the more moderate midway argument. In other words, it would either suggest that event processing and language production are separate processes that can dissociate in aphasia, or (perhaps more likely) that language can indeed influence conceptualisation, but in a way that differs for different individuals with developed adult language systems.

One final important question needs to be considered before moving on to the specific thinking underlying the development of the study's novel tests. This is the question of the relationship between thinking for speaking and thinking per se. Closely related to this is the question of to what extent non-verbal cognition remains intact in people with aphasia. This is the subject of the following section.

1.6 Thinking for speaking and non-verbal cognition in aphasia

In order to make a strong case that thinking for speaking is a genuine aspect of processing that can be significantly affected in aphasia, it is necessary to distinguish those individuals who have thinking for speaking difficulties from others with more general cognitive deficits. This links to a much wider debate in both the developmental and acquired literatures on the relation between language and cognition. If, for instance, the proponents of a 'cognitive conception of language' (Carruthers and Boucher, 1998) are correct, and language is centrally implicated in thinking, then language loss will necessarily have a profound effect on a person's general thinking abilities. If, on the other hand, a 'communicative conception of language' is more accurate, and language communicates rather than constitutes thought, then damage to a person's language will not necessarily so directly affect his or her non-linguistic thinking. The issue is complicated in aphasia by the fact that strokes are rarely entirely focal, so that damage is frequently seen in more than one processing domain.

Various studies, using different tests, have pointed to a link between aphasia and lower scores on measures of non-verbal cognition (e.g. Selinger, Adams Walker, Prescott and Davis, 1993; Kauhanen, Korpelainen, Hiltunen, Maatta, Mononen, Brusin, Sotaniemi and Myllyla, 2000). Selinger et al (1993) asked people who had had left- and right-sided CVA's and non- brain damaged controls to complete a set of six visuo-spatial puzzles. These involved re-creating a given shape from its component parts. Three shapes represented real objects (e.g. a butterfly), while the others were non-representative shapes. Participants with right hemisphere damage unsurprisingly found the task very difficult, constructing only 8% of items correctly. Those with left hemisphere damage fared better, achieving 48% correct, while the non-brain damaged group achieved 82%. All participants found the real objects easier than the non-representative shapes. The authors argue that this was because the real objects could be named. If so, it is interesting that even the participants with left hemisphere damage found them easier. This group had demonstrated more difficulty in constructing the non-representative shapes than the non-brain damaged controls. Selinger et al suggest that, when faced with real objects, they were able to recruit some preserved naming ability to support their visuo-spatial skills. However, as might be expected, they were not as successful in doing so as the control participants. An alternative possibility is that, rather than being easier to name, the real objects were more readily recognisable by reference to stored visual templates. It is difficult to tease these two possibilities apart, however, since the authors do not report whether there was a correlation between the participants' ability to construct the real objects and their success in naming them.

Despite such evidence, aphasia is frequently regarded as a disorder in which non-verbal cognition remains unaffected. This view is certainly supported by the subjective experience of interaction with many people with aphasia, who clearly retain excellent social skills and are able to achieve many tasks that require a range of cognitive abilities – for example, driving, managing finances, map-reading, and so on. Varley and colleagues (Varley, 1998, 2000, 2002; Varley and Siegal, 2000; Varley, Siegal and Want, 2001; Siegal, Varley and Want, 2001; Varley, Klessinger, Romanowski and Siegal, 2005) have taken a different tack from the group studies of cognition in aphasia to explore the relationship between language impairment and some of the cognitive skills underlying such tasks. Rather than testing large numbers of participants for possible associations between their language and non-verbal cognition, they have carried out a series of single case studies probing for dissociations between language and specific forms of thinking. Evidence from these studies has provided insights into the role of language in several different spheres. For example, a number of people with very severe aphasia, who had no access to grammatical propositions in either input or output, have demonstrated success on a range of tasks that had previously been thought to be dependent on language. The impairment to these individuals' propositional language was so severe as to preclude covert linguistic support to their thinking. Yet individual participants performed well on tests of causal reasoning, hypothesis testing, mathematical thinking and Theory of Mind tasks.

SA (Varley and Siegal, 2000; Varley, 2002; Varley et al, 2005) offers particularly striking evidence. He had severe aphasia and apraxia, with significant difficulties in verb and sentence comprehension and on grammaticality judgment tasks. SA's output consisted largely of single nouns. Yet he scored at the 91st percentile on the Wisconsin Card Sorting Test (Heaton, Chelune, Talley, Kay and Curtiss, 1993) and at the 84th percentile on the Story Arrangement subtest of the Wechsler Adult Intelligence Scale (Wechsler, 1981). He was consistently able to identify the appropriate cause for the outcome of a pictured event, and could generate novel causes for both possible and improbable events. He also performed well on tasks tapping Theory of Mind reasoning, in which he was required to infer other people's false beliefs about situations. Finally, he was able to solve a range of mathematical problems including calculation, infinity problems and bracket equations. All of these forms of cognition are therefore at least able to dissociate from explicit propositional knowledge.

Admittedly, only a small number of cases have been reported, and not all participants have achieved an equal level of success on all tasks. However, SA's performance indicates that, while language *may* be used to support thinking in certain circumstances, it is not an essential pre-requisite. Instead, Varley (1998) considers a supra-communicative view of the relation between language and thought. This suggests that language plays an important role in thinking, but that it provides an 'internal scaffold' for thought, rather than either constituting it, or being its necessary medium. Varley points to the use of 'inner speech' in non-brain damaged speakers when they find themselves under heavy cognitive load. The suggestion is that in such circumstances language may be recruited to support more central thinking processes. If the ability to recruit language in this way is disrupted in people with aphasia, this may lead to difficulty in tasks that are not traditionally seen as relying on language, such as some of the complex tasks included in tests of non-verbal cognition. On the other hand, since the proposal is that language supports this kind of thinking, rather than being necessary for it, the degree to which language impairment affects performance on such tasks may vary from individual to individual.

This is somewhat analogous to the suggestion about the role of language in thinking for speaking. As Varley (1998) points out, the proposal of a supra-communicative view of language bears no relation to its role in cognitive development. Just as language may be essential to the laying down of strong mappings between non-linguistic concepts and linguistic structure, so it may play a necessary role in organising the developing cognitive system. However, "Once this configuration has taken place, the new cognitive operations may take place with continued underpinning by the language system, or ... independently of it" (Varley, 1998, p. 145). In SA's case, the latter interpretation is clearly appropriate.

The precise nature of the relationship between language and non-verbal cognitive skills is still not clear. While some studies point to reduced performance on non-verbal neuropsychological tests in people with aphasia, there is considerable evidence that certain individuals with very severe language deficits can do well on particular cognitive tasks. However, for the purposes of the present study it is not necessary to show that participants perform at their pre-morbid levels on such tests. Rather, it is important to demonstrate that their thinking for speaking difficulties are not simply caused by impairments in non-verbal cognition. In other words, we need to show that their ability on (ostensibly) non-verbal tasks dissociates from their performance on tests of conceptual processing. It will be enough if they score within normal limits on such cognitive tests, even if this represents a lower level of performance than they would have achieved before the onset of aphasia. This issue is discussed further in Chapter 2.

1.7 Introduction to the current study

This study aims to contribute to the literature on conceptual processing in aphasia by investigating whether some of the people who have difficulties with verbs and sentences have associated difficulty in processing events. This is not a straightforward task. It is difficult to assess the impact of aphasia at the conceptual level, or to test the effects of conceptual processes relating to events on language. The processes involved are normally unconscious and not readily accessible to introspection, even by people with unimpaired language. They are also hard to reach experimentally. Tapping them requires tasks that (a) are achievable by people with aphasia and (b) do not rely on language skills that may be affected by the very processes being assessed. Nevertheless, the present study aims to contribute to the range of tests available for probing this area. By combining new tests with old, it also aims to offer stronger cumulative evidence about individual participants' ability to organise their thoughts about events for language.

The investigations reported in this thesis are intended to complement the existing studies by targeting the skills of particular individuals. The new tests described also aim to address some of the methodological difficulties highlighted in previous studies. Unlike some other studies in this area (for example, Dipper, 1999), the end point is not the development of a new theory about the nature of event conceptualisation. Instead, the aim is to offer more practical insights into the relation between event conceptualisation and the verb and sentence difficulties of certain individuals with aphasia. The following sections introduce the three novel tests that were devised for the study and discuss the literature that motivated their design. Each section gives a brief overview of the test, leaving fuller details to the relevant chapters. Section 1.8 first describes the Order of Naming Test, which probes speakers' focus over situations through their naming of the entities involved. Section 1.9 then moves on to the Sharon and Paul Test, which examines the effect of cueing on the adoption of perspective. Finally section 1.10 describes the Action Naming Test, which investigates the relationship between language and the generation of action gestures.

1.8 Investigating event focus: The Order of Naming Test

The Order of Naming Test investigates the way in which people adopt a focus over situations, by analysing the way in which they name the people and objects involved in pictured scenes. Participants are shown a series of scenes in which either one person acts upon another or a person acts upon an object. Rather than describing the scenes, they are asked simply to name the entities involved. Their responses are analysed in terms of both their selection of entities for naming from the wider situation and the order in which they are mentioned. On a later occasion the participants are asked to name the same entities, this time arranged in non-relational 'arrays'. They are also asked to produce sentences to describe the original scenes. By comparing the order in which the entities are mentioned in each condition, the test explores the influence of various potentially constraining factors on naming order. The factors explored include causal agency, animacy, page position and sentence structure. The Order of Naming Test was completed by two of the participants with aphasia and a control group of non-brain damaged speakers.

In order to investigate event focus in this way, we need to examine how situations are typically perceived by non-brain damaged speakers. Section 1.8.1 first considers the central role played by attention in the process of event perception. A particularly fruitful approach to the investigation of this typically 'hidden' area is through the use of non-verbal techniques such as eye tracking. Section 1.8.2 examines the evidence gleaned from eye tracking studies about the relation between looking at and talking about events. Section 1.8.3 then presents evidence from some key cross-linguistic studies of the relationship between event perception and language production. This is followed (in section 1.8.4) by more detailed discussion of one factor that seems particularly powerful in constraining our conceptualisation of events: the perception of causal agency.

1.8.1 Constraints on attention in event perception

Attention functions as "a set of related processes directed at reducing or constraining overall input to the cognizer" (Tomlin, 1997, p. 172). In the auditory domain, examples of such processes are the experience of attending to a single conversation at a party, or of concentrating on a particular instrument within an orchestra. The working of the attention system is clearly also central to the processing of events, whether simply for looking or in preparation for talking. However it is less obvious just how attention is constrained, or by precisely what factors. A number of perceptual factors have been proposed. In particular, the system has been shown to be sensitive to manipulations of visual salience. For example, Tomlin (1997) showed participants animated scenes involving two entities. In some cases the entities were animate and the situation dynamic (for example, one fish swallowing another). In others inanimate entities were presented in a static spatial array (for example, a circle above a heart). Participants' visual attention was manipulated just before they started to describe each scene. An arrow flashed above one of the entities in the dynamic scenes, while in the static scenes a cross appeared above one of the shapes. Participants were instructed to keep their eye on whichever entity was highlighted. This had a powerful effect on the structure of their descriptions, in that the highlighted entity was mapped onto sentence subject significantly more often than the non-highlighted entity, even where this resulted in a passive sentence.

While the Order of Naming Test aims to investigate the factors that constrain our perception of situations, it was not designed to probe specifically perceptual factors. For this reason, aspects of visual salience were controlled as far as possible in the test design. However, a number of conceptual factors have also been argued to constrain attention and, as a result, to influence sentence formulation. The Order of Naming Test aims to investigate whether the same conceptual factors that drive sentence construction also influence naming. A large body of evidence suggests that we are naturally drawn towards entities of greater conceptual salience (Schwartz, Fink and Saffran, 1995). Levelt (1989) describes this pull as being towards entities of high 'human interest'; very broadly, those that are the most relevant "in the eyes of the speaker" (Levelt, 1989, p. 266). Many different contributory factors have been proposed, including the degree of agency, animacy, and potency an entity commands (Saffran et al, 1980). Levelt (1989) reviews studies arguing for the influence of additional factors as diverse as humanness, definiteness, unexpectedness, vividness and change of state (i.e. foregrounding of a changing object rather than a static one). Talmy (1996) similarly argues for a general pre-linguistic conceptual preference for dynamism, causing attention to be naturally drawn to the more dynamic elements within situations.

Linguists have long argued that conceptually salient entities are most likely to be assigned to grammatically prominent positions within sentences. For example, Fillmore (1977) proposed a 'Saliency Hierarchy' according to which higher-ranking entities are more likely to be found in the position of a major grammatical function, such as sentence subject or object. In order of influence, this proposes that:

1. An active element outranks an inactive element
2. A causal element outranks a non-causal element
3. A human (or animate) experiencer outranks other elements
4. A changed element outranks a non-changed element
5. A complete or individuated element outranks a part of an element
6. A 'figure' outranks a 'ground'
7. A 'definite' element outranks an 'indefinite' element (Fillmore, 1977, p. 102).

Bock and Warren (1985) provide an example of this phenomenon. In their experiment, conceptual salience was equated with imageability. Participants were asked to listen to a list of spoken sentences, each of which involved two entities, one of high imageability and one of low. Within the list sentences were paired, each pair involving the same main verb and representing a particular alternation. For example, one pair contrasted the active sentence, '*The doctor administered the shock*' with the passive alternation, '*The shock was administered by the doctor*'. Participants' recall was then cued with the same verb. In the recalled sentences, the more imageable entities were topicalised to syntactically prominent roles. This was not simply a question of fronting to an earlier sentence position. The more imageable entity was only highlighted when there was scope for syntactic foregrounding, for example to sentence subject position.

In summary, entities to which attention is directed are perceived as more salient and are foregrounded to syntactically important positions in descriptive sentences. As a result they are most likely to be found in the position of sentence subject. Conceptual factors clearly exert a strong pull on attention, although perceptual factors such as visual salience are also influential. The Order of Naming Test examines whether the same factors that lead certain entities to be highlighted grammatically within sentences also influence our naming of the entities within situations. While the test does not aim to tease apart the large number of conceptual factors that have been proposed, it specifically probes the effects of causal agency and animacy in constraining participants' attention over pictured scenes.

Section 1.8.2 focuses on a particular source of evidence about event perception: studies of eye tracking. Non-verbal methods such as eye tracking are especially useful, since they offer scope for exploring the factors that constrain the very initial stages of the conceptualisation process. They also allow conceptualisation to be compared in different contexts, potentially permitting the influence of linguistic and non-linguistic factors to be teased apart. Non-verbal methods clearly offer additional advantages for the assessment of people with aphasia, since they allow perception to be investigated without demanding access to language. They are therefore particularly pertinent to the present study.

1.8.2 Event perception in non-brain damaged speakers: evidence from eye tracking

Studies of eye tracking strongly suggest that normal event perception is guided in a principled way. Moreover, for any task that requires us to conceptualise event structure, the way in which we look at an event is closely related to the way in which we talk about it. For example, Meyer and her colleagues have explored eye gaze during naming and when speakers are asked to describe event pictures. In the naming condition (Meyer, Sleiderink and Levelt, 1998), pairs of pictured objects were presented side by side, and participants' eye movements tracked while they named them. Direction and duration of gaze were determined by three main variables. First, participants tended to look first at the left most object, and then at the right. Second, how long they fixated on an object depended on whether the object was drawn with complete or partial contours, presumably reflecting the time it took to identify the item. Finally, duration of eye gaze was also affected by the object's lexical frequency. This suggested that participants did not look away from the object until they had both identified it conceptually and accessed its phonological form. A further experiment confirmed the last finding (Meyer and van der Meulen, 2000). Viewing times were found to be shorter when the stimulus was presented with a phonologically related distractor than with an unrelated distractor, again suggesting that duration of eye gaze was related to lexical access.

These findings contrast with the event condition (Meyer and Dobel, 2003). Here the stimuli were again line drawings, this time representing three argument change of possession events (e.g. '*The cowboy gives the hat to the clown*'). Participants' eye movements were tracked as they described the pictures. In this case fixation did not follow a left-right pattern. Rather, first fixations fell on the action region of the event, including the event's object. Only later did participants look at the agent, or giver. They hardly ever looked at the recipient before speech onset. Meyer and Dobel argue that these fixation times reflect the processes involved in event analysis. The early fixation on the object may serve to identify the event type, or even allow the selection of the verb. The agent is fixated for the purpose of language formulation, with subsequent fixations reflecting argument structure and eventual sentence order.

Rather similar conclusions were reached by Griffin and Bock (2000), who analysed participants' eye movements in response to pictures of reversible transitive events. Various conditions were explored. Two groups of participants had to describe the pictures, one while looking at them and one after they had been removed. A third group had to make decisions about who was the victim of the action. This required them to extract the causal structure of the event but not, at least overtly, to form a linguistic frame. The fourth group was simply asked to look at the pictures.

Participants in the fourth group did not systematically focus on any one region until 1,300 ms after onset. In other words, as long as they were not required to speak about the events, their attention was not initially drawn to elements related to event construal or language structure. On the other hand, the early pattern of eye gaze in the first (extemporaneous speech) condition was very similar to that in the third (victim-detection). This was particularly noticeable in relation to the relative attention paid to agent and patient, as reflected in the time point at which fixations on these two entities diverged. The similarity in response to these two conditions is interpreted as indicating that speakers extract the causal structure of an event *before* starting to speak. Response times in these two conditions were also similar: people both detected patients and started to describe the events after approximately 1,690 ms. A reasonable conclusion is that both groups were quickly formulating decisions about the role structure of the events. Being asked to identify the victim (or patient) of an event, perhaps unsurprisingly, requires a similar kind of analysis to event description.

Griffin and Bock further argue that this analysis of the event's causal structure was occurring before speech production (though not necessarily without any influence from language structure). Further analyses suggested that, in the speaking condition, there was a strong relationship between the order of subsequent eye fixations and word order. Speakers fixed their gaze on entities while they prepared words to refer to them. Before speaking, participants typically spent a longer time looking at the element that was to become the subject of the sentence. Once speech began, they spent more time on objects. The conclusion from this study was that people quickly apprehend the causal structure of events, and that an overall process of conceptualisation precedes sentence formulation. Eye gaze patterns are very similar in tasks that require conceptualisation of events, whether people are describing events or thinking about their causal structure. Once speaking, our eye movements seem to be governed by the language we use.

Taken together, the eye tracking studies indicate that, when we do any task that involves thinking about event structure, our looking is closely related to event conceptualisation. We quickly enter into a process of analysis, during which the event's causal structure, and possibly its argument structure, may be identified. The Order of Naming Test builds on this evidence by further probing participants' thinking about the entities involved in events, aiming to uncover more of the constraints in operation, and looking for specific differences between non-brain damaged speakers and some individuals with aphasia. The test investigates the way in which we name event participants, rather than how we look at them, and asks whether naming is organised in a similarly structured way. It is therefore not a test of 'pure' event focus in the same way as some of the eye tracking studies. Rather, it represents an attempt to use an easily-accessible method to probe how the product of the early construal phase is transformed into language.

The following section turns its attention to some of the cross-linguistic studies in this area. These provide a particularly powerful way of examining the relationship between event perception and linguistic expression. They offer the opportunity to compare responses to constrained situations among speakers of languages that differ widely in their surface structures. In this way they provide important evidence about the degree to which the constraints on attention and our understanding of event structure are universal, rather than being driven by the structure of particular languages.

1.8.3 Cross-linguistic investigations

Sridhar (1988, 1989) explored event perception with 300 non-brain damaged speakers of ten different languages. Using the *simply describing* methodology piloted by Osgood (1971), Sridhar developed a set of 70 non-verbal stimuli which participants were asked to describe in ordinary sentences, as if they were talking to a six-year-old child. The stimuli were short films involving a human actor and various everyday objects (balls, dolls, blocks, etc.). Participants were asked to view each film and then write a single sentence description of each event.

The scenes were manipulated according to various principles that were hypothesised to influence the viewers' construal and, as a result, their sentence descriptions. This was achieved through systematic manipulation of the content of the scenes and through the order in which they were presented. Both perceptual and cognitive factors were explored, including the construal of figure versus ground, agent/source versus object/recipient, and action versus change of state or static state. The temporal organisation of events was also explored, as was the influence of salience factors such as the size or familiarity of event participants.

The manipulated variables were found to influence production to different degrees, and not all the results were equally conclusive. However some results suggested that certain universal principles determine how speakers of different languages perceive simple events. One powerful cross-linguistic finding was that people tended to describe actions from the perspective of their source or agent rather than from that of the recipient. Correspondingly, source tended to be expressed earlier in the resulting sentences. In descriptions of states, figure was similarly strongly preferred over ground. Where a situation included elements of both action and state, actions and changes of state were far more often expressed than constant states. (So, for example, where a scene showed a man removing two blocks from a group of three on a table, all respondents described the man's action, with 20% also describing the end state. No respondents described the state alone.) One finding related specifically to the salience of the event participants. Entities that were said to be more 'intrinsically meaningful' (for example, human actors), or more perceptually salient, tended to be fronted in sentences in SVO languages, even when this led to production of passive structures or object-fronting.

A final hypothesis related specifically to the encoding of vertical and horizontal arrays (i.e. objects arranged on top of one another, or in nearer and more distant positions with respect to the viewer). As the encoding of vertical arrays is relevant to the control condition in the Order of Naming Test, results for this hypothesis alone are discussed. Sridhar hypothesised that vertical arrays would tend to be described from the top down, with upper objects being located in relation to lower ones. One example scene is discussed in detail in Sridhar (1989). Here a ball was shown resting on top of a tube, which was in turn placed on a plate. This scene was consistently described in the order hypothesised (although there was some variation in the precise way in which it was encoded), with the ball being located in relation to the tube and the tube in relation to the plate. Overall Sridhar concluded that our natural tendency, demonstrated cross-linguistically, is to describe vertical arrays from the top down.

Sridhar's findings are clearly useful as a source of further evidence about the principles that naturally constrain the perception of events among speakers of very different languages. However, they have some important limitations in relation to the present study. Most importantly, they cannot be used as the source of firm predictions about the production of spoken sentences, as different processes are likely to be at work in the course of writing from those that apply to speech. It is also difficult to establish the statistical power of the analysis, as findings are often presented in relation to one example scene only (albeit to one that provides a particularly strong example of each phenomenon discussed).

Chafe (1980) carried out another well-known cross-linguistic investigation of language production. The stimulus was a longer film which presented a simple story, intended to be as culturally non-specific as possible. It shows a man picking pears whose basket is stolen by a boy on a bicycle. The boy then falls off the bicycle and spills the stolen pears. Speakers of ten very diverse languages from widely differing cultures watched this film and were asked to retell the story. The resulting narratives were analysed as a source of information about the focus of speakers' consciousness and attention. Narratives across different languages were produced in brief spurts, said to correspond to 'idea units', with a mean length of about 2 seconds or 6 words per unit. Chafe proposed that these idea units corresponded to "linguistic expressions of focuses of consciousness" (p. 15). Perhaps unsurprisingly, the majority of idea units typically expressed a focus on people, their characteristics and their actions. Parallel to this was the finding that certain entities were more likely to attract speakers' attention and to be assigned the role of clausal subject (Bernardo, 1980). These were either entities that were already activated in the speakers' minds (for example, because they had already been mentioned), or those playing human or causal roles in the various sub-events within the story.

The cross-linguistic investigations suggest that certain of the principles hypothesised to affect attention and event perception are indeed universal. A particularly powerful example, and one that is intimately linked to language structure, is the bias demonstrated in our processing of causal agency. Perception of causal agency is a theme that runs throughout the assessments of event processing described in the current study. It is therefore discussed in some detail in the following section.

1.8.4 Causal Agency

Studies from a range of different theoretical backgrounds have suggested that concepts such as agency and causality are fundamental to our understanding of actions and events. Evidence for this proposal will be discussed under three broad headings: perception of causality, evidence from language development and evidence from adult language.

1.8.4.1 Perception of causality

A large body of evidence suggests that even infants develop a basic understanding of concepts such as animacy and causality. For instance, Corrigan and Denton (1996) argue that causal understanding is a developmental primitive, in that it occurs very early and is in fact a necessary precursor to development in a wide range of other areas. Oakes and Cohen (1990) used a habituation methodology to investigate infants' perception of causality within events. Following an established paradigm, they showed very young children a range of 'launching' events in which an object moves across a screen towards another object. In some cases the second object was hit and then started to move (a pattern that is apparently perceived by adult viewers as causal). In others both objects moved but without making contact, while in a third group the two objects made contact but there was a delay before the second object started to move. Children as young as ten months old responded to the element of causality within these events, treating the 'causal' examples as different from either of the 'non-causal' patterns.

Schlottmann and Surian (1999) used a similar methodology with nine-month old children. Here half of the children were habituated to an event in which a red square moved towards a green square, which started to move after the red square had come to a halt. The other half saw a similar event, but here the green square started to move before the red one had stopped, supposedly 'reacting' to its motion. Once they were habituated to their respective films, each child saw the same film in reverse. Only those who had seen the 'reaction' film dishabituated to its reversal, suggesting that it was the reversal of the causal element, rather than simply the colours, that surprised them. This once again implied that the children had already developed a sense of causation, which applied even when there was no physical contact between the entities involved (although see Cohen and Oakes, 1993, for rather different findings).

Studies of adult perception have similarly suggested that we are quick to infer conceptual properties such as animacy and causality, even when just viewing moving 2D geometric shapes (e.g. Scholl and Tremoulet, 2000). White and Milne (1997), for example, showed adult viewers a string of rectangular shapes arranged in a vertical column. Each rectangle started to move across the screen in turn, starting with the topmost and progressing down the column. Observers strongly perceived that the topmost rectangle was pulling the other shapes. It seems that we readily perceive both some form of animacy and a causal relationship, even when the stimulus is remarkably 'pared down' and removed from any real life context.

The evidence reviewed suggests not only that perception of causality is basic and very early-developed, but that our sense of causal agency remains influential in our understanding of even highly artificial, non-human situations. Studies of children developing language provide further evidence for the same bias.

1.8.4.2 Evidence from language development

Children as young as two have been argued to be sensitive to the difference between agents (sources) and objects (recipients) in reversible active sentences. For example, Golinkoff, Hirsh-Pasek, Cauley and Gordon (1987) showed children video films of two well-known characters, Cookie Monster and Big Bird. In each film one of the characters either tickled or fed the other. The films were shown in simultaneous pairs, each pair being accompanied by a spoken sentence that matched one or the other film. The children's visual fixations indicated an overall preference for the film that matched the spoken sentence. While this no doubt demonstrates their developing understanding of the significance of word order, it can also be interpreted as suggesting that the children understood who was acting upon whom.

Research on 'syntactic bootstrapping' in children acquiring verbs points to similar conclusions about the importance of agency. In the very well-known study by Fisher, Hall, Rakowitz and Gleitman (1994), three- and four-year old children and adults watched films of action scenes performed by puppets. The actions could plausibly be described in English from the perspective of either puppet. (Examples are *give* and *receive*, *chase* and *flee*.) As the participants saw the scenes, they also heard a sentence that contained a nonsense verb (e.g. *zike*). In each case they were asked the meaning of this nonsense verb. One set of sentences was neutral as to perspective. These explored the perspective that is most naturally adopted where there is no constraint from syntax. For example, in relation to a scene in which a rabbit pushes a monkey off a box, the perspective-neutral cue was:

> '*Look! Ziking*'

With this type of cue, both children and adults showed a strong preference for a more 'agentive' interpretation, preferring *feed* to *eat*, *push* to *fall*, and so on.

Further evidence about children's understanding of causal agency is provided by Gelman and Koenig (2001). They investigated children's appreciation of the difference between animate and inanimate entities in relation to the degree of causal agency they command over their actions. Three year olds, five year olds and adults were shown film clips of animals and toys being carried by a person, and were asked in each case whether the target entity was 'moving'. Five year olds and adults were more likely to describe inanimate than animate entities as 'moving', while three year olds were equally likely to agree in relation to both classes. This finding is interpreted as indicating that between three and five, children begin to develop an understanding of the relation between animacy and causal agency. More precisely, it is only at this age that they achieve the linguistic encoding of the relationship between the two. An animal is generally only said to be moving when it does so under its own steam, whereas an inanimate entity generally moves when caused to do so by an animate agent. For younger children, this distinction, or at least its reflection in language, does not seem to be so salient.

Development of the concept of agency also goes hand-in-hand with a more general sense of agents' intentions. At 18 months children can, for example, copy the action intended by an agent, even when they have only seen the person not achieving the intended end. In one study (Meltzoff, 1995), children watched a person try three times in different ways to achieve a particular goal. Each time the attempt would fail. For example, he might try to press a button on top of a box using a stick, only to see the stick slip off the box. When the children were later given the same objects, they immediately succeeded in pushing the button with the stick. This was not just a matter of copying particular bodily movements, since each failed attempt involved a different movement. Instead, it appeared that the children understood that different movements, with different outcomes, could reflect the same intention. They also understood that the intention was specifically that of a human agent, since they did not respond in the same way when they saw the same actions performed by a mechanical device, rather than by a human actor.

In terms of expression, too, the distinction between conceptually more 'active' events and less 'active' states seems not only to be marked in all natural languages, but also to be understood by children from an early age (Black and Chiat, 2003a). Children's early vocabularies include verbs expressing both types of situation (e.g. *go* or *get* versus *have* or *like*). They are also skilled in their application of the inflection '*-ing*' from an early age, using it to mark progressive events but not states (Brown, 1973). This skill is striking, given that at the same age they frequently over-generalise other rules, such as that governing the application of articles and numbers to mass and count nouns ('a water', 'a spaghetti') (de Villiers and de Villiers, 1978). Children's skill in manipulating event and state verbs points to an early-developed understanding of the relative degree of agency implied by each. Black and Chiat (2003a) offer a linguistic analysis of the distinction, arguing that event verbs naturally express a sense of control or execution over situations (for example, they may be modified by control-related adverbs such as *deliberately* or *carefully*), while state verbs do not.

Clark (2001) suggests that evidence from early language use can offer insights into the conceptual categories that are most salient for children. By studying the things that young children express in ways that are not conventionally permitted by their languages, she suggests that we can uncover the most salient categories of experience, before their expression is limited by the constraints of a particular language system. One of the conceptual categories uncovered by this method is an apparent focus, in English speaking children at least, on the degree of agency ascribed to an event. Children learning English are reported to make a distinction between activities over which they have a high degree of control or causal agency and those over which they have little. The former are often marked with the pronouns *me* or *my* (e.g. 'Me jump', 'My taked it off'), while the latter are often marked with *I* (e.g. 'I like peas', 'I no want those' – Budwig, 1989). In time, this distinction is lost, or at least is not expressed through pronouns, as the influence of the adult language system takes precedence. Of course, a potential criticism of this methodology is that it is difficult to interpret the meanings intended by such very young children with certainty. For example, it may not be certain that these children intended the precise distinction between highly-controlled (or 'agentive') and less-controlled (less 'agentive') actions.

In summary, the primacy of our sense of causal agency is highlighted by children's very early expressions of meaning, as well as being evident in their later comprehension and production of language. Studies of adult language, discussed in the following section, also point to a similar predisposition.

1.8.4.3 Evidence from adult language

Black, Nickels and Byng (1991) report the performance of a group of non-brain damaged speakers on the Reversible Sentence Comprehension Test (Byng and Black, 1999). In this test, each sentence must be matched to one of three pictures: the target, a reverse role distractor and a lexical distractor. Black et al found that the participants made significantly more errors on sentences describing psychological states (e.g. '*The dancer surprises the cook*') than on those expressing events (e.g. '*The astronaut photographs the clown*'). This finding was originally explained in terms of differences between the participant entities: events were easier because they involved agents and states were harder because they involved experiencers. However, this explanation has more recently been challenged as circular (Black and Chiat, 2000; Black, 2003). Instead, it is proposed that the situations described by these verbs differ in a whole range of ways relating to their semantic and conceptual structure, with the ease with which the agent can be identified being a key factor.

For instance, Black and Chiat (2000) suggest that scenes of psychological state do not offer the same degree of visual or conceptual contrast between their participants as action scenes. This makes it more difficult to identify which participant is to be seen as more 'agentive' or as the "anchoring point from whose perspective the scene should be understood" (Black and Chiat, 2000, p. 72).

This reinterpretation of the findings touches on a potential flaw in the test as an assessment of language comprehension. The results may reflect the fact that events are almost inevitably easier to represent pictorially than states. The stimulus verbs were also not matched for imageability; verbs describing events may additionally be easier to understand because they are more readily imageable. As a result, it is difficult to argue that state sentences are necessarily harder to comprehend than event sentences. However, as Black and Chiat (2000) suggest, it seems likely that states are generally more difficult because they are *both* hard to represent conceptually *and* hard to understand linguistically. One of the reasons for this may well be that it is more difficult to identify the causal agent or 'anchoring point' of a state scene than that of an event.

Studies of event segmentation represent a further attempt to examine the influence of causality on adults' perception of events. In a series of experiments, Zacks, Tversky and Iyer (2001) asked people to segment films of everyday activities by tapping the computer's space bar when they felt one unit ended and another began. In one condition participants were asked to segment the activities into coarse units (defined as the largest units that seemed meaningful to them), and in a second to identify fine units (the smallest that seemed meaningful). The boundaries between coarse and fine units tended to co-occur, leading the authors to suggest that events are perceived through a hierarchical structure, with fine units as subcomponents of coarse. The units were further organised according to a principle of goal-achievement, typically comprising the same kinds of goals and sub-goals that are expressed in event descriptions. In fact, simultaneous description increased the degree of alignment between course and fine segments. All of the descriptions produced expressed purposeful, causal, goal-oriented relations. As the authors point out, this need not have been so: participants might have described individual bodily movements, such as raising an arm or standing up, rather than the achievement of goal-related actions.

This study offers further evidence that the perception of events is driven in a principled way, underpinned by notions of goals, causation and intention. These principles clearly influence how we talk about events, but are also evident in non-verbal tasks such as segmentation.

Adding language into the equation brings them into even sharper relief. Zacks et al argue that in the process of producing language, people became more influenced by causal structure: "Using language, and perhaps language itself, biases away from raw perceptual statements and toward causal and intentional ones" (Zacks et al, 2001, p. 41).

In summary, our sense of causality and our bias towards causal agents seem to be fundamental and pre-linguistic. They are manifested early in children's responses to 'launching' events, and are influential in their developing comprehension and expression of event meaning. Evidence from adult studies, too, suggests that we typically find event-framed situations easier to conceptualise than states, possibly because of the relative ease of identifying their causal agents. Non-verbal (eye tracking and segmentation) studies suggest that a more general sense of causal agency, intention and goal-achievement governs not only our talking but also our perception of events.

1.8.5 Summary

The literature reviewed indicates that the perception of events occurs in a principled fashion. It is fundamentally guided by the attention system, which in turn is sensitive to a range of perceptual and conceptual factors. Particularly prominent among these is the sense of causal agency. We are quick to understand an event's causal structure, and are naturally responsive to the related notions of intention and goal-achievement. The effects of foregrounding within a perceived situation have primarily been described in relation to the syntactic structure of descriptive sentences, with foregrounded entities most often being assigned to the role of sentence subject.

The Order of Naming Test picks up a number of the themes raised in this review to explore the constraints acting upon event focus. It examines the influence of causal agency, animacy, sentence structure and page position on participants' focus over situations, as reflected in their naming of the entities involved. In doing so it considers both the selection of entities for naming and the order in which those entities are mentioned. The Sharon and Paul Test (Chapter 4) goes on to explore the adoption of perspective within situations, asking how perspective is naturally constrained in relation to a particularly problematic situation type. The nature of perspective taking is discussed in more detail in section 1.9.

1.9 Constraints on perspective taking: The Sharon and Paul Test

1.9.1 Introduction to perspective taking

According to Levelt (1989, 1999), perspective taking is one of the aspects of conceptual processing that is necessarily accomplished at the 'message' level. As part of the process of Microplanning, it is one of the ways by which speakers frame their thoughts and perceptions into structures that are compatible with the requirements of the language Formulator. Indeed, the language system is unable to accept perspective-free information as input. Perspective is therefore not only essential but also, as Levelt (1999) points out, ubiquitous. For example, different perspectives on the same object achieve different effects on the listener, depending on the context and the communicative intention of the speaker (Tomasello, 2003). For instance:

'An agile, partly nocturnal, quadrupedal carnivorous mammal'
'That bloody creature (has been digging up our garden again)'
'The neighbour's cat (is watching our television)'
'Our Bonny (is such a sweet creature)'

The process of perspective taking is one of the most powerful ways in which a speaker can guide the listener's perception of their subject matter. Clark (1997) quotes the following excerpt from a criminal trial, in which the witness's reframing of the attorney's language consistently shifts the listener's perspective on the situation:

> "Attorney: An' you went to a: uh you went to a bar? in X is that correct?
> Witness: It's a club
> Attorney: It's where uh girls and fellas meet, isn't it?
> Witness: People go: there
> Attorney: An' during that evening: uh: didn't Mr. Y come over to sit with you
> Witness: Sat at our table."

(from Drew, 1992)

One arena in which perspective taking comes to the fore is that of spatial language. Since languages differ in their encoding of spatial information, the use of perspective in describing spatial relationships or route directions provides a good example of thinking for speaking. Thoughts must be shaped to the requirements and perspective options available in each language (Levinson, 1997). For example, English and Dutch typically use a relative system to describe the position of small objects in the speaker's immediate environment, such as objects on a table. Descriptions centre on the perspective of the speaker: '*The bowl is to my right*' or '*The bowl is to the right of the cup*'. In certain circumstances an intrinsic frame of reference may also be used, in which the scene is described from the perspective of one of the participants. For example, a man standing in front of the front door of a house is described as standing '*in front of the house*', no matter from which viewpoint he is observed. By contrast Tzeltal (a Mayan Mexican language) uses an intrinsic frame only for describing objects that are strictly contiguous. All other spatial descriptions require an absolute system based on the points of the compass (e.g. '*The cup is north of the jug*').

American Sign Language (ASL), like English and Dutch, uses all three frames, depending on the context. The choice of frame is reflected in the positioning of the handshapes representing the participant entities. For a table-top array in which the objects have no intrinsic 'front' or 'back', a relative frame is most likely. Here the objects are likely to be described from the point of view of the signer. However, they may also be represented from the viewpoint of the addressee (Emmorey, 1996). Where one of the entities possesses intrinsic reference features (such as a front or a back), both relative and intrinsic systems can be used. For instance, an ASL user describing a scene in which a man is standing in front of a car can represent it as if from the viewpoint of the signer, or can locate the man with respect to the features of the car. In this case the handshape for an upright person will be located in front of that for the vehicle (Emmorey, 2002). Absolute frames of reference are also available, where cardinal direction signs are related to a 'map' created in signing space.

Linguistic differences like these have been shown to influence not only the expression of spatial relationships, but also speakers' spatial thinking. For example, Brown and Levinson (e.g. Brown and Levinson, 1993; Levinson, 1996) hypothesised that speakers of English, Dutch and Tzeltal would show differences in their processing of spatial arrays. Participants completed a number of tasks in which they viewed a table-top array, rotated through 180 degrees and recreated the array in the new orientation. Sure enough, the final arrays reflected their different language patterns. Those created by Dutch and English speakers maintained the participants' own perspectives, with the object that was originally to their right again placed to their right. Tzeltal speakers, on the other hand, maintained an absolute perspective, with the northernmost object still to the north. The implication was that the participants' memory of the arrays was strongly influenced by the habitual patterns of their own languages.

However, others have criticised this conclusion. For example, Li and Gleitman (2002) elicited responses consistent with both relative and absolute perspectives from English speakers. Responses were found to depend on the number of external landmarks available as they did the task. When they could see out of a window, they were more likely to recreate arrays according to an absolute reference system. When the blinds were drawn, they were more likely to recall them by reference to their own personal perspectives. Munnich and Landau (2003) further point out that people may approach such tasks by verbally encoding the arrays, limiting the conclusions that can be drawn about the automatic effects of language on non-verbal thinking. Still, whether or not the tasks are truly non-verbal, and whether or not speakers can be induced to respond against their habitual pattern, linguistic perspective still clearly influences our *habitual* responses. Given identical conditions, speakers of different languages performed differently, and consistently with their own language patterns. This was so whether the influence of language was on thought itself or on thought filtered through language.

1.9.2 Perspective taking in event description: Introduction to the Sharon and Paul Test

The Sharon and Paul Test turns the focus specifically on perspective taking in relation to the selection of verbs to describe events. By selecting a verb, a speaker not only highlights a particular event from their overall experience of a situation, but also signifies a perspective on that event. This specifies the viewpoint from which it is to be described and determines which elements are to be foregrounded and which omitted or downplayed. This focusing effect of language has famously been compared to that of a 'zoom lens' (Fisher et al, 1994). For example, faced with a situation like that shown in Figure 1.9.2, a speaker might decide to focus on the action of the giver or that of the receiver, or even on the movement of the flowers. Each of these options will correspond to a different verb, and a different sentence structure highlighting the roles of different participants. Inevitably, in a real-world context, there will also be a certain amount of background information that will either be included in the description or must be filtered out. This might include details of the physical setting and other, non-participant entities and more detailed information about the main participants. It will also include pragmatic information about the context of the action, such as the inferences that 'It's her birthday', 'He's late' or (as one control participant put it in relation to a similar item in the Sharon and Paul Test), 'He's hoping to get his leg over'.

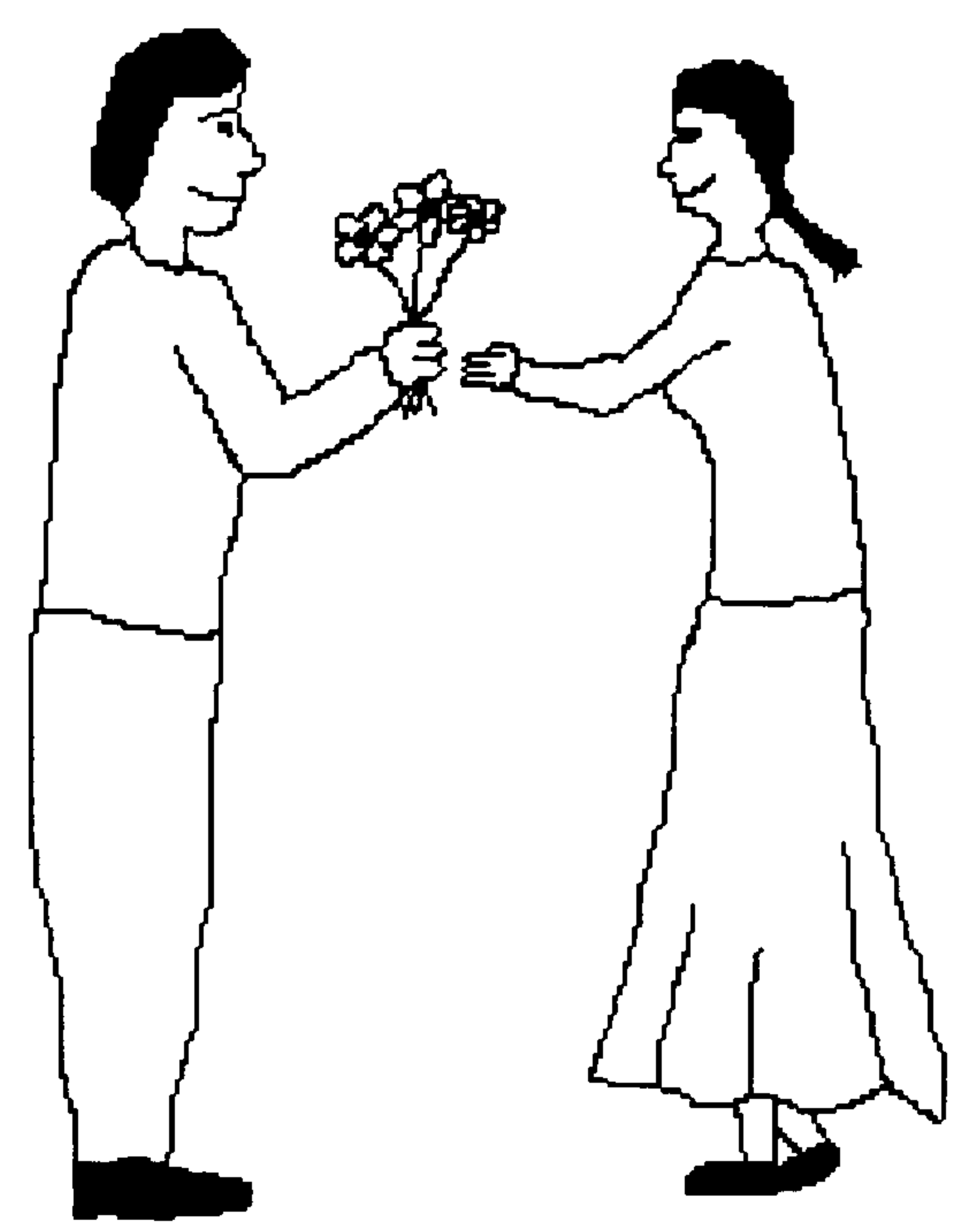

Figure 1.9.2 Example of '*giving/receiving*' situation

1.9.3 Constraints on perspective taking

The Sharon and Paul Test addresses a particularly problematic situation type: that in which there is an obvious dilemma of perspective. These are situations that involve at least two main participants of roughly equal perceptual salience, from each of whose perspectives the situation may be readily be described. Situations like these provide a particular kind of word-world mapping challenge, since neither perspective is automatically dominant. In each case the dilemma is caused both by uncertainty about which participant to focus on, and by the availability of common verbs that fit the perspective of each. Like the test devised by Fisher et al (1994) described in section 1.8.4.2, one of the aims of the Sharon and Paul Test is to explore the perspective naturally adopted over such situations – in this case by speakers both with and without aphasia. In the first condition, just as in the Fisher et al study, participants are therefore asked to produce verbs to describe situations that are presented neutrally, with no cue as to perspective. The test additionally aims to investigate the kinds of cue that can help people with aphasia to access more, or more relevant, verbs in relation to this kind of situation. In the subsequent conditions, the stimuli are constrained in a number of different ways, in order to reduce the complexity of the perspective choices they present. In the second condition the filming is manipulated so that each situation is presented from the perspective of each of the main participants, while in the third these 'perspective' cues are overlaid with a spoken sentence.

As suggested in section 1.8, our perspective over situations is naturally influenced by a range of perceptual and conceptual constraints. Most strikingly, a good deal of evidence suggests that we have a very strongly developed sense of causal agency and goal attainment. However, perspective taking is also highly sensitive to linguistic context. For example, participants in the Fisher et al (1994) study were significantly more likely to adopt the perspective of the causal agent than that of the non-causal participant when the target 'verbs' were presented neutrally. However, provision of a syntactic frame also influenced their interpretation of the scenes, and indeed over-rode the bias towards agents where the two were in conflict. This was demonstrated through a condition in which participants saw the stimulus films alongside spoken sentences that described them from the perspective of either one or the other puppet. For example, in the scene in which a rabbit pushes a monkey off a box, the relevant cues were:

(1) '*The bunny is ---ing the monkey*' (*push*)

(2) '*The monkey is ---ing*' (*fall*).

In sentence (1), the conceptual bias towards causal agency concurs with the bias of the syntactic frame: the participant we most naturally regard as agent is also highlighted by the syntax. In sentence (2) the two are at odds, since the syntactic frame foregrounds the action of the monkey. Here, participants were more likely to interpret the verb as *fall* than as *push*. This could, of course, be interpreted as evidence of the children's full understanding of the relevant syntax as well as of the concept of agency. Alternatively they may have been strongly influenced by the first-named entity, and likely to take that entity's perspective whether or not it was playing the role of causal agent. The Sharon and Paul Test takes a similar approach to the adoption of perspective in adult speakers. By manipulating the structure of the sentence cues so as to be either congruent with, or in conflict with the naturally more dominant perspective, it explores the power of syntax to constrain our interpretation of perspective-dilemma situations.

Translating a perceptual perspective into language is also heavily dependent on the linguistic options available (e.g. Clark, 2003; Pinker, 1989; Jackendoff, 1996, 1997). For example, in describing a scene involving two participants, the choice of perspective depends, amongst other things, on the availability of verbs to match the perspective of each one. Accessing a lexical label in turn helps in the conceptual process of organising information about the participants in the situation and the relationships among them, including foregrounding certain participants and backgrounding or omitting others (Dipper et al, 2005; Black and

Chiat, 2003a; McKoon and MacFarland, 2002; Talmy, 2003). For example, in order to describe a situation in which a wall's colour is changed, the most natural verb is probably the one that highlights the effect on the wall: *painting*. Other verbs would alter the focus; for example, if the action were described as *emptying* or *unloading* this would focus attention on the effect on the brush. Alternatively the speaker might highlight the movement of the paint from brush to wall, using a verb that will draw particular attention to its manner (for example, distinguishing a *trickling* from a *dripping* motion). In both cases the verbs have the effect of backgrounding the aspect of the situation that is probably most perceptually salient. In some cases there is no readily available verb to describe the scene from the perspective of one of the participants, even when that participant is animate. For instance, it is difficult to think of a verb to describe the specific experience of being driven as a passenger in someone else's car. Instead we are probably forced to use a passive construction.

Just as with spatial language, the process of learning a particular language entails learning the options it offers for describing events. For example, Pinker (1989) influentially argued that children learn which verbs are syntactically constrained in which ways by establishing careful rules linking the semantics and syntax of the verbs in their own languages. His suggestion was that the same verb (e.g. *load*) can be used to express subtly different aspects of meaning, which are distinguished by different syntactic frames. So, for example, the sentence

'*Fred loaded the hay into the wagon*'

expresses a subtly different meaning from

'*Fred loaded the wagon with hay*'.

The second option conveys the sense that the wagon has been filled. Similarly, perspective-pair verbs such as *pour* and *fill* command different syntax because they express subtly different semantics. *Fill* is able to appear in a construction such as

'*Fred filled the glass with water*'

because it focuses on the end effect on the glass. *Pour*, on the other hand, focuses on the transfer of the water, and is therefore not allowed to encode information about the effect on the glass. This means that it cannot appear in a sentence such as

*'*Fred poured the glass with water*'.

Children need to establish detailed representations of the links between verb semantics and syntax, which include information about the different perspectives encoded by particular verbs. This is already moving into the arena of conceptual processing, since verb selection depends on the particular message the speaker is trying to convey about, for example, an event in which liquid is transferred into a container. A likely knock-on effect is that, as suggested by Slobin (1996), in the process of learning how the verbs in their language work, children learning to talk about events are pushed to attend differentially to precisely those features that fit the available options. British Sign Language (BSL) provides a further illustration of this process. Asked to describe the action shown in Figure 1.9.3, English speakers have the option of describing it generically as '*attacking*', in which case they need only attend to the rather general features that relate to this verb. A BSL user, on the other hand, has no such generic verb easily available. He or she must therefore attend to the specific features that would lead to a more precise description; for example, to the features of manner that would lead the action to be described as '*stabbing*'. In encoding this verb, BSL dictates that not only the manner but also the direction of the action is specified (Marshall and Cairns, 2005).

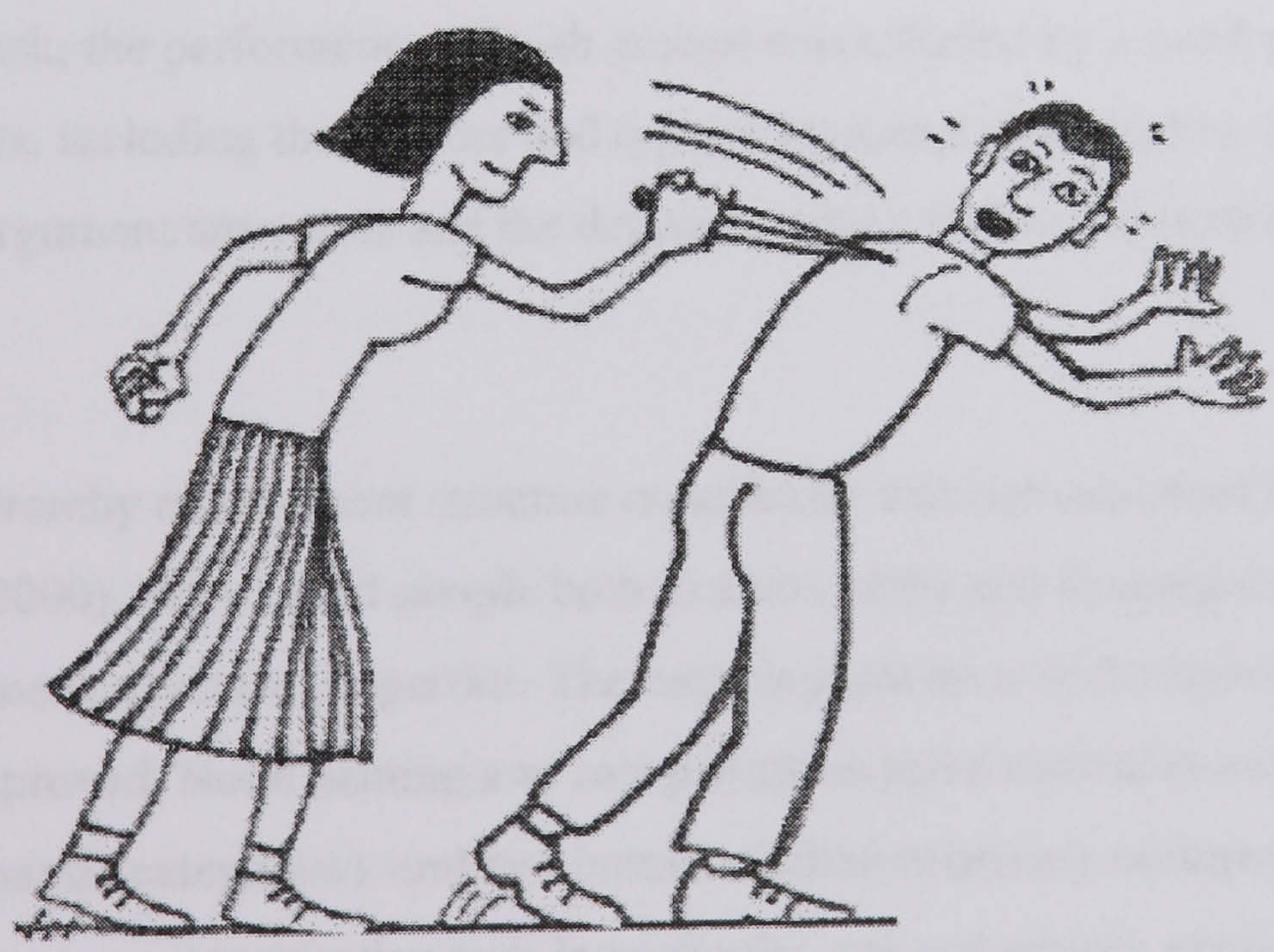

Figure 1.9.3 Example of '*attacking/stabbing*' situation

1.9.4 What affects the ease of perspective taking?

Black and Chiat (2000; 2003b) suggest that certain situations, and certain verbs, are likely to be more problematic than others. In general, situations are likely to be more difficult to frame in language, the more choices they demand of the speaker. This means that the more possible perspectives a situation offers, the more complex it is likely to be. Situations involving larger numbers of entities and more possible relations between them are therefore likely to be more challenging than those offering less choice.

This type of complexity is clearly closely related to the argument structure used to encode a situation in language. A number of studies have demonstrated links between the complexity of a verb's argument structure and its ease of processing, both in production and in comprehension. For example, Thompson et al (1997) elicited verbs with different argument structures from people with agrammatic aphasia and non-brain damaged controls in confrontation and story completion tasks. Target verbs were matched for frequency and familiarity. A consistent hierarchy of difficulty emerged for the participants with aphasia, though not all comparisons were significant. One-place verbs (e.g. *laugh*) were produced with the greatest ease, followed by two-place verbs (e.g. *fix*), three-place verbs (e.g. *put*) and complement verbs (e.g. *think*). Thompson et al conclude that, "Verbs with fewer and less complex argument structures appear to be easier for agrammatic aphasic subjects to produce – even when produced as single words" (p. 485). For the non-brain damaged controls, there were no significant differences between verb types. However, in a further sentence production task, the performance of both groups was affected by a number of argument-related factors, including the number and type of arguments required by the verb, the number of possible argument structures and the degree to which the inclusion of arguments was obligatory.

A similar hierarchy of argument structure complexity was demonstrated by Kim and Thompson (2000). They asked people both to name verbs and to categorise them according to their argument structure properties. The more arguments a verb required, the more difficult this proved. Noun naming and categorisation tasks were also included (the latter based on semantic categories), and by contrast elicited relatively unimpaired performances. Although the noun categorisation task in particular was not exactly equivalent to its verb counterpart, it at least indicates that the task of categorisation was not itself the root cause of the verb difficulty.

These findings are mirrored by others from studies of sentence comprehension. While less directly relevant to the issue of perspective taking in event description, these offer further evidence that the process of accessing a verb involves accessing information about its argument structure(s). For example, a number of studies have shown that the ease with which spoken sentences are processed is related to the number of argument structures permitted by the verb. Shapiro, Zurif and Grimshaw (1987, 1989) asked non-brain damaged speakers to do a lexical decision task whilst listening to spoken sentences. Reaction times to the lexical decision task depended on the number of argument structures permitted by the verb in each sentence. People with agrammatic aphasia have demonstrated a similar effect, suggesting that they too are sensitive to verbs' argument structures, even in sentences they would normally find difficult to understand (Shapiro and Levine, 1990; Shapiro, Gordon, Hack and Killackey, 1993). Results for people with fluent aphasia were more mixed, although McCann and Edwards (2001) have argued that some people with fluent aphasia show sensitivity to these properties in verb naming and sentence generation tasks.

The relationship between complexity of argument structure and perspective taking is still under debate. For example, Black and Chiat (2003b) argue that, "...relations with more arguments are also relations where the number of possible perspectives increases proportionately" (p. 245). In other words, many of the verbs involving the greatest argument complexity also describe the most inherently complex situations. This makes it difficult to tell whether argument structure complexity, or the complexity of adopting a perspective over a particular situation, is the more influential factor. Dipper et al (2005), for example, argue that there may be differences between verbs with identical numbers of arguments, if they express situations with different degrees of conceptual-semantic complexity. So, three-argument transactional verbs (e.g. *give/take*) may prove harder than three-argument verbs of motion (e.g. *run* from one place to another), purely because of the number of perspective possibilities they offer.

Situations in which the choice of perspective is relatively less constrained by perceptual features are also likely to pose a dilemma. These situations are likely to involve participants that are visually and conceptually similar, for example in size, animacy, or agency. In such cases it is harder to decide which participant should be regarded as the 'anchoring point' from which to conceptualise the scene (Black and Chiat, 2000). To return to the situation in which liquid is transferred from an object such as a jug to a receptacle such as a glass, here the speaker is presented with a number of readily available verbs that highlight different aspects of the process. One (*empty*) will foreground the effect on the jug, while another (*pour*) highlights the movement of the liquid, and a third (*fill*) the effect on the glass. In other cases the perspective dilemma is caused by the presence in the situation of more than one active participant. For example, many change of possession situations involve two active participants playing the roles of source and goal. The importance of both participants is frequently marked by the presence in the language of verbs that highlight each person's role: for example, *give/take*, *lend/borrow*, *sell/buy*. For a child learning language, such perspective-pair verbs will be particularly difficult to interpret, as they cannot be distinguished by perceptually salient differences in the same way as, for example, verbs highlighting manner of motion (e.g. *run/amble*). Instead, the situational differences they highlight relate to the role played by each participant. Interpreting such verbs requires the child to follow the speaker's perspective and to understand the way in which arguments are organised around the verb (Black and Chiat, 2000).

1.9.5 Evidence from aphasia

Similar difficulties may be observed in adults with aphasia, though it would be wrong to assume that they are exactly the same as those faced by a child learning language. However, matching a conceptual perspective with an available verb, and with the syntactic structure it entails, may be particularly problematic for people whose access to words is limited. A number of studies of individuals with aphasia have suggested that they had particular difficulty with perspective-related aspects of verb meaning. For example, BRB and JG (Byng, 1988) could understand related verbs that differ in their core meaning, such as *fall* and *rise*. However they struggled to understand verb pairs such as *buy* and *sell*, which relate to the same situation but differ in the perspective they adopt over it and in their assignment of thematic roles. Like them, PB (Marshall et al, 1997) was much better at differentiating verbs that differ in core meaning (e.g. *eat* and *drink*) than those that differ mainly by perspective (e.g. *give* and *take*), despite retaining considerable knowledge of verbs' syntactic properties. With 'perspective pair' verbs, he performed at a chance level.

However, this is not a universal pattern. For instance RG (Marshall et al, 1996) showed very good understanding of perspective pair verbs, despite making semantic errors with other verb pairs such as *slide* and *skate*. RG's performance shows that the kind of knowledge required for perspective taking is not necessarily impaired in people with aphasia. Perspective taking is also not a purely visuo-spatial process, since despite his retained understanding of perspective-related information, RG had trouble with visual tasks such as drawing from memory and answering questions about objects' appearance. Indeed, Marshall et al suggest that his underlying difficulty was in processing semantic information relating to concrete perceptual domains. RG's performance also shows that the tasks used to assess aspects of perspective taking are not inherently problematic. Rather it is a matter of assessing which aspects of processing are impaired or retained on an individual basis. Unlike BRB, JG or PB, RG had particular difficulty with nouns. For people with significant verb impairments, perspective-related information may still be especially vulnerable.

If the process of adopting a perspective occurs at the preverbal 'message' level, then it is likely to be particularly vulnerable in people who have difficulty in structuring their thinking about the world in a language-ready way. However, like all other areas of conceptual processing, perspective taking entails a 'mapping' between conceptual structure and language. In practice, teasing the two apart is clearly problematic. As previously discussed, it is very difficult to say whether a person's perspective on a situation is more heavily influenced by pre-linguistic preferences, or by the structures entailed by their language. Similarly, it is hard to say whether someone who has lost access to the relevant language has trouble in adopting a perspective because they are missing the appropriate language-driven structure, or because of direct damage to their conceptual processing mechanisms. As proposed in section 1.5.6, it may be most plausible to suggest an interplay between the conceptual and linguistic levels, in which both pre-linguistic conceptual constraints and the constraints entailed by language are potentially influential.

The Sharon and Paul Test aims to add to the evidence base about our natural perspective preferences. It also investigates the effect of introducing constraint to the process of perspective taking, exploring the differential effects of perceptual/conceptual and linguistic cues in constraining people's responses to 'perspective dilemma' situations. In doing so it aims to help people with aphasia to access a larger number of relevant verbs in response to a particularly problematic situation type. Finally, the test aims to move closer to the spontaneous production of event-based language. Its perspective manipulations are therefore superimposed on (at least somewhat) naturalistic films of everyday events, in order to move at least some way towards the challenges of talking in a real-world context.

1.10 Investigations of non-verbal modalities

The final investigations, presented in Chapter 5, concentrate on individual participants' use of non-verbal modalities. The main part of the chapter focuses on the way in which one person communicates events through gesture, while the final section looks at another person's drawing of events. In each of the non-verbal assessments, the individual participant's performance is compared with that of a group of non-brain damaged controls. The main aim is to shed further light on the person's conceptualisation of events, by investigating their performance in a modality that they used spontaneously, and that could be probed without demanding access to language. The non-verbal investigations therefore essentially aim to investigate the relationship between an individual's thinking-for-language and their thinking-for-gesture or –drawing. They also aim to offer more general insights into the thinking underlying the non-verbal communication of events in non-brain damaged speakers. Section 1.10 reviews the literature underlying the assessment of gesture. The test used in the investigation of drawing was not designed for the present study but for a much larger study of drawing in aphasia (Sacchett, 2005). This is discussed in more detail in Chapter 5.

1.10.1 Investigating gesture: The Action Gesture Test

Assessing gesture is a difficult matter. Methods of testing, scoring and analysis are all still very much 'ad hoc', meaning that it is much harder to establish what is 'normal' in relation to gesture than it is for language. Most studies of gesture in non-brain damaged speakers have focused on its production alongside speech in spontaneous communication. The value of this method is that it offers potential insights about mental representations. For example, McNeill (1997) argues that "speech-accompanying gestures make mental representations visible and analysable" (p. 190). This is clearly attractive in relation to the present study, which aims to shed light on people's representations of events. However, the vagueness of the gestures that accompany speech can make them difficult to interpret. It is also very hard to specify exactly how gestures are related to the speech they accompany. For example, it is often problematic to identify the precise onset of a gestural sequence in relation to a particular speech segment.

Nevertheless, studies of speech-accompanying gestures have helped to identify a number of different ways in which gesture is used (for example, to clarify or add to the semantic content of speech: Kendon, 2000), and have offered some important insights into the relationship between the language and gesture systems. They also offer further evidence about the ways in which speakers of different languages conceptualise events (McNeill, 1997; 2000a; Kita and Özyürek, 2003). Here, links can be drawn with the thinking for speaking literature. For example, although there are some cross-linguistic similarities, speakers of different languages tend to use gesture to highlight different linguistic elements.

For instance, in describing actions English speakers tend to use gesture to foreground the path of motion, while speakers of Spanish, Georgian and Swahili are more likely to highlight its manner. This is congruent with the way in which these languages package motion events. As already described, English typically encodes manner within the main verb and path in an adjunct satellite, while Spanish, for example, encodes path within the verb but manner outside it. In both languages, gestures are therefore typically used to supplement the semantic content of the main verb. Just as language structure affects the way in which events are encoded, so it also appears to constrain the use of gesture. This points to at least close links between the language and gesture systems, providing support for the idea that investigating gesture may shed light on the process of producing language.

Unlike the studies of spontaneous gesture, the investigations presented in Chapter 5 examine the gestures produced when people's access to language is compromised. The Action Gesture Test explores the action gestures produced by a person with aphasia and by a group of control participants. It specifically targets gestures produced in isolation from spontaneous communication. In doing so it sacrifices potential insights into the nature of the online speech-gesture relationship. However, it offers more scope for detailed investigation of the processes governing gesture production in aphasia, where language is naturally compromised. A similar approach was taken in a study by Kemmerer, Chandrasekaran and Tranel (2007), where as well as assessing the participant's spontaneous gestures during narrative production, tasks also required him to gesture verb and sentence targets *after* naming. In his case this was because his severe verbal dysfluency may have delayed his production of gestures for the same targets. In the present study, action gestures are produced in different test conditions in order to assess the influence of elicitation context, and specifically language, on the nature of the gestures produced. In the first condition, participants produce gestures in response to pictures of actions. In the second, they are asked to name each action before producing a gesture. In the final condition, gestures are produced from verbal cues alone.

Perhaps unsurprisingly, there is much less evidence available about the gestures produced by non-brain damaged speakers when gesture is separated from language; for example, when it is used as a primary means of communication. However, the form of gestures is acknowledged to differ, depending on the extent to which they are absorbed into a language system. A number of authors (e.g. Kendon, 2000; McNeill, 2000b) have pointed out that gestures produced alongside spontaneous communication do not take on the properties of language and are relatively un-conventionalised. Instead, they are largely driven by visual imagery (McNeill, 1997). The more gesture is used in isolation from speech, on the other hand, the more language-like it becomes. This was demonstrated by Goldin-Meadow, McNeill and Singleton (1996), who analysed the gestures produced by a group of adults in response to a series of action scenes. They were first asked to describe the scenes naturally, and secondly to do so using only their hands. The gestures produced in the second condition showed some of the characteristics of a simple syntax. In particular, they tended to be combined into strings, in which particular semantic elements adopted predictable positions. For example, they were significantly more likely to represent an object before an action (e.g. '*girl jump*') than vice versa. This was so even when the object was stationary, and when the resulting string did not follow a typical English word order (e.g. '*hoop jump*'). The same was not true in the 'spontaneous description' condition. The participants' action gestures were also much more likely to incorporate information about the objects involved - for example, by adopting a particular hand shape - when separated from speech.

Kendon (1988) proposed that gestures occur along a continuum, stretching from speech-accompanying gesticulation at one end to fully fledged sign languages at the other, as follows:

Spontaneous gesticulation	→	Pantomime	→	Emblems	→	Sign languages

Three main changes occur from left to right along this continuum: the amount of language required alongside a gesture is reduced; gestures take on more of the properties of language; and they become less idiosyncratic and more socially-regulated. McNeill (1997) offers definitions of each category (pp. 192-193):

Gesticulation is "an idiosyncratic production, by an individual speaker, at the moment of speaking", but co-occurring with language. Gesticulation is further broken down into sub-categories. The most abstract forms serve to indicate new thematic units (*Deictics*) or changes in discourse level (*Beats*), but bear no relation to the meaning expressed. For example, a deictic gesture might establish a new topic by pointing into empty space alongside a question. *Metaphorics* "display images of abstract concepts and relationships". For instance, a gesture in which the hands are held together as if holding a container alongside the utterance, 'it was a Tweety and Sylvester cartoon' is interpreted as a metaphoric representation of the cartoon genre. *Iconic* gestures refer more directly to narrative content - for example, a hand appearing to grasp something and pull it backwards alongside the utterance, 'he grabs a big oak tree and bends it way back'.

Pantomime is defined as "a speechless enactment of complex action sequences". A pantomime of starting a car might involve a sequence of actions including opening the door, sitting down, adjusting the mirrors, checking the gear lever, putting the key in the ignition and turning the key.

Emblems are socially constrained, standardised gestures – for example, the 'thumbs-up' sign understood within particular Western cultures as indicating approval.

Finally, *Sign Languages* are "full-fledged linguistic systems, complete with socially established grammars and lexicons and a historical tradition that imposes its own standards of form". As gestures become transformed into signs they become more constrained, both physically within the signing space and linguistically within the phonological rules of the particular sign system. The development of new sign languages such as Nicaraguan Sign Language offers evidence of this process (e.g. Morford and Kegl, 2000).

Until the 1980's Nicaragua had no standard form of sign language and no schools for deaf children, many of whom grew up in isolation from other deaf people. As a result they created individual systems of home signs, used consistently to convey meaning but lacking all the features of fully-fledged language. Once schools for deaf children were established, these systems developed into more language-like 'Contact home sign'. Forms were used consistently within each group to represent meaning, and basic language structures such as combinations of action signs and noun arguments began to appear. Signs also became more arbitrary and less expansive. For instance, most of the home signs for '*apple*' showed the apple being held and eaten, while in some it was also rubbed on the chest. The Contact home sign for '*apple*' included all three elements, but the 'rubbing' now appeared after the 'eating', in response to an emerging phonological constraint that movement within a compound should be from head to chest. Whole-body gestures were replaced by more constrained signs; for example, movement of the legs was represented with the hands. Changes in perspective within events were also represented in a more conventionalised way, by turns of the head or torso rather than by shifting the whole body. In other words, signs gradually adopted many of the properties of language and moved towards the right hand end of Kendon's continuum. Interestingly, children under seven who grew up with these more language-like signs eventually developed their own fully-formed sign language.

Kendon's continuum makes it reasonable to predict that the form of gestures will vary according to the context in which they are elicited. More specifically, they should move further to the right of the continuum the more they are driven by language rather than by visuo-spatial processing. This 'Right Shift' theory would be supported if normal language users could be shown to gesture differently in different contexts, producing more 'pared down' gestures to linguistic than to visual cues. This hypothesis is the basis for the design of the Action Gesture Test, which compares the gestures produced in three different conditions: to picture stimuli in isolation, to pictures alongside verbal cues, and to verbs alone.

There is an important difference between producing gesture *alongside* language in the context of spontaneous communication and producing it independently of communication but in a way that is *driven by* language. According to Kendon's continuum, the former condition should lead to relatively simple spontaneous gesticulations that carry little semantic information independently of the language they accompany. Rather than exploring this type of gesticulation, the Action Gesture Test asks participants to produce gestures in an entirely non-communicative context, either without speaking at all (in the first condition) or in response to a single verb. The aim is therefore not to explore the nature of the gestures produced alongside 'normal' talk, but to investigate the effect of channelling gesture through a language route. According to Kendon's continuum, gestures produced independently of spontaneous communication may be either pantomimic or more conventionalised. However, the Right Shift theory predicts that, the more a gesture is driven by language, the more it will be constrained in a language-like way. In relation to Levelt's (1989) model, this means that it should be increasingly influenced by the 'pared down' conceptualisation that precedes language access.

In practice this should mean that gestures cued with language alone will be more standardised, simple, and naturally 'pared down' than those cued, for example, with photographs. A photograph of someone cutting a birthday cake might elicit a pantomimed sequence involving outlining the cake, cutting slices and serving them onto plates. It might even include additional detail such as blowing out candles. A similar gesture cued by the verb '*cutting*' alone might be much sparer, perhaps simply involving two fingers imitating a 'scissoring' motion across the body. Figures 1.10.1 (a) and (b) illustrate these two extremes.

Figure 1.10.1 (a) Pantomime sequence for cutting a cake

Figure 1.10.1 (b) Emblematic gesture for 'cutting'

Since this study does not aim to contribute to the development of a specific model of gesture production, there is not scope to review all of the existing models. However, one in particular informed the interpretation of the test findings, especially in respect of the relationship between conceptualisation, gesture and speaking. This model is described in the following section.

1.10.2 The Sketch model of gesture production

The Sketch model of gesture production (de Ruiter, 2000) attempts to map the process of gesturing onto Levelt's (1989) speech production model. In Levelt's model, as described in section 1.2, the Conceptualizer generates a *message*, containing a propositional representation of the intention to be communicated. This is then sent to the Formulator to be given grammatical and (later) phonological shape. The Sketch model proposes that the Conceptualizer also creates the basic representation for gestures, the gestural equivalent of the linguistic message being the *sketch*. de Ruiter's model is illustrated in Figure 1.10.2.

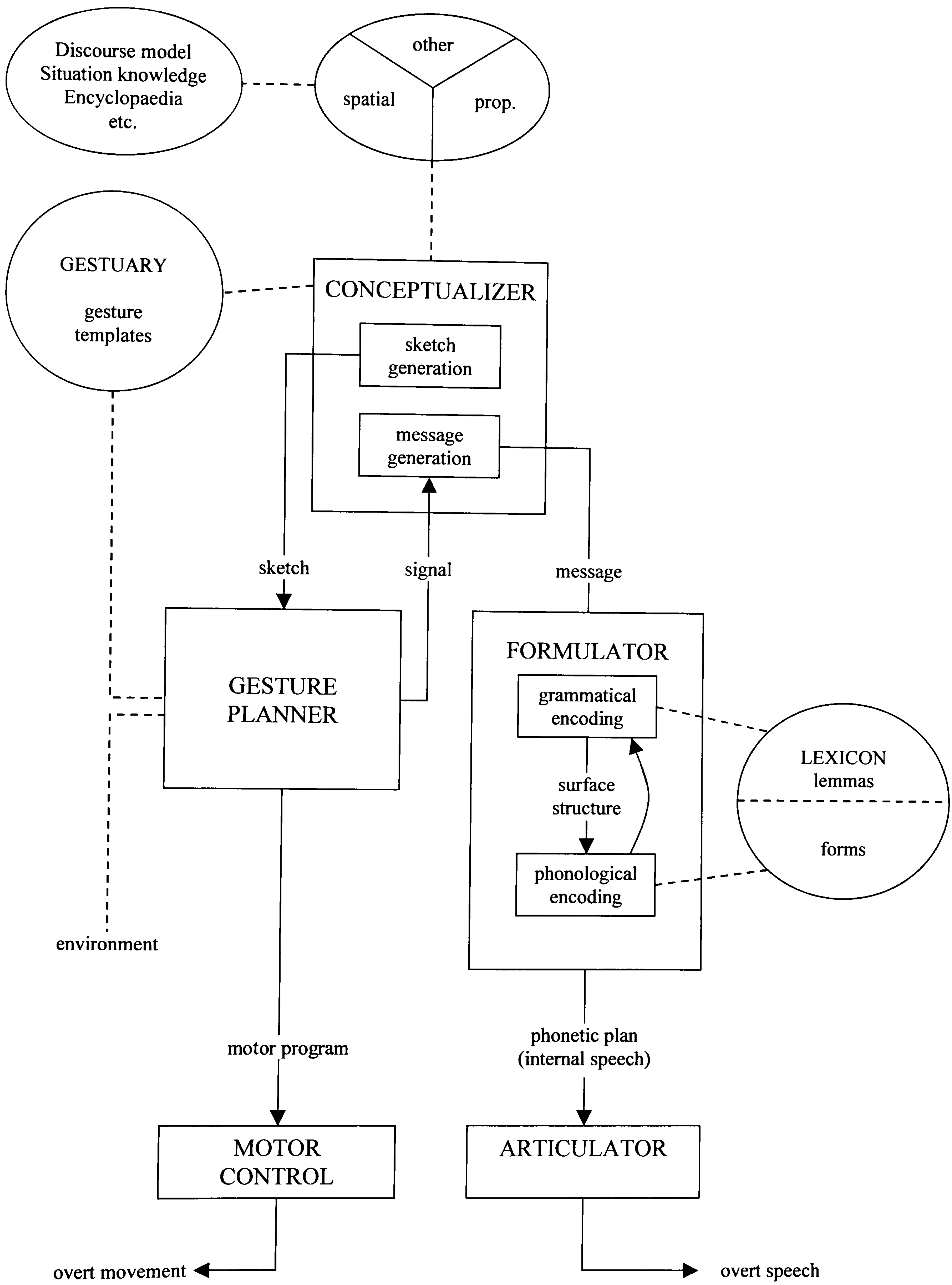

Figure 1.10.2 The Sketch model of gesture production (de Ruiter, 2000)

The Sketch model proposes that different types of knowledge are accessed for different types of gesture. For example, iconic gesticulations necessarily involve extracting imagistic and spatio-temporal information from working memory. In spontaneous communication this has to be done afresh in relation to each gesture, since there is no accepted 'vocabulary' of iconic gestures. Pantomimes, which represent real-world actions, require access to procedural motoric knowledge about, for example, the way in which people typically act upon objects. de Ruiter (2000) gives an example from one of McNeill's gesture studies, in which a speaker was telling the story of a cartoon involving Sylvester the cat and Tweety Pie (see McNeill, 1992, for a detailed description). Alongside the phrase, 'and Tweety drops the bowling ball into the drainpipe', she produced a gesture that was clearly intended to represent the action of throwing down a bowling ball. Yet, rather than producing a slavish copy of the movement made by Tweety in the film, the speaker adapted his action to her own size in relation to a bowling ball. In this sense the gesture was not generated purely from the visual imagery generated by the film, but by reference to the speaker's own knowledge of how bowling balls are typically thrown down drainpipes. Although produced alongside speech, this gesture moved away from 'pure' gesticulation and towards the category of pantomime.

Emblems differ from either gesticulation or pantomime, since they are by definition conventionalised within a particular culture. For example, a circle made with the thumb and index finger, with the other fingers raised above, is recognisable throughout Western English-speaking cultures as meaning 'OK' or 'perfect'. This would not hold true if the gesture were made with any other finger. However, as de Ruiter (2000) points out, there are still some aspects of such gestures that are unconstrained. The same gesture would be recognised no matter where the hand was located in space, or how long it was held. According to de Ruiter, emblems like this are not generated afresh from a store of imagery, but are stored in their complete form in a *gestuary*.

Once formed, the sketch is sent to a *gesture planner*, which forms a motor programme for the gesture, including how it is to be produced and with which body part. For example, the gesture planner needs to consider how much space is available and whether the hands are free. The final stage is the production of the planned movement by *motor control units*. The timing of gesture with speech production is controlled by feedback between the gesture planner and the Conceptualizer. This raises the possibility that gesture may also support the production of speech. However, this would only be possible if the gestural sketch were brought close to a readily-expressible preverbal message. Otherwise the gesture system might encourage the formation of concepts that map readily onto gestural forms, but not onto words.

Rather than investigate the facilitation of speech by gesture, the Action Gesture Test explores whether the process of message generation for language has any effect on gesture production. In relation to Levelt's and de Ruiter's models, it asks whether, by bringing language into the immediate gestural context, gestures become more driven by the linguistic *message* than by the non-linguistic *sketch.*

Not all models of gesture production would support this prediction. For example, the model described by Krauss and Hadar (1999) and Krauss, Chen and Gottesman, (2000), though similarly based on Levelt (1989), proposes that gestures are generated in working memory, before the pre-verbal message has been constructed. As a result, there is no mechanism whereby language can influence gesture production. On the other hand, the Right Shift theory outlined above is consistent with proposals by Kita and Özyürek (2003). Their model, while still based on Levelt (1989) and closely related to the Sketch model, proposes that gestures are generated in the interface between language and spatio-motoric thinking. It therefore allows for feedback between the pre-verbal 'Message Generator', which turns communicative intentions into propositions that can be expressed in language, and the 'Action Generator', which produces spatio-motoric representations ready for gesturing. Kita and Özyürek also suggest that there is feedback in both directions between the Message Generator and the language Formulator. In this way, gestures are said to be "shaped on-line by linguistic formulation possibilities" (Kita and Özyürek, 2003, p. 28). However they are not completely constrained by language, since they may also express information that is not encoded in the accompanying speech. If gestures can be shown to differ depending on the degree to which they are channelled through language, this would provide additional support for Kita and Özyürek's proposal, suggesting that there is indeed scope for feedback between the linguistic *message* and the non-linguistic *sketch.*

The following section turns its attention more specifically to the use of gesture as a means of investigating event conceptualisation.

1.10.3 Using gesture as a window on event conceptualisation

Evidence from a range of sources suggests that it may be possible to use a test of gesture to explore the way in which people with aphasia conceptualise events. First, a number of different studies have demonstrated that people with aphasia make spontaneous use of gesture alongside speech. For example, Rose and Douglas (2003) found that people with very limited speech produced a large number of meaningful gestures (such as pantomimes and emblems) in a conversational context. Fex and Mansson (1998) similarly identified a total of 412 gestures produced by a group of four people with aphasia during an object naming task, as compared to only one produced by a matched group of non-brain damaged controls. Hadar, Burstein, Krauss and Soroker (1998) monitored the gestures of a group of people with anomic aphasia, a group with visuo-spatial impairments and a group of non-brain damaged controls in their retelling of cartoon stories. The people with aphasia gestured more than either of the other groups, while those with visuo-spatial difficulties, who had no language problems, gestured the least. There is some debate over the interpretation of this finding. Hadar et al argue that, because language and gesture were differentially impaired in the two groups, they cannot be produced by a common conceptual mechanism. Dipper (1999), on the other hand, suggests that a single conceptual system embraces both linguistic and visuo-spatial elements, each of which can potentially influence output independently of the other.

A range of evidence further suggests that gesture and language are intimately linked, providing support for the idea that gesture may offer a 'window' onto conceptualisation for language. One source of evidence comes from studies of people with dementia. A number of studies have reported difficulties in gesturing developing alongside problems with language. For example, Béland and Ska (1992) report the case of HC, a French-speaking woman with primary progressive aphasia. HC was monitored over a three year period. At each session she was asked to describe activities such as making an omelette, for which she was given pictures of the relevant objects. Her descriptions were analysed in terms of both the language produced and the accompanying gestures. HC's language was also formally assessed, and her praxis was monitored by asking her to produce action pantomimes and copy meaningless gestures.

HC's scores on the tests of praxis remained within two standard deviations of the mean of a group of control participants throughout the test period. Indeed, only one of her scores in the final session fell short of the controls' mean. HC's language and gestural skills, on the other hand, both deteriorated markedly. Her language declined both on formal testing and in the description task, where she produced fewer nouns and verbs and far greater proportions of pronouns such as '*ça*' and stereotypes such as '*chose*' or '*affaire*'. Her spontaneous gestures also changed. She began to point more to target objects, while producing fewer pantomimes.

There was a particularly marked decrease in the number of pantomimes produced alongside verb phrases, with a slight increase in those produced to 'empty' stereotypes. HC did not appear to be able to use gesture to facilitate access to language, and made little use of it (apart from pointing) to replace missing words.

HC's case is interesting in that she lost the use of spontaneous communicative gesture, while retaining the ability to produce gestures and pantomimes within formal tasks. Other studies of people with dementia have reported different patterns, while still uncovering correspondences between their language abilities and their production of semantically meaningful gestures. For example, in a study of eight individuals with Alzheimer's type dementia, Dumont and Ska (1998) found a correlation between their production of object gestures and their performance on a test of language comprehension. Carlomagno, Pandolfi, Marini, di Iasi and Cristilli (2005) further demonstrated general similarities between the 'empty' speech of people with DAT and their reduced production of meaningful gestures. However, the pattern was not universal, since two of the participants produced a large number of gestures, many of which were semantically meaningful.

Evidence from aphasia has also pointed to a close connection between gesture and language. For example, some people with aphasia have been shown to display apparently verb specific semantic knowledge in their gestures. 'Marcel' (Kemmerer et al, 2007) was able to produce subtle iconic gestures in both spontaneous and elicited contexts, despite a severe impairment in retrieving nouns, verbs and prepositions and in forming verb phrases. Although his gestures did not help him to access words, they appeared to reflect a number of factors specifically relating to the packaging of English verb meanings. For example, his gestures of motion verbs such as *roll*, *run* and *limp* reflected their core aspects of manner and/or path. When he gestured the same verbs in combination with prepositions (e.g. '*The man limped around the room*'), his gestures included both the manner encoded in the verb and the path specified by the preposition. Marcel's gestures seem therefore to have fallen towards the right hand end of Kendon's continuum, in as much as they took on the core properties of language while being produced in a speech-free context.

Finally, there is also some evidence that gesture may assist lexical access in people with aphasia. For example, Pashek (1997) describes the case of KR, a right-handed man with non-fluent aphasia and apraxia but no hemiplegia. KR was trained to repeat object and action names, either in isolation or alongside gestures. His naming improved significantly, from approximately 30% accuracy at baseline to a maximum of 85-90% when gesturing, while untreated items showed little improvement. Rose and Douglas (2001) also report positive naming results, particularly for people with primarily phonological impairments. Three out of their six participants demonstrated improved object naming when producing iconic gestures, whereas pointing, visualisation and cued articulation had no effect. A follow-up study with one of the same individuals (Rose, Douglas and Matyas, 2002) indicated equally strong treatment effects for therapies based on gestural cueing, verbal cueing and a combination of the two. However, it is difficult to tease apart the specific effects of each type of cue, since both gestural and verbal therapies included a number of very similar tasks.

While these facilitation effects suggest that the gesture and language systems are functionally related at some level, gestures do not automatically support lexical access. For Marcel, described above, gesture provided an augmentation to speech rather than a facilitator. 'Charles' (Marshall, Atkinson, Smulovitch, Thacker and Woll, 2004), a Deaf man with sign language aphasia, similarly demonstrated a stark dissociation between language and gesture. His signing of object names was much more impaired than his ability to gesture their use. This was so even when the signs involved were highly iconic (i.e. similar in form to the related gestures). Gesture clearly did not cue Charles's production of even closely-related signs, suggesting that the two systems are at least partially distinct.

Facilitation of language by gesture could only be expected in cases where the gesture is closely related to a particular word or sign (Krauss et al, 2000). Many gestures express either different aspects of meaning from the language they accompany, or convey only part of the meaning of a related word (Kendon, 2000). As Marshall (2006) points out, if gestures are to act as direct cues for language, "they should express constrained, selective meanings that can be mapped onto specific words" (p. 113). Even where gesture is used as a channel for conceptualisation, as in the therapies devised for MM (Marshall et al, 1993) and EM (Marshall et al, 1998; Marshall, 1999) described earlier, the thinking underlying gesture production must be brought into line with thinking that can support language. In order to talk about events, as already suggested, the gestural sketch must be sufficiently close to a language-ready message to be able to drive verb access. This is particularly true for individuals whose conceptualisation for language is very out-of-kilter with the requirements of their particular language. This kind of mismatch is one possible explanation of the difficulties experienced by the person for whom the Action Gesture Test was designed.

1.10.4 Summary

The nature of the link between gesture and language is still under debate. However, it appears sufficiently close to justify the use of a gesture test to investigate event conceptualisation. It is also clear that many people with aphasia, like the person described in Chapter 5, use gesture whilst speaking. Rather than aiming to clarify the nature of the speech-gesture relationship in general, the Action Gesture Test aims to highlight the relationship between this individual's action gestures and his event processing for language.

A number of different hypotheses might be entertained in relation to a person who had difficulty in conceptualising events for language. First, he or she might be unable to gesture actions at all. Such a complete lack of action knowledge would however be unlikely, given that gesture production can also draw on largely non-linguistic, visuo-spatial action schemas. A second possibility is that the person would only be able to produce the type of gestures that fall at the left hand end of Kendon's continuum. He or she might produce gesticulations or pantomimes of actions, but would not naturally make use of more conventionalised or emblematic action gestures. The Action Naming Test explores a third hypothesis. This is that people who have trouble in conceptualising events for language will not demonstrate the same 'Right Shift' in their gestures as is predicted for non-brain damaged individuals. While non-brain damaged speakers are predicted to produce more 'pared down' action gestures the more they are driven by language, people with event conceptualisation difficulties are not predicted to be influenced by the linguistic context. For them, both verbs and photographs of events should elicit similar gestures. By manipulating the degree to which language is involved, the Action Gesture Test aims to offer insights into its influence on thinking-for-gesturing in both non-brain damaged speakers and in an individual with suspected event conceptualisation difficulties.

1.11 General Summary and Conclusions

This study asks whether difficulty in talking about events and states can arise, at least in part, from trouble in adopting a focus over situations that is optimally organised for language. In order to adopt such a focus, we have to master the complex interplay between conceptual information and its linguistic encoding. Talking about events and states requires the paring down or 'packaging' of complex conceptual information into meanings that can be expressed in language. We must extract a comprehensible event structure from a perceived situation, specifying what is going on, who or what is involved, and what role each is playing. Entities that are identified as playing roles in the event or state to be described must be selected from others that are also present in the perceptual situation. The highlighted entities must be organised so as to express the speaker's perspective. One way in which this is achieved is through the selection of a particular verb structure. Difficulty with any aspect of the conceptual preparations for language, or in the mapping between conceptual structure and language, will impact on a person's ability to express ideas – and in particular on the ability to express relational information. Aspects of this 'packaging' process are explored in the tests described in the following chapters.

The issue of thinking for speaking has obvious implications, not only for talking about events, but for therapy with people with aphasia who have difficulty in doing so. Clinically, we need to know if there are indeed people with this kind of difficulty and, if so, to establish reasonably economical clinical markers of their abilities. While the present study is not a therapy study, it was therefore important that it should keep an eye on clinical practice in the design of its novel tasks, and should specifically consider the therapeutic implications of their findings. Not all of the new tasks are applicable to everyone with suspected event processing difficulties (for example, some tasks were designed for particular individuals and so require particular basic skills). However, the overall aim was to contribute to the battery of assessments that cumulatively can identify people with trouble in conceptualising events. Finally, a conscious effort is made to draw out the potential of any cueing mechanisms uncovered by the tests that might help to structure people's thinking about events in a more language-relevant way.

The aims of the study are therefore:

1. To investigate whether some people with verb and sentence difficulties also have difficulty in the conceptual preparations for language about events
2. To develop new, clinically relevant tests of these conceptual processes
3. To identify cueing mechanisms that can help people structure their thinking for expression

In order to meet these aims, six people with aphasia who had difficulties with verbs and sentences were identified. They first completed a battery of assessments, which aimed to tap their language and more general cognitive abilities, as well as a range of skills associated with event processing. These preparatory assessments included a number of published and unpublished measures, including some of the tests that were designed for the case studies described in section 1.5. They are described and criticised in more detail in Chapter 2.

As a result of this process, two individuals, Ron and Harry, were hypothesised to have difficulties that stemmed at least in part from trouble in conceptualising events. A number of novel assessments were designed to investigate their particular abilities in more detail. In one case (the Sharon and Paul Test), the issue being investigated was felt to be relevant both to people with specific event processing difficulties and to those with verb and sentence production difficulties arising from other causes. As a result, this test was completed by all six participants with aphasia. The Order of Naming Test (Chapter 3) first probed Ron's event focus through his naming of the entities involved in pictured scenes. The Sharon and Paul Test (Chapter 4) explored the factors that constrain the adoption of perspective over situations. The Action Gesture Test (Chapter 5) explored the nature of Ron's action gestures, and the relationship between his gesturing and his talking about events. Finally, a recently devised drawing assessment (the Event Drawing Task, Sacchett, 2005) was used to investigate Harry's ability to convey events through drawing. The Discussion chapter (Chapter 6) considers the implications of the test findings for the thinking for speaking hypothesis and for the assessment of event processing in aphasia. It revisits the question of how amenable to testing difficulty at this level is. The study ends by discussing the implications of the findings for therapy with people with aphasia.

Chapter 2 Preparatory Testing

This chapter describes the process of recruitment and screening for the study, and the responses of the six final participants on a range of preliminary assessments of language and event processing.

2.1 Recruitment of participants with aphasia

Potential participants were recruited through two sources: a charitable organisation that offers specialist services to people with aphasia, and a hospital outpatient Speech and Language Therapy service. Ethical approval was granted by the appropriate Local Research Ethics Committee. Individuals were then referred by their Speech and Language Therapists. Referral criteria stated that participants must have non-fluent aphasia of at least six months' duration stemming from a single episode CVA, with no evidence of other cognitive deficits. It was also important for them to have some access to language output in order to be able to complete the experimental assessments. Since the study aimed to investigate the connections between conceptual processes and language, participants also needed to be native speakers of English, the language in which all the assessments would be carried out. As a number of potential participants were speakers of more than one language, this criterion was refined so that either monolingual English speakers, or those who had learned English concurrently with their primary language might be referred. People who expressed interest were invited to a one-to-one meeting at which the project was explained in detail using an aphasia-friendly information booklet (see Appendix 1). At a later date, following further opportunities for discussion and questions, those who were still interested in taking part were asked to sign an aphasia-friendly consent form (see Appendix 2).

Eleven people were referred to the study, of whom three did not meet the referral criteria. Of these, two had fluent aphasia with significant comprehension difficulties compromising their ability to understand test instructions, and one had not learned English until school age. One other person sadly died before the start of the study. The remaining seven individuals completed three screening tests to establish their suitability for the project. These are outlined in the following section.

2.2 Screening

2.2.1 Cognitive screening

First, it was important to distinguish specific difficulties in processing events from other more general cognitive abilities. Raven's Standard Progressive Matrices (SPM, Raven, 1958) was used to assess participants' non-verbal cognitive and visuo-perceptual skills. The SPM was designed to test a person's systematic reasoning processes, through the ability to perceive relationships among geometric figures. The test presents 60 problems in sets of 12, each set becoming progressively more difficult. Problems are picture based, requiring the selection of a figure to complete a given sequence. Little language is required to explain the task and none to respond, making the test appropriate for use with people with aphasia.

The SPM was preferred over the Raven's Coloured Progressive Matrices (CPM, Raven, 1976), despite the fact that the CPM was devised for use with various disabled populations, including those with language difficulties. However, the CPM was only designed to assess mental development up to the level at which a person can consistently reason by analogy. Both control participants and participants with aphasia would be expected to have developed beyond this level, meaning that the test would not offer a true reflection of their ability. There would be a real risk of participants scoring at ceiling, as the CPM is only intended to differentiate the skills of people in the bottom 20% of the range. In addition, only limited recent norms are available, covering children and adults aged 55 to 85 (Smits, Smit, van den Heuvel and Jonker, 1997), though even here an abbreviated version of the test was used. In theory it is possible to convert scores from one version of the Matrices to the other, allowing comparison with a larger set of normative data. However, in practice this is also problematic, since there is little room for discriminating between higher CPM scores. For example, a CPM score of 30/36 for an adult over 70 (between the 75th and 90th percentiles) equates to an SPM score of 36 (between the 10th and 25th percentiles).

On the other hand, the SPM brings a higher risk of failure on a larger number of items. Other problems relate to the test's standardisation. The most recent and largest UK standardisation used a representative sample of the adult population of Dumfries, said to be demographically representative of the UK. However, rather than being completed 'live', the test was left for people to complete in their own time, raising questions about reliability. As a result the norms produced may be too high, although scores on the Matrices have been gradually increasing since they were first published. The number of older people who agreed to take part was also rather low, so that good data is still lacking for people aged over 70. A further problem that potentially threatens the test's validity with people with aphasia is that of the 'verbalisation hypothesis'. This suggests that in order to succeed, particularly on the more complex items, it is necessary to verbalise the problem-solving process. Here too the evidence is unclear, with some studies identifying differences, and others finding none, between the performance of people with left and right hemisphere damage.

In order to feel confident about using the Raven's Matrices as a screen for participants' cognitive abilities, it is important to consider the effect of aphasia on performance. A number of studies have found correlations between scores on the CPM and various language measures (e.g. Edwards, Ellams and Thompson, 1976; Kertesz and McCabe, 1975; David and Skilbeck, 1984). However, when improvement on language measures is considered, the evidence is less strong. For example, Bailey, Powell and Clark (1981) found that CPM scores correlated with both severity of aphasia and improvement on the Minnesota Test for the Differential Diagnosis of Aphasia (MTDDA, Schuell, 1965), while SPM scores did not, possibly because of the small number of people tested. In contrast, David and Skilbeck (1984) found no relationship between CPM scores and improvement on either the Functional Communication Profile (FCP, Sarno, 1969) or the MTDDA.

Overall, the evidence is not clear. It remains possible that people with aphasia may perform worse than non-brain damaged speakers on this kind of non-verbal test, either because of problems in understanding the test instructions, or because of difficulty in recruiting language to help them problem-solve. More generally, a deficit of attention may impair their performance (see Murray, 1999, for a review). However, as suggested in Chapter 1, it was not necessary for the present study to establish that people were performing at their pre-morbid level. Rather they needed to perform within the normal range, and significantly better than they did on assessments of language. For this reason a cut-off criterion for the SPM was set at the 10th percentile (between one and two standard deviations below the mean on a normal distribution). People who scored above this level, although at the lower end of the normal range, could certainly be considered to be performing within normal limits.

2.2.2 Screening for action naming

The second entry criterion aimed to establish that participants had specific difficulty with language relating to actions. Two screening tests were used in order to distinguish difficulties in naming actions from general semantic or naming deficits. These were the three-picture version of the Pyramids and Palm Trees Test (PPT, Howard and Patterson, 1992) and the Object and Action Naming Battery (Druks and Masterson, 2000).

The Pyramids and Palm Trees Test assesses the ability to derive semantic information non-verbally from object pictures. Each of the 52 items presents an object along with a semantically related target and a distractor. The target must be selected on the basis of its semantic association. If a person can perform at a normal level on this test, this suggests that they can recognise object pictures, and can make judgments on the basis of accurately retrieved conceptual/semantic information about the objects shown. The test is also useful in that it demonstrates a person's ability to understand the demands of this type of task and manipulate information in the necessary way. These are skills required by a number of the other tests used in the present study. If a person performs poorly on any of these later tests, having fared well on the Pyramids and Palm Trees Test, this is unlikely to be a function of the task format. Normative data is available: non-brain damaged controls made no more than three errors. The authors state that a person who scores above 90% (or 47/52) does not have a clinically significant impairment. This was therefore set as the entry criterion for the study.

The Object and Action Naming Battery (Druks and Masterson, 2000) presents line drawings of 162 objects and 100 actions for naming. Normative data is available for two age groups: people aged 61-70 and those aged 71-80. Both groups were slightly more successful at naming nouns than verbs. The younger group made a mean of 2.82 noun errors (S.D. = 1.87) and 3.05 verb errors (S.D. = 2.40). The older group made slightly more errors, with a mean for nouns of 4.23 (S.D. = 2.72) and for verbs of 5.41 (S.D. = 4.10). To be included in the study, participants must succeed in naming a significantly higher percentage of objects than actions. As the aim was to determine whether there was a word class effect, the test was administered in each participant's strongest response modality, either speech or writing. Responses were scored in accordance with the test instructions. Self-corrections, compound nouns and a limited range of synonyms were permitted. The test protocol also allows a range of prompts to be used when non-target responses are produced. For example, where an object is named in place of an action, the person is prompted to say what is happening or what the person in the picture is doing. (This is in addition to similar general reminders throughout the action naming test.) Responses corrected after such prompts are however counted as errors for the purposes of comparison with the controls (and therefore for scoring in this study). The Battery additionally offers scope for probing any effects of frequency, familiarity or age of acquisition on naming. Participants' responses were also analysed for each of these factors.

The responses of two participants were limited by apraxia, which affected their production of initial phonemes. A scoring criterion was established to deal with these instances. Responses were counted as correct if all but the initial phoneme was correctly produced and if the whole was an intelligible approximation to the target.

2.2.3 Results of screening tests

Of the seven people who completed the screening tests, one was excluded following a very low score on the Raven's SPM. The six remaining participants performed according to the entry criteria. Their responses are summarised in Table 2.2.3. Both raw scores and their equivalent as percentages of the maximum possible are given. Pseudonyms are used throughout.

Participant	Raven's SPM Raw score (N=60) (%)	Raven's SPM Percentile	Pyramids & Palm Trees Raw score (N=52) (%)	Object Naming Raw score (N=162) (%)	Action Naming Raw score (N=100) (%)
Carl	45 (75)	25^{th}	52 (100)	3/19 (15.79)	0/19 (0)
Jack	42 (70)	$10^{th} - 25^{th}$	52 (100)	103 (63.58) * (writing)	39 (39) * (writing)
Helen	53 (88.33)	$50^{th} - 75^{th}$	51 (98.08)	152 (94) *	81 (81) *
Ron	43 (71.67)	$10^{th} - 25^{th}$	48 (92.31)	116 (71.6) *	17 (17) *
Harry	42 (70)	$10^{th} - 25^{th}$	52 (100)	103 (63.6) *	31 (31) *
Melvyn	33 (55)	$10^{th} - 25^{th}$	49 (94.23)	158 (97.5)	77 (77) *

Table 2.2.3 Responses of participants with aphasia on screening tests

As the table shows, all participants scored above the 10^{th} percentile on the Raven's SPM, and above criterion on the Pyramids and Palm Trees Test. Scores on the Object and Action Naming Battery that fell more than two standard deviations below the mean of the appropriate control group are marked with an asterisk. For Helen, Ron and Harry, who were younger than 60, no age-matched control data is available. Their scores are therefore compared with those of the group aged 61-70. Carl had great difficulty in completing the naming test, which was abandoned after the first 19 items in each set. Comparison with non-brain damaged controls is therefore not possible in his case. Instead, a shorter version of the Naming Battery was constructed for him. This is described in more detail along with the discussion of subsequent language assessments in section 2.5 (below). All of the other participants fared significantly better in naming objects than actions. Their performance is also discussed further in section 2.5.

In summary, the screening tests established that participants had no significant cognitive or visuo-spatial deficit that might impair their performance on later assessments. The tests also showed that they did not have a significant general difficulty in deriving semantic information from pictures, and that they were significantly better at naming objects than actions. The six people who met these criteria were invited to take part in the final study. The following section presents some brief biographical information about each.

2.3 Participants

The amount and type of background information required in studies of aphasia has been the subject of recent discussion (e.g. Brookshire, 1983; Roberts, Code and McNeil, 2003). For the present study, all but two of the variables recommended by Brookshire (1983) are reported where possible. These are the source of participants, their age, education, gender, hemisphere damaged and lesion location, handedness, aetiology of aphasia and time post onset. The final two recommended variables (aphasia severity and type of aphasia) are only reported descriptively. This is because no test battery that would objectively yield such information (such as the Boston Diagnostic Aphasia Examination – Goodglass, Kaplan and Barresi, 2000, or the Western Aphasia Battery – Kertesz, 1982) was included. Completing a full test battery in addition to the assessments already included would have significantly increased the burden on participants. However, a large body of assessment data is presented which offers more detailed information in many of the areas assessed by such batteries.

Roberts et al (2003) reviewed a corpus of 100 published aphasia studies, finding a good deal of variation in the amount of background information provided and in the quality of the reporting. They recommended the inclusion of a number of additional variables, depending on the type of research report in question, but including information on participants' native language and possible bilingualism, hearing status and visual acuity. While native language was considered carefully in the present study, no formal screening of hearing or vision was included. Only one participant, Melvyn, had a reported loss of hearing acuity, which was not evident in everyday conversational contexts. It was assumed that all participants had either normal or corrected-to-normal vision. It is possible that subtle deficits of hearing or vision may have affected individual participants' responses to the experimental assessments. However the effects of such deficits would be general, affecting responses across the board. Where specific dissociations are found (which are the focus of interest in this study), these are unlikely to be the result of visual or hearing difficulties. Roberts et al (2003) also recommend that details of previous therapy are included in treatment studies. These are not described here as the present study does not focus on treatment effects.

Carl

Carl was 53 years old at the time of the study and lived with his wife and adult daughter. He was born in Goa, and grew up speaking English, Portuguese and Hindi with equal fluency. He was right handed. At the time of his stroke four years before the study Carl was working as a police officer, and subsequently returned to work in a different capacity. Carl suffered a left Middle Cerebral Artery CVA, causing severe aphasia but no physical disability. No further details of his stroke were available. Carl had very little access to spoken content words, although he was able to produce some very skeletal structure (e.g. repeated use of phrases such as 'This guy he's got…', 'He have to…', and 'Try to get…'). His written naming was slightly more successful, but was still mostly limited to occasional initial letters. Carl also had some comprehension deficit, particularly affecting his understanding of reversible sentences, although he was extremely adept at using contextual cues. He remained an excellent communicator, making very resourceful use of speech, drawing, gesture, written numbers and dates, and exploiting every form of conversational support (calendars, newspapers, maps, etc).

Jack

Jack was 65 years old and was married with one adult son. He left school at 16 and held many different jobs, most recently as a painter and decorator. He was right handed and a monolingual English speaker. Five years before the study he had a left CVA (no further details were available), which caused severe aphasia and right-sided hemiplegia. Jack's spoken output was very limited, although he retained excellent comprehension. His only intelligible spoken words were 'Yes', 'No' and expletives. The rest of his spoken output consisted of a repeated neologistic utterance: [ʒwɛdʒwɛdʒwɛdʒ]. Jack was able to write some single words and initial letters, and readily combined these with non-verbal methods such as drawing and very expressive intonation. He remained an excellent and assertive communicator, making good use of his conversation partner to support his output.

Helen

Helen was 48 years old and lived with her partner. She was right handed and a monolingual English speaker. She was educated to PhD level in Pharmacology, later holding a senior position in medical device regulation as well as working as a self-employed consultant. Four years before the study Helen suffered a subarachnoid haemorrhage from a ruptured anterior communicating artery aneurysm, causing aphasia and right-sided hemiparesis (which subsequently resolved). She found it impossible to return to her previous job, but developed a large number of new interests. Helen's language was non-fluent and hesitant with significant word finding difficulties and phonological errors, leading to many false starts and revisions. Her spontaneous speech contained very little verb argument structure, although she frequently produced phrases such as 'It's very…', 'It's not…' in conjunction with writing. Helen had better access to written than to spoken words, and frequently supported her speech with single written words, drawings, diagrams and some gestures. Her comprehension was generally good in conversation.

Ron

Ron was 51 years old, and was married with a large family. He was right handed and a monolingual English speaker. Ron left school at eighteen to work as an electrical engineer and later as a car salesman. He had a CVA in the left Middle Cerebral Artery region ten years before the study, causing aphasia and right-sided hemiplegia. (No further information was available.) Ron had not worked since his stroke, but was active in a number of different groups and adult education classes and maintained many interests including jazz, photography and football. Ron's language was characterised by long strings of noun and adjective phrases, linked by resourceful use of social phrases such as 'Interesting, actually…', 'Funny you should say that…', and 'Imagine that'. Outside of these phrases he produced very few verbs and minimal verb argument structure. Ron's writing was very limited, but he made some use of supportive gesture. His comprehension was good for social conversation but sometimes broke down with increasing complexity.

Harry

Harry was 56 years old and lived with his partner. He was right-handed and a monolingual English speaker. Harry left school at 18 but later returned to several years of further study, gaining his degree while working as a construction planner. Four years before the study he suffered a left parietal lobe infarct, causing severe aphasia, apraxia of speech and right-sided hemiplegia. Harry had not been able to return to work since his stroke, and spent most of his time at home. His spoken output was still greatly limited by both aphasia and apraxia. It was generally confined to single words and phrases such as 'Yes', 'No', 'Thank you', 'Right', 'It's...', 'I can't...' and 'I don't know'. Occasionally Harry produced a key content word or proper name (e.g. 'opera', 'Festival Hall', or his partner's name), but this was usually very effortful and involved some approximations. Harry was able to write some initial letters and a small number of single words, which he combined with numbers, dates and drawings. However conversation was very effortful, and was typically led by his communication partner. Harry's comprehension was good for normal social conversation.

Melvyn

Melvyn was 78 years old, and was married without children, although he had a close wider family. After leaving school at 14 he worked as an engineer and fitter for the Ministry of Defence, and later as an industrial photographer. He was right handed and a monolingual English speaker. Melvyn had a left temporal frontal haemorrhagic infarct three years before the study, causing aphasia but no lasting physical disability. Melvyn's language was the most fluent of all the participants with aphasia, and he had access to a number of verbs as well as to some verb-argument structure. However his speech was frequently disorganised and somewhat rambling, with evidence of occasional word finding difficulties affecting naming of both objects and actions. Melvyn had good conversational comprehension, but experienced some difficulty when in a distracting environment or processing complex instructions. He also had some age-related hearing loss which was not corrected at the time of the study.

Introduction to assessments of language and event processing

Following the screening tests, a range of language assessments was used to clarify participants' skills in processing verbs and verb argument structure. These assessments are outlined in section 2.4, with an overview of the group's scores, before section 2.5 discusses each person's performance on the tests so far described. A number of assessments specifically targeting the non-verbal processing of events was then used to pinpoint difficulties in the conceptual preparations for talking about actions. These assessments are described in section 2.6. As suggested in Chapter 1, the precise relationship between event conceptualisation and language is not yet clear. In particular, it is not evident to what extent difficulty with language relating to actions is necessarily associated with problems at the conceptual level. The aim of the event-related tests was therefore to distinguish individuals for whom trouble in conceptualising events seemed likely to have contributed to their language impairment. Section 2.7 discusses each participant's performance in relation to developing hypotheses about possible event conceptualisation difficulties. A number of further tests, administered on a case-by-case basis to explore individual participants' abilities, are also described. In reporting test scores, those that fall outside the normal range (where such information is available) are marked with an asterisk. Depending on the test, this may indicate scores that lie outside the total range of non-brain damaged controls, or those that are more than two standard deviations below their mean.

2.4 Assessments of language

Although the relationship between event conceptualisation and language is not fully understood, it is reasonable to predict that trouble in conceptualising situations for language will be reflected in the language a person produces. The assessments of language were used to identify whether participants showed the pattern of abilities that would be predicted to accompany this kind of difficulty. For example, Dipper et al (2005) argue that, "Describing situations that involve relations between or among participants would be particularly difficult since selection of the relevant participants and of aspects of the situation would have to rely more on non-linguistic coding" (p. 424). As well as finding it hard to name actions, a person with trouble in conceptualising situations for language would therefore be predicted to have difficulty in talking about events in connected speech, producing few verbs and little sentence structure. Their signalling of verb-argument structure should be particularly impaired, since this requires analysis not only of the nature of an action but of its role and relational structure. Talking about objects should be relatively less impaired, as objects are perceptually more clearly bounded and typically maintain their identity over time.

Comprehension would not necessarily be expected to be impaired to the same degree as production. People who show the features generally associated with agrammatism typically have relatively spared comprehension (Berndt et al, 1997a; Kim and Thompson, 2000). More specifically, as outlined by Dipper et al (above), aspects of the comprehension process will automatically support the processing of events. Comprehension is at least driven by a complete linguistic form, which is already necessarily 'pared down'. Interpretation will also be aided by other clues to meaning such as pragmatic information. The tasks typically used to test comprehension provide a further source of constraint, as the targets are usually presented in picture form for selection from distractors, limiting the range of possible interpretations. However, despite these cues to meaning, some difficulty in accomplishing the mapping between language and conceptualisation would still be predicted, particularly in relation to verbs and sentences where there is greater scope for the process to go awry.

2.4.1 Language production

The participants' skills in connected speech were investigated by asking them to retell the contents of a short film clip. This was an almost-silent excerpt from a Laurel and Hardy film. Participants were asked to view the clip twice and then tell back the story. In order to minimise any difficulties in distinguishing or naming the two main characters, still photographs of Laurel and Hardy were provided along with their written names. Responses were video recorded and transcribed. Five non-brain damaged individuals aged 50-75 (mean = 65.8) were also asked to retell the same clip for comparison. Their narratives are included in Appendix 3.

The narratives were subjected to a simple quantitative analysis, based on the systems devised by Berndt, Wayland, Rochon, Saffran and Schwartz (2000) and Byng and Black (1989). This gave a measure of the total number of words produced and the proportion of words of different classes, as well as a more detailed breakdown of the predicate-argument structures represented. The systems used strictly require a sample of at least 150 narrative words, after exemplars of a large number of extraneous categories have been removed. These include conjunctions, habitual or stereotyped phrases, comments on the narrative, direct discourse markers, repeated words or phrases (except where deliberately repeated for emphasis), and any words that are later amended or elaborated. For both participants with aphasia and controls, the analysis presented represents the first 150 narrative words produced (to the nearest utterance boundary). The total number of words used to convey the story is also given for comparison.

Producing 150 narrative words proved problematic for some of the participants, either because they produced very little language or because a large proportion of the words produced fell into the excluded categories. Some participants additionally required the use of non-verbal methods such as drawing and gesture as well as speech to convey the narrative. These were noted as faithfully as possible, but were not included in the quantitative analysis. Jack's narrative was almost entirely conveyed through drawing, and therefore could not be subjected to formal analysis. For Ron and Harry, the small number of analysable words produced made comparison with non-brain damaged speakers problematic. In theory when this occurs participants are asked to tell further stories until the narrative quota is reached. However, the story-telling task proved very demanding and so in practice only the Laurel and Hardy film was used, despite the smaller corpus. In Ron's case, since the film elicited only 32 narrative words, an excerpt from an additional filmed conversation was also analysed. Here Ron was recounting an incident that was already known to the interviewer, involving a visit to the London Transport lost property office.

The Laurel and Hardy film offered scope for the expression of a range of situation types. These included changes of state (e.g. waking/getting wet); events of motion, involving both change of location (e.g. standing/sitting/crossing) and manner (e.g. floating/splashing); events of communication (e.g. ordering); and events of attachment/detachment (e.g. removing). The situations involved a range of different participants, including a person or animal acting alone, a person acting upon an inanimate object, a person acting upon an animal and one person acting upon another. Both reversible events (e.g. one man lifting another) and non-reversible events (e.g. a man dropping his rucksack) were included. There were also examples of situations involving two animate participants where there was a clear dilemma of perspective. Here the situation could be described from the perspective of either participant, as verbs that matched each were readily available. For example, one scene could be described either as a man leading a donkey or as the donkey following the man. Conversely, several of the situations involving two animate participants could only be easily described from one perspective. For example, in a scene where one man dries the other there is no readily-available verb to describe the experience of the man being dried. This situation could only easily be described from his perspective by using the passive form.

The narratives produced by the participants with aphasia are considered in the individual case discussions. Tables 2.4.1 (a) and (b) present a summary of the language produced by each person and by the control participants.

	Carl	Helen	Ron	Harry	Melvyn	Controls (mean)
Total words produced	261	171	102	94 (excluding responses to interviewer)	700	264
Narrative words in analysed sample	147	115	64	59	152	146
Open class words	46	58	50	25	65	71
Closed class words	101	57	14	34	87	75
Proportion closed class words	0.69	0.5	0.22	0.58	0.57	0.51
Nouns	9	13	14	5	25	29
Pronouns	19	29	6	22	17	13
Proportion pronouns / nouns + pronouns	0.68	0.69	0.3	0.81	0.40	0.3
Verbs	28	24	8	10	29	30
Copula 'be'	28	15	1	10	2	2.2
Proportion verbs / nouns + verbs	0.76	0.65	0.36	0.66	0.54	0.5
Inflectable verbs	11	3	7	0	23	20
Inflectable verbs inflected	3	3	2	n/a	17	19.4
Proportion inflected verbs	0.27	1	0.4	n/a	0.74	0.97

Table 2.4.1 (a) Summary of responses to narrative task (from Berndt et al, 2000)

	Carl	Helen	Ron	Harry	Melvyn	Controls (mean)
1 Noun phrase	3 (10.7)	8 (25)	11 (44)	7 (36.8)		0.2 (1.1)
2 Verb only	1 (3.6)	1 (3.1)	5 (20)			0.4 (2.2)
3 PP only		2 (6.3)		2 (10.5)		
4 AP/Adv P only	1 (3.6)		6 (24)			
5 NP_1 V	8 (34.8)	5 (15.6)	2 (8)	4 (21.1)		1 (5.4)
6 V NP_2						1 (5.4)
7 NP_1 XP (X = N, A, P, Adv)	1 (3.6)	1 (3.1)	1 (4)			
8 XP NP_1	1 (3.6)					
9 V AP/PP/AdvP	2 (7.1)					1.2 (6.5)
10 NP_1 V NP_2	3 (10.7)	4 (12.5)		3 (15.8)		1.8 (9.8)
11 NP_2 NP_1 V	1* (3.6)					
12 NP_1 V PP	5 (17.9)	4 (12.5)		2 (10.5)	9 (60)	4 (21.7)
13 NP_1 V AP/AdvP	2 (7.1)	6 (18.8)		1 (5.3)	1 (6.7)	0.6 (3.3)
14 V NP_2 NP_3/PP						0.4 (2.2)
15 NP_1 V NP_2NP_3/PP_1		1 (3.6)				0.4 (2.2)
16 NP_1 V PP PP						0.4 (2.2)
17 NP_1 V Non-Arg XP						0.2 (1.1)
18 NP_1 V XP Non-Arg XP					4 (26.7)	1.8 (9.8)
19 NP_1 V S					1 (6.7)	5 (27.2)
Total	28	32	25	19	15	18.4

Table 2.4.1 (b) Predicate-argument structures present in narratives (with percentage of total in brackets) (from Byng and Black, 1989)

Only structures that are represented in the narratives are included in the table. Pragmatic discourse markers such as 'you see', and those that do not contain a verb (e.g. 'for some unknown reason') are excluded from the analysis. Temporal markers not including a verb (e.g. 'after a little') are also excluded, although those that contain a verb (e.g. 'when it starts') are analysed. The Byng and Black system also allows any mis-ordered structures to be categorised. This would include structures in which the head noun is produced after the verb, or where a number of noun phrases are included in incorrect order. People who have difficulty in forming a predicate-argument structure might be expected to produce examples of such structures. In fact, the only example from the present narratives was Carl's phrase, 'Inside he was' (marked with an asterisk). This is categorised as NP_2 NP_1 V, which was judged to be the nearest equivalent.

The first five categories (shown without shading) represent the production of isolated phrases that are not obviously integrated into a predicate-argument structure. People who have difficulty in processing events might be expected to produce a relatively high proportion of utterances of this type, and indeed all of the participants but Melvyn did so. Utterances of this type accounted for between 50 and 96% of the total produced by Carl, Helen, Ron and Harry, compared to a mean for the control group of 8.6%. Ron (96%) and Harry (68.3%) in particular produced a large proportion of these isolated utterances.

Categories 6 to 16 (shown with pale shading) represent different types of predicate-argument structure, the number of arguments increasing through the table. People who have trouble in producing predicate-argument structures would be expected to produce relatively few examples of these later categories. Ron again fulfilled this prediction, in that he only produced one example of a predicate-argument structure, of the type NP_1 AP ('glasses identical'). The other four participants performed rather more like the controls in this respect, producing a large proportion of utterances of the type NP_1 V NP_2/PP/AP/AdvP.

The last three categories represent more complex utterances involving the production of non-arguments alongside predicate-argument structures. For example, category 17 includes the control utterance, 'Hopefully he dried off towards the end', while category 18 represents utterances such as, 'Laurel and Hardy were walking down the unmade road with a donkey'. Category 19 covers any type of sentence embedding, including relative clauses; for example, 'Hardy is upset when the raft goes over a big stone'. People with difficulties in sentence construction would be unlikely to produce many such complex structures, and indeed, of the participants with aphasia, Melvyn was the only one who did so.

2.4.2 Comprehension of single words

Verb comprehension was tested with the relevant subtest of the Verb and Sentence Test battery (VAST, Bastiaanse, Edwards and Rispens, 2002). This presents a series of spoken verbs, each of which must be matched to a target picture. Distractors represent an object that is semantically related to the target, a semantically related action and an object semantically related to the action distractor. For example, for the target *cycling*, the distractors are a bicycle, a person driving and a car. Twelve of the semantically related objects have names that are homophones of the target verbs (e.g. *rake/a rake*), although all targets are presented in present continuous form. This makes it possible to investigate whether a person is consistently interpreting verbs in terms of associated objects. This is particularly relevant to people with difficulties in conceptualising verb meaning, who may demonstrate a correspondingly stronger focus on objects. Twenty three non-brain damaged control participants made errors on no more than two of the 40 test items, achieving a near-perfect mean score of 39.70.

Noun comprehension was measured by means of subtests 47 and 48 of the Psycholinguistic Assessments of Language Processing in Aphasia (PALPA, Kay, Lesser and Coltheart, 1992): spoken and written word - picture matching. The participants' responses on all three tests of single word comprehension are summarised in Table 2.4.2.

Participant	VAST verb comprehension Raw score (N=40) (%)	PALPA test 47 Raw score (N=40) (%)	PALPA test 48 Raw score (N=40) (%)
Carl	33 (82.5) *	39 (97.5)	40 (100)
Jack	37 (92.5) *	40 (100)	40 (100)
Helen	37 (92.5) *	39 (97.5)	40 (100)
Ron	30 (75) *	38 (95)	39 (97.5)
Harry	35 (87.5) *	39 (97.5)	38 (95)
Melvyn	40 (100)	39 (97.5)	40 (100)

Table 2.4.2 Responses on tests of single word comprehension

As the table indicates, all participants but Melvyn scored more than two standard deviations below the mean of the controls on the VAST verb comprehension test. This contrasts sharply with their performance on the PALPA tests, where all scored above this level. The VAST battery does not include an assessment of written verb comprehension. None of the participants showed a significant discrepancy between their comprehension of spoken and written nouns (though it is possible that this was subject to a ceiling effect). Had such a discrepancy emerged, a written verb comprehension test would also have been constructed.

2.4.3 Sentence comprehension

Sentence comprehension was also expected to show some impairment. Sentences that cannot be understood through the meaning of their constituents alone, but that require accurate processing of word order, should be particularly problematic for people with difficulty in conceptualising events. For this reason assessment focused particularly on the comprehension of semantically reversible sentences. The first test used was the Reversible Sentence Comprehension Test (RSCT, Byng and Black, 1999). Here a spoken reversible active sentence must be matched to a target picture selected from a reverse-role and a lexical distractor. For example, a picture matching the sentence, '*The queen splashes the nun*' must be identified from distractors showing the nun splashing the queen and the queen touching the nun. Four predicate types are represented: action and non-action verbs (e.g. *photograph/delight*), adjectives of psychological state (e.g. *fond/shy*) and locative prepositions (e.g. *on/under*). Use of this test is problematic, however. The non-brain damaged controls performed rather poorly on all sections, leaving little margin to indicate whether a person with aphasia shows a significantly worse pattern on any section. Controls' scores for action verbs ranged from 8 to 10, for non-action verbs from 6 to 10, for adjectives from 7 to 10 and for locative prepositions from 8 to 10. It is also not clear whether the control group's errors were caused by particular problematic items. It is therefore difficult to say whether a person's pattern of errors matches or differs from that of the controls. Interpretation of an individual's performance on the different sections is also problematic, as the difference between sentence types may well be matched by differences in the verbs' imageability, or in the ease with which they can be represented pictorially. What may be interpreted as a problem in understanding a certain sentence type may in fact represent a difficulty in interpreting a particular type of picture.

The RSCT was included despite these caveats as a potential source of information about people's ability to process a wide range of reversible structures. In view of the difficulties, however, the sentence comprehension subtest of the VAST (Bastiaanse et al, 2002) was also included. Here a spoken sentence must again be matched to a target, this time presented with three distractors. Distractor pictures represent the target action with participants playing reversed thematic roles, the same participants engaged in a different action, and the distractor action with reversed thematic roles. For instance, the target, '*The boy follows the girl*' must be distinguished from pictures showing a girl following a boy, a boy photographing a girl and a girl photographing a boy. Selection of non-target actions suggests that a person has difficulty in processing the verb's core meaning, while selection of reverse- role distractors indicates difficulty in the mapping between word order and the thematic role information encoded with the verb. Target sentences include both canonical structures (active and subject cleft) and moved-constituent structures (passive and object cleft). In the first type the agent precedes the theme (e.g. '*The boy follows the girl*'), while in the second theme precedes agent (e.g. '*The woman is painted by the man*'). Again, non-brain damaged controls achieved very high scores: out of 40 items, the mean was 39.90, with a range of 39-40.

Table 2.4.3 presents participants' responses on the tests of sentence comprehension.

Participant	RSCT Raw score (N=40) (%)	VAST sentence comprehension Raw score (N=40) (%)
Carl	27 (67.5) *	20 (50) *
Jack	35 (87.5)	39 (97.5)
Helen	35 (87.5)	22 (55) *
Ron	21 (52.5) *	24 (60) *
Harry	30 (75)	35 (87.5) *
Melvyn	34 (85)	38 (95) *

Table 2.4.3 Responses on tests of sentence comprehension

Only Carl and Ron scored outside the range of the non-brain damaged controls on the RSCT, whereas all participants but Jack scored more than two standard deviations below the mean on the VAST sentence test.

Each participant is now considered in more detail in relation to the assessments so far presented.

2.5 Responses on non-verbal and language assessments

2.5.1 Carl

Non-verbal cognitive and semantic ability

Carl scored at a level equivalent to the 25th percentile for his age on the Raven's SPM. His perfect score on the Pyramids and Palm Trees Test confirmed his non-verbal cognitive ability and demonstrated that he was able to make accurate semantic judgments about objects.

Naming of objects and actions

Carl found all assessments of naming extremely difficult. Spoken naming was impossible, and while written naming was slightly more successful it became clear that Carl would not be able to attempt the full naming battery. On the first 19 stimuli from each set he achieved three correct object names and no correct action names. However his action naming included one close approximation ('simming' for target *swimming*) and several semantically related errors:

'colding' for target *snowing*
'lion' for target *roaring*
'cup' for target *drinking*
'dog' for target *biting*
'poline' for target *stopping* (where the picture shows a policeman stopping traffic)

As Carl's performance had hinted at some residual writing ability, a shorter version of the battery was constructed. This involved subsets of 30 object and 30 action pictures, matched for word length and frequency. Target names were all between three and five letters long. Each subset contained five 3-letter targets, 19 4-letter targets and six 5-letter targets. Pairs of object and action names were matched as closely as possible for frequency using Francis and Kucera (1982). Frequency ratings for objects ranged between 20 and 348 (mean = 109.2), while ratings for actions ranged between 20 and 333 (mean = 109.33). As Carl was often unable to write a whole object or action name correctly, the number of correct initial letters and the total number of correct letters was also calculated for each subset. Carl's responses are summarised below.

	Complete correct words (N=30)	At least 1st letter correct (N=30)	Total correct letters (N=121)
Objects	8	23	59
Actions	3	9	25

Table 2.5.1 Object and action naming: Carl's scores on matched subsets

χ^2 (Object vs. Action naming, complete words) = 2.78, df = 1, not sig.
χ^2 (Object vs. Action naming, total letters correct) = 21.078, df = 1, $p \leq 0.001$

The number of whole correct words was too small to show any discrepancy between objects and actions. However it was clear from the analyses of initial and total letters that, even when complete names were inaccessible, Carl retained significantly more knowledge of object than of action names. The subsets were also too small to allow for investigation of any potential effects of frequency, familiarity or age-of-acquisition. Carl again showed a tendency when naming actions to produce either a related object name, or an intelligible approximation to one:

'god' for target *pray* (he indicated that he knew this was wrong)
'cox' for target *sail*
'toe' for target *tie* (the picture shows a person tying a shoelace)
'gloos' for target *drop* (the picture shows a person dropping a glass)
'eleted' for target *pull* (the picture shows a child pulling a toy elephant)

Language production

In addition to speech, Carl's retelling of the narrative involved drawing, gesture and writing the initial letters of the main characters' names. His spoken narrative is difficult to understand out of context, with little content conveyed verbally and repeated use of the phrase 'try to get ...' The only intervention from the researcher occurred when Carl asked the name of the animal he had drawn. The transcript shown in Figure 2.5.1, and those that follow, represents the sample used in the analysis.

"There's that one [writes L] and ... [writes S]. All right, the big one and small one, better. Both of the ... both of ... try to get [draws donkey]. What is that one?

[D: It's a donkey]

Rather than ... not ... And he's got [draws pallet] for him [points to L and draws rope]. This guy he's got ... the big one, asleep. But this guy he have to [gestures pulling rope] ... I know that one but also ... Try to get ...this side. This guy sleep [gestures sleeping], he is perfect ... And try to get ... up. But he ... later these guy ... [draws river]. And this one inside here and [draws circle in middle of river]. And ... one the outside. But this one he is somewhere here [draws in middle of river]. And try to get ... quite a lot [draws water]. But this guy he'll be here [draws arrow to the other side of river]. There's nothing. They have finished. They are finished here. This guy he does know, he sleep. This guy he is going quite a lot. Then suddenly he is be outside [blinks] inside he was. So ... but these, this guy and that one they are went. He try to get, the big one."

Figure 2.5.1 Carl's narrative from Laurel and Hardy film

Carl produced the same number of words as the control participants, but with a far higher proportion of closed than open class words. In part this reflected the large number of pronouns and very few nouns included. The single noun 'guy' in fact accounted for almost all those produced. Although Carl's narrative contained a relatively large number of verbs, only a small number of those that might potentially bear inflection were in fact inflected. Many of Carl's verbs represented either the repeated phrase 'try to get' or copula 'be'. The latter was also reflected in the large number of structures involving a combination of verb and single argument noun phrase. There were also, however, several examples of predicates combined with two arguments, in most cases a noun phrase and an adverb.

Language comprehension

Carl's verb comprehension score was more than two standard deviations below the mean of the controls. His seven errors involved selection of one distractor action and six semantically related objects. Carl indicated very clearly that he understood the basis on which the targets were distinguished, and was consistently able to show which object picture was related to which action. However he was clearly waylaid at times into choosing the target verb's object counterpart. By contrast his comprehension of single nouns was almost flawless.

Carl's sentence comprehension indicated a significant difficulty with reversible sentences. On the RSCT his overall score was outside the controls' range, although this was mainly accounted for by his poor performance on non-action verbs and locative prepositions. His 13 errors displayed confusion over role information, 12 of them involving selection of reverse-role distractors. Carl's score on the VAST sentence comprehension test was the lowest of all the participants with aphasia, almost entirely thanks to errors on reversible items. As in the test of single verb comprehension, this pattern suggested that Carl was able to identify the core meaning of verbs from spoken sentences. However, he had trouble in accurately schematising who or what was playing each role.

2.5.2 Jack

Non-verbal cognitive and semantic ability

Jack scored just below the 25th percentile on the Raven's SPM. He also performed flawlessly on the Pyramids and Palm Trees Test, indicating that his non-verbal cognitive skills were well within normal limits and that his ability to make judgments about the semantic features of objects was unimpaired.

Naming of objects and actions

Jack completed the test battery entirely through writing. His responses were very slow and effortful, but showed a significant advantage for objects over actions (Objects: 103/162, Actions: 39/100, $\chi^2 = 15.05$, df = 1, $p \leq 0.001$). Jack's naming was also analysed for any effects of frequency, familiarity and age-of-acquisition. Results of this analysis are presented in tables 2.5.2 (a) to (c) below. In each case, the analysis represents the comparison of the total score for naming of objects plus actions across the three levels of the variable under consideration. So for table 2.5.2 (a) the comparison was between the scores 27, 53 and 23. The same system is used in all subsequent analyses of these lexical variables for the other participants. Though none of these factors proved to have a significant effect on Jack's naming, it is clear that the total scores in each case display the same discrepancy between objects and actions.

	High frequency (N=24) (%)	Medium frequency (N=48) (%)	Low frequency (N=28) (%)	Total
Objects	20 (83.33)	31 (64.58)	12 (42.86)	63
Actions	7 (29.17)	22 (45.83)	11 (39.29)	40
Total	27 (56.25)	53 (55.21)	23 (41.07)	103

Table 2.5.2 (a) Frequency-matched items: Jack's correct responses

$\chi^2 = 3.40$, df = 2, not significant.

	Very familiar (N=26) (%)	Familiar (N=46) (%)	Less familiar (N=28) (%)	Total
Objects	16 (91.54)	37 (80.43)	17 (60.71)	70
Actions	10 (38.46)	17 (36.96)	13 (46.43)	40
Total	26 (50)	54 (58.70)	30 (53.57)	110

Table 2.5.2 (b) Familiarity-matched items: Jack's correct responses

$\chi^2 = 1.08$, df = 2, not significant.

	Very early acquired (N=25) (%)	Early acquired (N=47) (%)	Later acquired (N=28) (%)	Total
Objects	18 (72)	32 (68.09)	16 (57.14)	66
Actions	9 (36)	20 (42.55)	11 (39.29)	40
Total	27 (54)	52 (55.32)	27 (48.21)	106

Table 2.5.2(c) Age-of-acquisition matched items: Jack's correct responses

$\chi^2 = 0.74$, df = 2, not significant.

Language production

Apart from a brief initial attempt to write: 'Stan – Lorry with a [crossed out]', Jack's narrative was entirely conveyed through drawing (see Appendix 4 – numbers added). His drawings divide the narrative into a number of 'scenes', some of which represent more than one event. Movement is indicated either by the use of arrows, or through the style of drawing. For example, the first scene shows Laurel leading the donkey with Hardy behind it. Below this, Laurel is again shown (with an arrow) leading Hardy and the donkey towards the river, while Hardy is also represented (with heavy dark lines) falling into the water. To the right, Laurel is shown walking on with the donkey. Scene 2 also illustrates the use of an arrow to indicate Laurel returning to Hardy in the river while the donkey waits on the right.

Language comprehension

Jack made three errors on the VAST test of verb comprehension, still more than two standard deviations below the mean of the controls. All three involved the selection of related objects. Jack's comprehension of single nouns was perfect. He was the only participant with aphasia whose scores on both tests of sentence comprehension were within the range of the non-brain damaged controls. Still, four of his five errors on the RSCT involved selection of reverse-role distractors.

2.5.3 Helen

Non-verbal cognitive and semantic ability

Helen's score on the Raven's SPM fell between the 50th and 75th percentiles for her age. This is considerably higher than any of the other participants with aphasia, but may reflect Helen's educational background. She achieved a near-perfect score on the Pyramids and Palm Trees Test.

Naming of objects and actions

Helen's naming scores were both high, but still showed a significant advantage for objects (Objects: 152/162, Actions: 81/100, $\chi^2 = 10.34$, df = 1, $p \leq 0.01$). Helen's naming was not significantly affected by frequency, familiarity or age-of-acquisition. Data for these factors is presented below.

	High frequency (N=24) (%)	Medium frequency (N=48) (%)	Low frequency (N=28) (%)	Total
Objects	21 (87.5)	47 (97.92)	25 (89.29)	93
Actions	18 (75)	41 (85.42)	22 (78.58)	81
Total	39 (81.25)	88 (91.67)	47 (83.93)	174

Table 2.5.3 (a) Frequency-matched items: Helen's correct responses

$\chi^2 = 3.72$, df = 2, not significant.

	Very familiar (N=26) (%)	Familiar (N=46) (%)	Less familiar (N=28) (%)	Total
Objects	25 (96.15)	44 (95.65)	26 (92.86)	95
Actions	23 (88.46)	32 (69.57)	26 (92.86)	81
Total	48 (92.31)	76 (82.61)	52 (92.86)	176

Table 2.5.3 (b) Familiarity-matched items: Helen's correct responses

$\chi^2 = 4.70$, df = 2, not significant.

	Very early acquired (N=25) (%)	Early acquired (N=47) (%)	Later acquired (N=28) (%)	Total
Objects	24 (96)	46 (97.87)	22 (78.57)	92
Actions	22 (88)	35 (74.47)	24 (85.71)	81
Total	46 (92)	81 (86.17)	46 (82.14)	173

Table 2.5.3 (c) Age-of-acquisition matched items: Helen's correct responses

$\chi^2 = 2.21$, df = 2, not significant.

Language production

Helen's narrative (reproduced in Figure 2.5.3) involved a variety of different communication modes including gesture, pointing and drawing as well as speech. The total number of words produced was more than the required 150; however a large number, mostly conjunctions and repetitions, had to be excluded from the analysis. The proportion of open and closed class words was close to that of the controls, but Helen produced a far greater number of pronouns than nouns, reflecting the generally unspecific content of her narrative. Like Carl, Helen's verb score was high, but many of her verbs were again exemplars of the copula 'be'. Only three verbs were produced in inflectable contexts, all of which were correctly inflected. Helen produced a large number of isolated phrases that were not linked to a predicate-argument structure. However she also included several appropriate predicate-argument combinations, many of them, like Carl's, involving a noun phrase and adjective or adverb phrase.

"Two guys [reading] ... and Hardy. And they have a ... a donkey [draws donkey and man]. And er … this is the [points to drawing of man] ... is walking [gestures walking with hands] and, er … donkey. And this [draws pallet] there is er … lying down it's like er … it's you know, it's, you know it's um … [draws on right hand side] that, for … it's like a, you know like [mimes bumping movement] [unintell.] and they've got ... [draws pallet attached to donkey with man lying on top?] er ... the man, like that. So it's ... it's [gestures bumping movement] you know like [mimes someone asleep] sleep [unintell.]. And then this was right [points to picture] and then er … it water [gestures walking] the, the man [drawing] and the donkey, and it's, it's, it's not [makes horizontal movement with hands] it's ... so in the lake it was like, asleep [mimes sleeping]. It's um ... wet [mimes waking up and gesticulating]. And then he um … and then the other man [points to picture of Laurel], and he's 'Oh I really sorry' sort of thing [mimes removing handkerchief from pocket, drying Hardy and wringing out handkerchief] off with the ... that one and ... stuff like that. And er … and ... and it's very ...[stæt]. And then, and then, he goes with the [mimes person with water up to chest] [unintell.] and um … the, the ... Laurel and it's water thing and it's [mimes walking and turning round] 'Oh, it's ... gone'. And it's very ... [gestures depth of water] deep, and it's [mimes person underwater]. And er … that's right, that's all."

Figure 2.5.3 Helen's narrative from Laurel and Hardy film

Language comprehension

Helen's comprehension of single verbs was below the range of non-brain damaged controls, although like Jack she only made three errors (all involving selection of the related verb distractor). Her comprehension of single nouns was near-perfect. Helen's sentence comprehension, on the other hand, was very much affected by difficulties in processing role information. This led to a large number of reverse-role errors on the VAST sentence comprehension test in particular. Reverse-role errors were also evident on the RSCT, although Helen's score here was still within the range of the non-brain damaged controls.

2.5.4 Ron

Non-verbal cognitive and semantic ability

Ron scored between the 10^{th} and the 25^{th} percentiles for his age on the Raven's SPM. If scores are normally distributed, one standard deviation below the mean is represented by a score around the 16^{th} percentile. As Ron's score lies closer to the 25^{th} than to the 10^{th} percentile, it seems likely that it would be above this point, and is in any case well within the normal range. On the Pyramids and Palm Trees Test Ron's score fell above the level considered clinically significant by the test's authors. However, in order to rule out any attentional deficit that may have affected his ability to manipulate visual information, Ron also completed two visual search tasks with structured fields (letter and figure cancellation). These were similar to the tasks described in van Zomeren and Spikman (2003). On these he performed perfectly.

Naming of objects and actions

Ron's score on the Object and Action Naming Battery indicated a very large discrepancy between his naming of objects and actions (Objects: 116/162, Actions: 17/100, $\chi^2 = 73.75$, df = 1, $p \leq 0.001$). Further analysis indicated that his naming was not affected by frequency, familiarity or age-of-acquisition, although the object/action discrepancy was still clearly present within each subset. Data for each of these factors is presented below.

	High frequency (N=24) (%)	Medium frequency (N=48) (%)	Low frequency (N=28) (%)	Total
Objects	16 (66.67)	35 (72.92)	19 (67.86)	70
Actions	3 (12.5)	10 (20.83)	4 (14.29)	17
Total	19 (39.58)	45 (46.88)	23 (41.07)	87

Table 2.5.4 (a) Frequency-matched items: Ron's correct responses

$\chi^2 = 0.88$, df = 2, not significant.

	Very familiar (N=26) (%)	Familiar (N=46) (%)	Less familiar (N=28) (%)	Total
Objects	21 (80.77)	34 (73.91)	21 (75)	76
Actions	5 (19.23)	5 (10.87)	7 (25)	17
Total	26 (50)	39 (42.39)	28 (50)	93

Table 2.5.4 (b) Familiarity-matched items: Ron's correct responses

$\chi^2 = 1.16$, df = 2, not significant.

	Very early acquired (N=25) (%)	Early acquired (N=47) (%)	Later acquired (N=28) (%)	Total
Objects	21 (84)	37 (78.72)	18 (64.29)	76
Actions	7 (28)	4 (8.51)	6 (21.43)	17
Total	28 (56)	41 (43.62)	24 (42.86)	93

Table 2.5.4 (c) Age-of-acquisition matched items: Ron's correct responses

$\chi^2 = 2.43$, df = 2, not significant.

Far from showing an advantage for higher-frequency words, Ron produced a number of relatively low-frequency nouns in place of target verbs. For example, he produced 'goose pimples' for the target *pinching*, 'Jaffa orange segments' for *peeling* and 'Belisha beacon' for *crossing*. He also made a small number of semantic errors (e.g. 'brush, fork' for the target *rake*, and 'train, track' for *tunnel*). Most of Ron's errors on the action naming test consisted of names of objects that were visible in the picture. Use of the permitted prompt reminding Ron to name the action at this point enabled him to produce 18 additional action names. (This was in addition to the general reminders to name actions that are permitted throughout the test.)

The effects of cueing on Ron's naming were further probed using a subset of the same stimuli. Four months after the original assessment Ron was again asked to name the first 30 objects and the first 30 actions from the battery. In this case each item was accompanied by a cue. Object stimuli were first presented with phonemic cues and actions with semantic cues.

Semantic cues referred to the general situation or context but did not name people or objects visible in the picture. (For example, the cue for the target *drinking* was 'He's thirsty'). On a later occasion the cues were reversed so that actions were presented with phonemic and objects with semantic cues. Ron's responses to the cued conditions were compared with his initial un-cued scores and, for actions, with the score achieved when responses to general cues to think about the action were also credited. Results are presented below.

	Un-cued	General cue	Semantic cue	Phonemic cue
Objects	24	n/a	27	29
Actions	4	11	13	12

Table 2.5.4 (d) Ron's correct responses on tests of cued object and action naming (N=30)

As this table shows, all three types of cue were somewhat helpful, taking Ron's object naming almost to ceiling as well as increasing his naming of actions. It seemed that Ron in fact had knowledge of more verbs than he could access in the un-cued condition. However it was not clear how the cues were working. Even on occasions when they helped Ron to name a target, the target was not always the first word produced. In both the phonemic and semantic cueing conditions Ron frequently first named an object visible in the picture, just as he had done in the un-cued condition. However in the semantic condition this was often spontaneously followed by an attempt to name the action. In some cases this consisted of the target verb, at times with a predicate-argument structure:

'Sam [his own dog's name]... biting'
'Sandwich...man...eating the sandwich'
'Ball and woman... kicking'
'Woman...lighting candle'
'Woman... tickling a feather'
'Man...painting the brush'

On other occasions Ron demonstrated that he was moving towards a description of the pictured situation, even if this was not always precisely focused on the target action:

'Continent...truck...sitting' (target = *driving*)
'Cup of tea...talking at' (target = *drinking*)
'Bottle...sea...bobbing up' (target = *floating*)

‘Fork…blowing’ (target = *raking*)
‘Woman…ball…balancing’ (target = *juggling*)
‘Going away…woman’ (target = *crying*).

It was striking that semantic cues, which aimed to focus Ron on the specific context of the targets, were not significantly more effective in helping him to produce verbs than general cues to think about the actions. Even taking into account the effects of cueing, Ron’s naming still showed a significant discrepancy between objects and actions. Taking the most favourable condition in each case (i.e. phonemic cueing for object naming and semantic cueing for action naming), he successfully named 97% of objects and 43% of actions ($\chi^2 = 20.32$, df = 1, $p \leq 0.001$). Ron’s ability to access object and action names was further investigated with two additional tests using the same stimuli: written naming and reading aloud. His responses on these tests are summarised below.

	Written Naming	Reading Aloud
Objects	11	29
Actions	1	13

Table 2.5.4 (e) Ron’s correct responses on tests of written naming and reading aloud (N=30)

Both tests again indicated a considerable advantage for objects over actions (written naming: $\chi^2 = 10.42$, df = 1, $p \leq 0.01$; reading aloud: $\chi^2 = 20.32$, df = 1, $p \leq 0.001$). As with spoken naming, Ron frequently wrote the names of objects visible in the stimulus pictures in place of action targets. Indeed his single correct action name (‘slide’) was also questionable as a noun/verb homonym. Ron’s writing was noted to be ‘parasitical’ upon speech, in that he was unable to write any words without first producing their spoken names. It is possible that this would lead to a regularity effect in his spelling. There were too few examples of irregular words in the set tested to offer clear evidence of such an effect, although all the correctly-spelt words were indeed regular.

Ron’s reading aloud of action names included 11 inflectional errors in which he produced an infinitive (e.g. ‘light’ for the target *lighting*). Seven of these errors yielded a clear noun/verb homonym. Ron also made five derivational errors, four of which yielded related nouns (e.g. ‘juggler’ for the target *juggling*). His final error was a semantic substitution (‘tickling’ for the target *pinching*). These patterns may all be indicative of deep dyslexia and reflect a general semantic impairment. Further evidence for this possibility came from two additional assessments of Ron's reading. First he was asked to read aloud a set of non-words. Ron was unable to produce any of the targets correctly. Most of his errors (22 of the 24 items) were lexicalisations. These all shared letters with the target; for example, 'arrow' for the target *nar*. Finally PALPA test 31 (Kay et al, 1992) was used to tease apart the effects of imageability and frequency on Ron's reading. His responses are summarised below.

	Imageability	Frequency
High	38	31
Low	25	32

Table 2.5.4 (f) Ron's correct responses on PALPA test 31 (N=40)

While Ron's reading aloud was clearly not affected by word frequency, he was significantly more successful at reading words of high than of low imageability ($\chi^2 = 12.62$, df = 1, $p \leq 0.001$). Both of these findings concur with the previous data. Frequency has already been shown not to influence Ron's confrontation naming, and he was often able to access low frequency words in testing as well as in conversation. The imageability effect concurs with the suggestion that Ron may have some degree of semantic impairment, hinted at by his errors in object naming. Semantic differences might similarly underlie Ron's greater difficulty in naming actions than objects. However, his reading aloud was much less severely affected than his action naming.

In summary, Ron's naming showed a very significant advantage for objects over actions, with a consistent tendency to produce names of visible objects in place of action targets. The same pattern was evident in his written naming and in his reading aloud. Reading aloud also provided evidence of deep dyslexia and semantic impairment. Both phonemic and semantic cues assisted Ron's naming, but his action naming was equally helped by general reminders to focus on the action shown. This might simply reflect a failure to remember the task instructions, causing Ron to fall back on production of whatever related words he could most easily access. However it was striking that the same pattern occurred on every version of the test and in every modality, suggesting that it may stem from a less full semantic specification of actions than of objects, or from a stronger conceptual focus on objects.

Language production

Ron's telling of the Laurel and Hardy story was very brief. Much of the content, particularly the action elements, was conveyed through gesture. This narrative was supplemented with an account of a visit to the London Transport lost property office. Both are reproduced in Figure 2.5.4.

"Two men … straight [gestures tall person] and then … [gestures fat person asleep]. Then river … river, and then … asleep … and then snoozing. And then one … 'Bye!' [waves]. And then … [gestures splashing]. 'Oy!' And then obviously wet, dripping wet. And Olly [gestures drying]. And rip, rip [gestures wringing handkerchief]. And 'All right?' [gestures thumbs up]. 'All right' [gestures moving on]. And then river … [gestures falling under water] … dripping wet. And then … Oh, hang on … horse or donkey … then sit down, and forgot … dripping [gestures wringing handkerchief]. And then … and 'Bye!' [waves]." "You remember, er… Victoria and er… Borehamwood, no, sorry, Blackfriars, and you remember, um… three… dozens and dozens and dozens. Nice fella and 'Yes!' but unfortunately no. I thought "Oh great" and glasses identical but unfortunately no [points to glasses]. So, er… one of those things, isn't it? Yeah."

Figure 2.5.4 Ron's narratives

Ron produced a very high proportion of open class and very few closed class words. Unlike Carl and Helen he produced many more nouns than pronouns, though the proportion of pronouns exactly matched that of the control participants. Ron produced the lowest proportion of verbs of all the participants with aphasia, although neither of his narratives was without verbs. However only two of the seven inflectable verbs were produced in inflected form. Ron produced very little in the way of predicate-argument structure. Instead almost all of his utterances consisted of isolated noun, verb or adjective phrases.

Language comprehension

Ron's score on the VAST verb comprehension test was considerably outside the range of the controls. His errors followed the same pattern as his verb naming, with six related objects and one unrelated object selected in place of targets. For example, for the target *kneading* he chose a picture of some dough. The remaining three errors involved selection of the distractor action. Ron's comprehension of single spoken and written nouns, by comparison, was almost perfect.

The assessments of sentence comprehension suggested that Ron had very significant difficulties in understanding reversible sentences. On both tests he scored well outside the range of non-brain damaged speakers. The majority of his errors involved selection of reverse-role distractors, although he made both lexical and role errors on both tests. This suggested that Ron may have difficulty both in processing a verb's core meaning (or in interpreting its picture representation), and in mapping the role structure of a spoken sentence onto a situation. On the RSCT Ron's scores fell outside the range of the controls for all sections apart from non-action verbs (where controls themselves performed most poorly). He fared particularly badly with locative prepositions, making seven reverse-role errors. This suggested that he understood the basic conceptual and semantic properties of prepositions (e.g. that *above* concerns vertical organisation), but had trouble in working out their role structure, or which object was in which position.

2.5.5 Harry

Non-verbal cognitive and semantic ability

Harry's score on the Raven's SPM was very similar to Ron's, again placing him between the 10^{th} and 25^{th} percentiles. While perhaps lower than might be expected for someone educated to Harry's level, this is still well within the normal range. Harry achieved a perfect score on the Pyramids and Palm Trees Test, indicating that he was able to derive semantic information about objects from pictures.

Naming of objects and actions

Harry's spoken naming showed a marked advantage for objects over actions (Objects: 103/162, Actions: 31/100, $\chi^2 = 25.88$, df = 1, $p \leq 0.001$). Frequency, familiarity and age-of-acquisition did not significantly affect his naming success. Data for these factors is presented below. Once again, the discrepancy between naming of objects and actions was clearly maintained across all three subsets.

	High frequency (N=24) (%)	Medium frequency (N=48) (%)	Low frequency (N=28) (%)	Total
Objects	17 (70.83)	34 (70.83)	15 (53.57)	66
Actions	9 (37.5)	16 (33.33)	6 (21.43)	31
Total	26 (54.17)	50 (52.08)	21 (37.5)	97

Table 2.5.5 (a) Frequency-matched items: Harry's correct responses

$\chi^2 = 3.82$, df = 2, not significant.

	Very familiar (N=26) (%)	Familiar (N=46) (%)	Less familiar (N=28) (%)	Total
Objects	18 (69.23)	23 (50)	17 (60.71)	58
Actions	5 (19.23)	16 (34.78)	10 (35.71)	31
Total	23 (44.23)	39 (42.39)	27 (48.21)	89

Table 2.5.5 (b) Familiarity-matched items: Harry's correct responses

$\chi^2 = 0.48$, df = 2, not significant.

	Very early acquired (N=25) (%)	Early acquired (N=47) (%)	Later acquired (N=28) (%)	Total
Objects	19 (76)	30 (63.83)	15 (53.57)	64
Actions	7 (28)	12 (25.53)	12 (42.86)	31
Total	26 (52)	42 (44.68)	27 (48.21)	95

Table 2.5.5 (c) Age-of-acquisition matched items: Harry's correct responses

$\chi^2 = 0.72$, df = 2, not significant.

Overall it is striking that Harry was able to name so many of the targets, particularly objects, given his very limited spoken output in conversation. However this test was extremely time-consuming and effortful, and many items involved self-corrections and gradual approximations to the target. A number of Harry's responses were clearly affected by apraxia; for example, they were produced with either an absent or an incorrect first phoneme (e.g. 'ping' for target *king*). These approximations were scored by reference to the criteria already established. In action naming, Harry produced 11 names of visible objects in place of verbs. Unlike Ron, however, his score was not increased by cues to think about the actions.

Harry was also later invited to complete the test in writing. This proved much more problematic, so only the first half of each stimulus set was attempted. Harry achieved 11/81 written object and 0/50 action names. The effects of cueing were also explored in the same way as with Ron. Harry's responses to these cued conditions are summarised below.

	Un-cued	General cue	Semantic cue	Phonemic cue
Objects	18	n/a	23	27
Actions	6	6	12	26

Table 2.5.5 (d) Harry's correct responses on tests of cued object and action naming (N=30)

Harry's response to cueing was striking. While specific semantic cues led to a small improvement in his naming of both objects and actions, he was not helped by general cues to think about the actions shown. However he showed a particularly positive response to phonemic cues, leading to the disappearance of any difference between word classes. This suggested that the initial discrepancy between his naming of objects and actions sprang from difficulty in accessing lexical representations. This may reflect a problem at the level of the Phonological Output Lexicon. Alternatively, Harry's representation of the 'core' semantics attached to verbs may have been generally under-specified. In this case phonemic cues would enable him to attach verb labels to constellations of semantic features that would otherwise remain insufficiently specified to drive verb access.

Language production

As the transcript in Figure 2.5.5 shows, Harry's re-telling of the film was almost entirely non-verbal, the content mainly being conveyed through drawing and gesture. As Harry found the production of a verbal narrative so difficult, a certain number of prompts were used. These aimed to encourage his language production and to clarify the meaning of his drawings and gestures. In order to avoid cueing specific responses, most prompts took the form of comments rather than questions that would invite a particular answer. Questions were used where the meaning of a gesture or drawing remained unclear (e.g. 'What's going on here?'), or as a prompt for more information ('Anything you want to add?'). The only time a question specifically invited Harry to name an object was when communication appeared to have broken down (line 50: 'Yes, what's that?'). It seems likely that Harry was here describing the boulder over which Hardy was being carried, rather than the action shown. The quantitative analysis excluded all direct responses to questions and comments.

For his drawing, Harry spontaneously divided the page in the manner of a cartoon strip (see Appendix 5). When asked, 'Anything you want to add?' he returned to the top of the page and added an additional scene in the appropriate place. This highlights Harry's skill in accurately sequencing events. His drawings have been numbered for convenience, and are referred to by numbers in the transcript. Line numbers relate to conversational turns.

1. Harry: [reads] "Laurel and Hardy… er, um, one, um … ah dear, it's … [draws – 1], it's, OK, um … and um ...
2. Deborah: You've drawn the donkey …
3. H: Yes
4. D: And the thing he's pulling.
5. H: Yes. And, um … a [unintell.] [draws] that one
6. D: Right
7. H: And, um … [draws – 2] he ... Well [draws] that ... there, like that
8. D: Is this the river that you're drawing?
9. H: Yes, yes.
10. D: OK, this is the river and he's in the river
11. H: Yes. And he [laughs] and, er … er … [draws – 2a] and …
12. D: Mm hm, this is the donkey.
13. H: Yep and er ... [unintell.] then oh, well … [drawing – 3] [fʊ]
14. D: You're showing the donkey moving off, away …
15. H: Yes
16. D: and he's still in the river
17. H: [gestures moving away] Yes, and then, um … er … [laughs] then [draws – 4, 4b?] er … er … that's it [laughs], there and ...
18. D: You're showing the donkey turning round the other way
19. H: Yeah, yes, and er … [draws man – 4a] yes
20. D: Yes.
21. H: There
22. D: He's clearly Laurel

23. H: Yes [laughs]. And then [draws – 5] um … um … Hardy [draws] and Laurel, and [drawing – 6?] that one, he um … [draws] and … that's it. Uh huh, and … right
24. D: So this (5) shows them standing together
25. H: Yes
26. D: In the water
27. H: Yes
28. D: And in this one (6) … What's going on here?
29. H: [laughing] Er ... um …
30. D: That's Hardy
31. H: Hardy, it's like that [emboldening part of previous drawing – 6]
32. D: Ok
33. H: Like that … and Laurel [indicates drawing of Laurel]
34. D: Yes
35. H: And Hardy
36. D: Yeah, great, so Hardy's in the water again [pointing to picture]
37. H: Yes
38. D: And Laurel's forgotten about him, moving off again
39. H: Yes. Ah, it's… [laughing] Oh God, yes
40. D: Is that the whole thing?
41. H: Yes
42. D: Well done, excellent. Anything you want to add?
43. H: Um, no, um … it's er … [draws – 7] high, high, um … [gestures circular motion] it's um … oh, it's [gestures repeated motion of hand from ground level upwards]
44. D: You're showing him, showing somebody pulling I think
45. H: Yes, [laughs] er … yeah, uh … [gestures 'tugging'-like motion from floor to neck] um, yes [laughs]
46. D: Yeah, so this, is this Hardy and he's being …you're showing the string, the rope…
47. H: Yes [draws]
48. D: Uh huh
49. H: [draws] But it's that one [indicates drawing with pen]
50. D: Yes, what's that?
51. H: Um … boulder, boulder [laughs], yeah. And that's it."

Figure 2.5.5 Harry's narrative from Laurel and Hardy film

Harry's verbal narrative consisted of only 59 analysable words, and so cannot be directly compared to those of the controls. However, the limited range of words produced was striking, as was the very high proportion of pro-forms. All of Harry's ten verbs represented the copula 'be', which is excluded from the analysis of inflection. In terms of predicate-argument structure, Harry again produced a large number of isolated phrases, and where these were connected structurally the content was still very non-specific ('that's it'/'it's that one').

Harry's drawings are also interestingly under-specified. For example, although the correct participants are present in each scene, there is no indication of who is acting upon whom. An obvious counter to this is that it is naturally much more difficult to represent actions or relationships through drawing. However one way to do so might be by physically linking participants on the page, or, like Jack, by using arrows to convey the path or manner of a movement. Unlike Jack, Harry used no such schematic forms. In fact, a number of key events were omitted in favour of representations of static states. For example, picture 5 shows Laurel and Hardy simply standing together in the water, omitting the events that were most salient at this point (Laurel picking Hardy up and drying him with a handkerchief). In the episode represented by picture 6 (lines 23, 28-39), Laurel walks away across the river while Hardy again falls in. Here Harry's drawing shows Laurel standing at the side of the river and Hardy lying in the water, as if these events were already complete. When prompted with a question that directly invited an action-based answer ('What's going on here?'), Harry used the technique of emboldening his drawing to indicate that Hardy was the main focus of the scene. However he did not give any more information, either verbally or non-verbally, about the event that had just occurred or its relationship to surrounding events: 'Hardy, it's like that ... like that ... and Laurel ... and Hardy.'

Language comprehension

Harry's comprehension of verbs was outside the range of the controls. Of his five errors, four involved selection of the semantically related verb distractor and one the related object. Errors all occurred in relation to transitive verbs and included both high and low frequency items. Harry's comprehension of single nouns, on the other hand, was almost perfect. All errors here involved the selection of semantic distractors. Harry performed better on the tests of sentence comprehension than Ron, and his overall score on the RSCT was within the normal range. However, on two of the four sections (Action Verbs and Locative Prepositions) his score was lower than that of the controls. All of his errors involved selection of reverse-role distractors. On the VAST test Harry performed outside the controls' range, again making six reverse-role errors. It seemed that when processing spoken sentences he was able to comprehend the verb's core meaning, but had difficulty in precisely distinguishing role information. It is worth noting, however, that these tests do not demand a very precise appreciation of subtle distinctions in meaning between verbs. Distractor items represent verbs that are clearly distinct and remote from the 'core' meaning of the targets. Harry's success on these assessments cannot, then, be used as evidence for intact understanding of the more subtle aspects of verb semantics.

2.5.6 Melvyn

Non-verbal cognitive and semantic ability

Melvyn's score on the Raven's SPM was lower than any of the other participants, but still between the 10^{th} and 25^{th} percentiles for his age. His score on the Pyramids and Palm Trees Test was also within the range of non-brain damaged controls and above the level of clinical significance.

Naming of objects and actions

Melvyn was able to name a high proportion of items in both classes, yet he was still significantly more successful with objects than with actions (Objects: 158/162, Actions: 77/100, $\chi^2 = 28.23$, $df = 1$, $p \leq 0.001$). Frequency, familiarity and age-of-acquisition did not significantly influence Melvyn's naming. Data for these factors is presented below. Once again the discrepancy between objects and actions was clearly maintained across all three subsets.

	High frequency (N=24) (%)	Medium frequency (N=48) (%)	Low frequency (N=28) (%)	Total
Objects	24 (100)	47 (97.92)	27 (96.43)	98
Actions	20 (83.33)	35 (72.92)	22 (78.57)	77
Total	44 (91.67)	82 (85.42)	49 (87.5)	175

Table 2.5.6 (a) Frequency-matched items: Melvyn's correct responses

$\chi^2 = 1.14$, df = 2, not significant.

	Very familiar (N=26) (%)	Familiar (N=46) (%)	Less familiar (N=28) (%)	Total
Objects	26 (100)	46 (100)	27 (96.43)	99
Actions	20 (76.92)	36 (78.26)	21 (75)	77
Total	46 (88.46)	82 (89.13)	48 (85.71)	176

Table 2.5.6 (b) Familiarity-matched items: Melvyn's correct responses

$\chi^2 = 0.40$, df = 2, not significant.

	Very early acquired (N=25) (%)	Early acquired (N=47) (%)	Later acquired (N=28) (%)	Total
Objects	25 (100)	45 (95.74)	26 (92.86)	96
Actions	19 (76)	38 (80.85)	20 (71.43)	77
Total	44 (88)	83 (88.30)	46 (82.14)	173

Table 2.5.6 (c) Age-of-acquisition matched items: Melvyn's correct responses

$\chi^2 = 1.27$, df = 2, not significant.

Language production

Melvyn's narrative was the longest of all the participants with aphasia, and was far longer than that of any of the controls. In many other respects it was very similar to the controls' responses, although a larger number of words (mostly comments on the narrative) were excluded from the analysis. Melvyn used a large and diverse range of verbs. No phrases were entirely without predicate-argument structure, although there were fewer examples of embedding than in the controls' narratives. Melvyn's ability to express predicates in this context was particularly striking given his score on confrontation naming. Figure 2.5.6 shows the sample used in the analysis.

> "Er ... well, it's a Laurel and ... Laurel and Hardy short films, er ... what we've got here to look at. And ... um ... when it starts, um ... I can't ... have to excuse me a minute ... I can't quite remember which one's Laurel. Laurel is pulling a sort of a cart along with the old fella ... the big fat fella sitting on the back you see. And they're going along this country road [whistles]. And they come to the [laughs] ... just one momento please ... anyway they come to this river you see, so without thinking Laurel ... or Hardy ... whichever the case may be, he starts going across this river you see, with the chap on the back. Well instead of it being on wheels and going a ... across like a ... a track if you like, it doesn't, it goes right underneath the water. As it goes across, the fat one begins to float off this little trolley and he goes in the water, you know, and sinks to the bottom. While all this is going on the little fella, he crosses over to the other [saɪn] and starts going up the road."

Figure 2.5.6 Melvyn's narrative from Laurel and Hardy film

Language comprehension

Melvyn's comprehension of single verbs and nouns was near-perfect. He also scored highly on the tests of sentence comprehension, making only two errors on the VAST test. Although his overall score on the RSCT was no worse than that of the controls, it was interesting that he made the same number of lexical and role-related errors. (Controls had made far more reversal than lexical errors.) This perhaps indicated some slight uncertainty about core meaning as well as about role information in spoken sentences.

2.5.7 Summary of language assessments

All six participants with aphasia had difficulty in naming actions. With objects, on the other hand, they were able to make accurate semantic judgments and had significantly less naming difficulty. All of the participants but Melvyn also demonstrated difficulty in accessing verbs and in constructing verb-argument structures in continuous speech. Again, all but Melvyn made more errors in comprehending single verbs than nouns, though the discrepancy between word classes was not as great as in output. Across the group there was also a pattern of impairment in comprehending reversible sentences. Here only Jack performed consistently within the limits of non-brain damaged controls.

Carl, Jack, Helen, Ron and Harry all demonstrated skills similar to those shown by people previously identified as having difficulty in event processing, although Jack's strength in sentence comprehension was unusual. Any of these five individuals might therefore have some difficulty in conceptualising events for language, though such a difficulty need not underlie their performance. Melvyn's responses, on the other hand, do not fit this pattern. Despite relatively better confrontation naming of objects than actions, he produced a considerable number and range of verb argument structures in his narrative, and demonstrated unimpaired verb comprehension. Melvyn would not, therefore, be predicted to have difficulty on tests of event processing. Indeed it would be difficult to explain any such difficulties in the face of his strong verb and sentence production skills.

These predictions were tested with five further assessments that aimed to probe skills specifically associated with event conceptualisation. These assessments are described in section 2.6.

2.6 Assessments of skills in event processing

2.6.1 The Picture Attribute Knowledge Test (Fiez and Tranel, 1997)

This test is part of a large battery of assessments that was designed to investigate a person's lexical and conceptual knowledge of actions. The Picture Attribute Knowledge Test assesses conceptual knowledge through responses to questions about paired action pictures. In the first section photographs of two semantically related actions, such as *chopping* a pepper and *spreading* jam, are presented. Participants are asked to select a photograph in response to a question such as, '*Which action would make the loudest sound?*' In the second section two events are again presented, but this time each one is represented by a pair of pictures showing an object before and after some change takes place. For example, a *decorating* event is represented by pictures of a cake with and without hundreds and thousands. This is contrasted with a *carving* event in which a pumpkin is shown before and after it has been carved with a Halloween face. The test again asks questions; in this case, '*Which change would require a tool or utensil to complete?*' Here, though, four photographs must be considered, each response entailing selection of a picture pair.

The knowledge tapped by this test is not intended to be language-specific (for example, knowledge of the properties of particular verbs). Instead the aim is to assess recognition of action stimuli and retrieval of the relevant concepts. Of course, such knowledge is not entirely distinct from language. For example, conceptual knowledge of the attributes associated with paired actions such as *skiing* and *skating* is closely related to the core semantic information required to distinguish one verb from another (downhill movement on snow as opposed to horizontal movement on ice). However, many of the questions focus on knowledge that is less intimately linked to the verbs' meaning, and more to general real-world knowledge of the actions (such as which one would be more tiring). In theory at least, a person who had significant difficulties with the more specifically language-related aspects of event knowledge, might achieve a fairly high score on sections of this test.

Of the 75 items, non-brain damaged controls (American undergraduates) achieved a mean of 69 (92%) correct, with a standard deviation of 4. This seems rather low, given that the test is designed to measure basic knowledge about actions. It may reflect the difficulty of individual items, or a lack of agreement among participants as to the nature of the actions involved. Although correct responses are defined as those given by most of the 86 participants in the pilot study, there is still some room for disagreement. For example, one item asks whether shearing a sheep or stroking a pony is more good or helpful. Other items are open to variation as a result of differences in personal experience. For example, asked whether connecting Lego pieces or splicing electrical wires would take a longer time, Ron, who had formerly worked as an electrician, insisted that there would be no difference. Despite these caveats, the Picture Attribute Knowledge Test was included in the test battery as it offers a means of exploring knowledge of actions without demanding any language output.

Of course it is possible that people with aphasia may fail on the test for reasons unconnected with their knowledge of actions. The format requires a certain degree of language comprehension, and some stimulus questions are rather long, complex or abstract (e.g. '*Which change would be most permanent (hardest to undo)?*'). The second section in particular makes considerable demands on a person's information processing capacity, as they must retain the question whilst comparing four pictures. These problems are somewhat counterbalanced by the inclusion of practice items in both sections. All of the participants in the present study were also specifically asked whether they had understood each stimulus question. Their test scores are presented in Table 2.6.1.

Participant	Raw score (%)
Carl	68 (91)
Jack	65 (86.67)
Helen	72 (96)
Ron	67 (89)
Harry	57 (76) *
Melvyn	71 (94.67)

Table 2.6.1 Responses on the Picture Attribute Knowledge Test (N=75)

As the table shows, only Harry's score was more than two standard deviations below the mean of the non-brain damaged controls.

2.6.2 The Event Video (Dipper, 1999)

This task was adapted from the photograph sorting task devised by Nickels, Byng and Black (1991). It explores the very preliminary level of analysis that distinguishes events from static situations. The task is based on Langacker's (1987, 1991, 1997) theory that the temporal profile of an event is conceptualised through a process of 'scanning' its component movements. Twenty scenes are presented on video, half of which show events (e.g. a person washing up) and half static states (e.g. some crockery on a rack). Scenes are shown twice, and must be classified as either events or states on the basis of whether or not they show something happening. For events, this means that the component movements must be analysed as parts of the same action, while for states the scene can be conceptualised in summary, without further breakdown into component parts. Both events and states are filmed with a moving camera so that states may not be identified by the absence of movement alone.

Non-brain damaged controls in the original study were able to complete this test without error. If a person does make errors, this may indicate difficulty at a very preliminary stage of event analysis, similar to the difficulty in distinguishing events and non-events shown by LC (Byng et al, 1994). Errors may of course also suggest that a person has not understood the task, or is making decisions on the basis of different criteria from those intended. For example, the states might be classified as events on the basis of the camera's movement. Although not diagnostic of event processing difficulties in itself, therefore, the Event Video may point to potential difficulties which warrant further investigation. Table 2.6.2 presents the responses of the participants with aphasia.

Participant	Raw Score (%)
Carl	20 (100)
Jack	20 (100)
Helen	20 (100)
Ron	18 (90) *
Harry	20 (100)
Melvyn	13 (65) *

Table 2.6.2 Responses on the Event Video (N=20)

Only Ron and Melvyn achieved scores on this test that fell outside the range of the non-brain damaged controls.

2.6.3 The Role Video (Marshall, Pring and Chiat, 1993)

This test further probes the ability to analyse events, and in particular their role structure, without requiring access to language. Sixteen reversible and 16 non-reversible events are presented on video. After the first viewing of each event, photographs of three possible outcomes are offered. After a second viewing, the correct outcome must be selected. One distractor shows the result of the target action but with a change of roles, while the other presents the outcome of a different event. For example, one reversible event shows a man selling a camera to a woman. The target outcome photograph shows the woman holding the camera, while in the role distractor the man holds the camera and in the event distractor the woman holds a letter. In a non-reversible item someone is shown mashing a banana. Here the target photograph presents the mashed banana. The role distractor shows the outcome of the same action performed on another object that was present in the film but not involved in the event (a mashed avocado). The event distractor presents the result of a different action performed on the target object (a sliced banana).

The three non-brain damaged controls in the original study performed at ceiling on this task, as do many people with aphasia. Errors therefore suggest that a person has difficulty either in identifying what type of event has occurred (if event distractors are selected), or in schematising its role structure (if role distractors are chosen). Consistent selection of role distractors across both reversible and non-reversible events may indicate a general difficulty in identifying event participants. A more specific difficulty in analysing the role structure of reversible events would be indicated by selection of role distractors on the reversible items only. Table 2.6.3 presents the responses of the participants with aphasia.

Participant	Raw score (%)	Role distractors selected	Event distractors selected
Carl	31 (96.88) *	1	0
Jack	32 (100)	0	0
Helen	32 (100)	0	0
Ron	27 (84.38) *	2	3
Harry	30 (93.75) *	0	2
Melvyn	26 (81.25) *	4	2

Table 2.6.3 Responses on the Role Video (N=32)

Jack and Helen performed at ceiling on this test. The other participants all scored below the level of the non-brain damaged controls, making between one and six errors.

2.6.4 The Kissing and Dancing Test (Bak and Hodges, 2003)

This is a test of semantic knowledge of actions, designed as a companion to the Pyramids and Palm Trees Test, to which it is identical in format and instructions. Fifty two triplets of action pictures are presented, and participants are asked to select from the lower pair the action that is most closely semantically related to that shown at the top. As with the Pyramids and Palm Trees Test, only the picture version was used, since the aim was to assess participants' knowledge of the semantic features of actions without requiring explicit access to language. Target actions are linked semantically in a number of different ways. Some are subordinate members of a single superordinate category. For example, *dusting* and *hoovering* are subordinates of the category *cleaning*, while *weaving*, the distractor, is not. In other cases all three actions are members of the same superordinate category, but the targets share a larger number of specific semantic features. For example, *skiing*, *skating* and *swimming* are all examples of sports but the first two take place in winter and involve frozen water. Some targets differ from their distractors by only one or two semantic features that are also essential meaning components of the related verbs. For example, *falling*, *slipping* and *swimming* are all examples of actions involving movement, differing in features of direction and manner. In this sense the knowledge tapped by the test is more closely related to the properties of relevant verbs than, for example, much of that demanded by the Picture Attribute Knowledge Test. However there is still no explicit requirement to access language. Twenty non-brain damaged control participants aged between 51 and 73 (mean age 61.2) made up to four errors (mean score = 50.4, S.D. = 1.5). The authors argue that any score falling within this range represents a normal performance. The responses of the six participants with aphasia are presented in Table 2.6.4.

Participant	Raw score (%)
Carl	51 (98.08)
Jack	49 (94.23)
Helen	51 (98.08)
Ron	46 (88.46) *
Harry	42 (80.97) *
Melvyn	44 (84.62) *

Table 2.6.4 Responses on the Kissing and Dancing Test (N=52)

As the table shows, Carl, Jack and Helen all achieved scores within the range of the non-brain damaged controls, while Ron, Harry and Melvyn scored outside this range.

2.6.5 The Event Perception Test (Marshall, Chiat and Pring, 1999)

As described in Chapter 1 (section 1.5.2), this test assesses the ability to analyse the specific features of actions that are most relevant to verb selection. In each of the 60 items, two representations of the same verb must be distinguished from a distractor. Distractors vary in their semantic and syntactic closeness to the targets. Targets and distractors are also visually similar so that, in theory at least, actions cannot be matched on the basis of visual features alone. Instead, the test requires access to features that relate actions to particular verbs. For example, two representations of *dripping* must be distinguished from a *filling* distractor. This taps the knowledge that *drip* invites a focus on the manner of movement, while *fill* invites a focus on its effect. In another item two *pouring* actions must be distinguished from a representation of *spraying*. Here all three actions feature human agency and represent the transfer of liquids, but the *pouring* actions also share the same manner of movement and an emphasis on both source and goal. Like the Kissing and Dancing Test, therefore, the Event Perception Test assesses the ability to access semantic information from pictured situations. However, where the Kissing and Dancing Test relies on more general knowledge about the properties of actions, the Event Perception Test requires knowledge of the factors that distinguish the meanings of different verbs. Of the tests used here to explore event processing it is therefore the one that most closely approaches language production, though still without demanding any output.

Ten non-brain damaged control participants made up to three errors, most of which involved selection of closely-related distractors. A pilot group of 12 people with aphasia made between one and twelve errors. As with previous tests, it is impossible to conclude on the basis of this test alone that a person has difficulty in conceptualising situations in the way required for verb access. However, in the context of poor performance on other related tasks, a pattern of more than three errors can strengthen this hypothesis. In particular, a person who made many errors here would be expected to have significant difficulty in accessing verbs and sentence structure. This is supported by a strong positive correlation ($r = 0.85$, $df = 10$, $p \leq 0.001$) between scores on the Event Perception Test and naming of the same actions within the original pilot group of people with aphasia. As the authors point out, this finding alone provides no evidence about the direction of such an effect: whether poor verb access leads to low scores on the Event Perception Test, or vice versa. However, a score of less than three errors would suggest that any difficulty with verb and sentence production did not spring from trouble in identifying the language-relevant aspects of actions.

Table 2.6.5 summarises the responses of the participants with aphasia.

Participant	Raw score (%)
Carl	53 (88.33) *
Jack	54 (90) *
Helen	54 (90) *
Ron	51 (85) *
Harry	48 (80) *
Melvyn	54 (90) *

Table 2.6.5 Responses on the Event Perception Test (N=60)

As the table shows, all participants' responses fell outside the range of the non-brain damaged controls. However, just as with the other tests described, it is difficult to know whether a person makes errors because of a real difficulty in analysing the features of actions. For example, they may have trouble in understanding or retaining the task instructions (although this is less likely if they have succeeded on other similar tests, such as the Pyramids and Palm Trees or Kissing and Dancing Tests). Alternatively they may find it difficult to interpret the stimulus pictures, or may base their responses on reasoning that is unrelated to the properties of verbs. For example, despite the clear test instructions and worked practice items a person might be strongly influenced by an uncontrolled visual feature, such as a similarity in the depiction of the objects involved. This last possibility was followed up with a further analysis of the test stimuli, identifying any items on which it would be possible to respond consistently without analysing the actions shown. Three non-brain damaged judges were asked to identify items where there was either a clear semantic link between the objects depicted, or a purely visual connection such as the use of strongly emboldened parallel lines to indicate movement. The results of this analysis are presented in Appendix 6.

All three judges agreed on the presence of a non-action based link in relation to 39 of the 60 test items. Thirty-seven of the identified links (shown with green shading in the Appendix) were between the given picture and the target. On these items a person reasoning on the basis of object-based or visual links might be expected to select the target picture. Only two links (shaded yellow in the Appendix) were unanimously identified with distractors. These would be expected to cause errors. The judges were less unanimous about the remaining 21 items (shaded blue). These might also be expected to cause some errors, although it would not be possible to make such a firm prediction. However, if a person were to respond at chance on these items they would make either ten or 11 errors. While this analysis simply suggests that it is possible to respond to a large proportion of the stimuli on the basis of non-action based reasoning, it may possibly account for the rather small number of errors made overall by both the pilot group and the participants in the present study. A person applying the proposed reasoning absolutely would be expected to make a total of 12 or 13 errors. This matches the maximum number made by any of the reported participants with aphasia.

Appendix 6 shows the pattern of errors made by the participants in the present study. These are broken down according to whether they occurred on the predicted items, or on those that would be expected to elicit correct responses. Looking first at the latter group, the participants as a whole produced 205 out of a possible total 222 correct responses. Conversely, 29 of their total 46 errors occurred on the items that were predicted to cause difficulties. Only Jack clearly responded in a way that went against the predicted pattern, producing five errors on items that were predicted to elicit correct responses, and only one on the items that were hypothesised to be more problematic.

Of course this does not prove that the group was responding according to the proposed reasoning. Nor did any one participant produce responses that were completely consistent with the suggested pattern. This may be because they were in fact analysing many of the items on the basis of the relevant features of the actions. However, a simple analysis at least provides some support for the hypothesis of non-action based reasoning. A χ^2 test compared the numbers of correct and incorrect responses on items on which errors were predicted as opposed to those on which they were not. This suggested that the group as a whole was significantly more likely to make errors on the predicted items: $\chi^2 = 13.63$, $df = 1$, $p \leq 0.001$.

Each participant's response to the assessments of event processing is now discussed in more detail, with the aim of identifying those whose performance may suggest some difficulty in conceptualising situations for language.

2.7 Responses on assessments of event processing

2.7.1 Carl

Carl's score on the Picture Attribute Knowledge Test was very close to the controls' mean. He also achieved a perfect score on the Event Video and a near-perfect score on the Kissing and Dancing Test. These results indicated that he had intact conceptual knowledge of a range of actions and events, was able to make accurate judgments about the semantics of actions as well as of objects, and could identify the features of situations that distinguish events from states. Carl's score on the Role Video was also near-perfect, suggesting that he could not only identify the event type and who or what was involved, but could also process who was playing which role, as long as no language was involved.

The Event Perception Test proved more difficult, causing Carl to make more errors than the non-brain damaged controls. This reinforced the suggestion that he had difficulty with the processes leading specifically to verb selection, while he performed well on entirely non-verbal tasks. Carl's difficulty arose when he was required to pick out the features of semantically related actions that would cause them to be described by a particular verb. So, for example, he failed to match two visually very different representations of *pouring*, selecting instead a picture of a person spraying a car. In most cases the distractors Carl selected differed from the targets by features of either manner or direction. For example, he chose a picture of *passing* in place of *throwing*, both of which represent a caused change of location but with a clear difference of manner. Only one of his errors involved a difference of role information. Here he matched a representation of *eating* to the distractor *feeding*. Carl's difficulty in identifying the specific verb-related features of actions was presumably also reflected in his action naming, which would inevitably highlight a weakened link between these features and their lexical labels. It may also have contributed to Carl's difficulty in verb comprehension although, as noted before, comprehension may make fewer demands since an already 'pared down' label must be matched to the correct set of features.

In summary, Carl showed unimpaired non-verbal cognitive abilities and intact non-verbal processing of the semantic features of both objects and actions. He had great difficulty in producing either nouns or verbs, whether in confrontation naming or in narrative, but demonstrated more intact partial knowledge of object than of action names. Carl's comprehension of verbs was also somewhat impaired, leading to the selection of a number of related objects. His sentence comprehension indicated significant difficulties in understanding role information, though in non-linguistic contexts this was much less problematic. Despite Carl's difficulty in producing and comprehending verbs, a number of tests indicated that he was able to perceive and analyse events accurately. He only had difficulty when the task moved towards the production of lexical labels, requiring him to pick out the specific features of an action that would cause it to be linked to a particular verb. This did not prevent Carl from being able to make accurate semantic judgments about non-verbally presented actions.

2.7.2 Jack

Jack scored well within the range of non-brain damaged controls on all the assessments of event processing apart from the Event Perception Test. Indeed on the Event Video, Kissing and Dancing Test and Role Video he scored at or near ceiling. He made six errors on the Event Perception Test, all involving selection of semantic distractors. Like Carl, Jack's difficulty arose when the task demanded thinking specifically about features relating to verb selection. However this did not prevent him from accurately processing the semantic features of actions when language access was not required.

In summary, Jack demonstrated normal non-verbal cognitive skills and was able to make accurate judgments about the semantics of both objects and actions. He had very severe output difficulties, but still found it significantly more problematic to produce verbs than nouns. Jack's comprehension of both single words and sentences was strong. His performance on the tests of event processing indicated that he was able to access and employ intact conceptual knowledge about a range of actions, that he could distinguish events from states, and that he could analyse role and relational information. Jack had some difficulty in isolating the features that link different exemplars of the same verb but, despite his severe output problems, processing events in isolation from language did not appear to cause him difficulty.

2.7.3 Helen

Helen also achieved perfect or near-perfect scores on all of the event processing assessments apart from the Event Perception Test. Like Carl and Jack, she was able to retrieve and manipulate conceptual information about actions, including the specific semantic features that distinguish related actions. She had no difficulty in identifying events from states, or in determining their participants and their roles. Again like Carl and Jack, Helen only experienced difficulty when the task required her to match actions on the basis of the particular semantic features that distinguish one verb from another.

In summary, despite her strong object and action naming, Helen's spontaneous speech and narrative contained very little verb-argument structure. Her comprehension of single nouns and verbs was also strong, but she had significant difficulty in understanding role information within sentences. In non-verbal contexts, on the other hand, she had no trouble with role information, and only foundered when she was required to pick out the specific semantic features that link actions to particular verbs. This would also underlie her lower score in confrontation naming of actions than of objects.

2.7.4 Ron

Although Ron made eight errors on the Picture Attribute Knowledge Test, this was still within one standard deviation of the controls' mean. This suggested that, providing he could understand the stimulus questions, Ron could recognise photographed actions, could retrieve relevant conceptual knowledge about their more pragmatic aspects, and could make accurate judgments on the basis of this knowledge. In some cases the complexity of the question caused him difficulty. For example, the question, '*Which change would be most permanent (hardest to undo)?*' was particularly problematic, although Ron indicated that he often knew which of the changes shown would be 'finished'.

Ron's two errors on the Event Video were both false positives (i.e. identification of states as events). Although this is a very low error rate, the test taps such a basic ability in scanning and profiling events that any errors are noteworthy. Ron's score may suggest that he had some difficulty in distinguishing events from states, or alternatively that his responses were based on different criteria from those intended. Ron also had some difficulty on the Role Video, making five errors and openly guessing at least one further item. All but one of his errors were on reversible items, and included selection of both role and event distractors. Although this is again a low error rate it matches the performance of MM (Marshall et al, 1993), the person for whom the test was originally designed, and who was deemed to have an event processing impairment. However unlike Ron, MM's errors only involved selection of reverse role distractors. It seems that Ron, like MM, had some difficulty in analysing events and schematising their role structure. His additional selection of event distractors may also suggest that he had some trouble in identifying the type of event shown.

Ron's score on the Kissing and Dancing Test was slightly lower than that on the Pyramids and Palm Trees Test and again fell below the range of non-brain damaged controls, hinting at a more marked semantic impairment for actions than objects. Ron's performance on the Event Perception Test was also well below that of the controls, suggesting that, again like MM, he may have difficulty in conceptualising events and their role structure in the way necessary for verb production. There were some hints that Ron may have been basing his thinking on factors unrelated to the actions, such as semantic features of the objects involved, or visual aspects of the stimuli. For example, Ron often cued himself by naming an object visible in the picture, e.g. 'milk' in response to a *pouring* event. He later indicated in discussion that many of his decisions were based on similarities between visible objects.

The analysis of the stimuli involved in the Event Perception Test provided some support for this proposal. Ron achieved correct responses on 34 of the 37 items for which a correct response was predicted. The 23 items that were predicted to cause difficulty, on the other hand, accounted for six of his nine errors. Although hypothetical, this analysis suggests that it was at least possible for Ron to base many of his choices on factors unrelated to the actions. It is even possible that, once he had identified a number of such links, he might be encouraged to look for object-based or visual connections in each new item. Of course his reasoning may have been quite different, perhaps based on more subtle semantic connections than those intended. However, whatever his thinking, he seemed to have some trouble in adopting a linguistically driven perspective, or at least one that was driven by verbs. He made both close and distant semantic errors but only one gross error, suggesting that he could distinguish very different events (such as actions and changes of state), but had more trouble with those that differed by fewer features. While Ron was clearly able to achieve some semantic analysis, this was not always sufficiently detailed to allow the kind of judgment typically made through access to verbs.

In summary, Ron had intact skills on a range of non-verbal cognitive tasks. He demonstrated significant difficulty in producing and comprehending verbs and sentences, offset by strong processing of concrete nouns. In action naming he frequently substituted names of visible objects for action targets. Ron's spontaneous speech contained very little in the way of verb structure. He also made errors on a number of event-related tasks, indicating some difficulty in analysing the specific semantic features of events, schematising their role structure and conceptualising them in the way necessary for verb access. While none of these tests is individually conclusive, and the number of errors on any one test was low, Ron's overall pattern suggested that he may have some difficulty in thinking about events in the way that is required for language production.

2.7.5 Harry

Harry's score on the Picture Attribute Knowledge Test was the lowest of all the participants with aphasia, and indeed was the only one that fell more than two standard deviations below the controls' mean. A number of possible explanations arise. For example, Harry may have misunderstood the test instructions. On the other hand, he firmly indicated that he understood the task and his total score, well above chance, also suggests that this was so. The test format itself may have proved problematic. For example, Harry may have found it difficult to retain questions for long enough to make an accurate comparison between actions. Alternatively, he may have had a specific difficulty in understanding abstract words, many of which feature in the stimulus questions. This possibility should have been investigated further. Another possibility was that Harry had particular difficulty in understanding one or more of the questions. Since each question was repeated several times in relation to a number of different action pairs, this might account for the large number of errors. However, the fact that Harry's errors were scattered throughout the test, rather than in response to particular questions, suggests that this was not so. Finally, Harry may simply have based his choices on thinking that was different from that underlying the test's design or the controls' responses. Alternatively, his score may reflect a genuine difficulty in harnessing basic conceptual, pragmatic understanding of actions to the kind of judgments demanded.

It was possible that Harry was making his judgments through some process involving naming the actions. As verbs would often be inaccessible for him, this might lead to difficulty in making judgments even about the actions' non-linguistic properties. In order to investigate this possibility, the test was re-administered two months later, this time with a written verb supporting each picture. Harry's score rose slightly, to a point just above two standard deviations below the controls' mean (62/75 – 83%), though interestingly he firmly indicated that he was not using the written cues. The slight improvement may suggest that some of Harry's initial errors were caused by difficulties of verb access. However, some improvement might in any case be expected, given that this was the second time he had completed the test. It seems unlikely that lexical access difficulties can entirely account for Harry's difficulty in making the kind of judgments required.

Harry's score on the Picture Attribute Knowledge Test was not matched by his performance on the Event Video. Here he performed perfectly, indicating that he was able to achieve the 'scanning and profiling' of situations necessary to distinguish events from states. He also made very few errors on the Role Video, demonstrating no difficulty in understanding the relational aspects of any of the events depicted. Harry's ability to make sense of who or what was involved, and in which role, contrasted with his performance on the tests of sentence comprehension, where he made a large number of role-related errors. His difficulty in processing role information appeared only to arise when language was involved. When events were presented non-verbally, as in the Role Video, he was able to schematise their role structure clearly. Both of Harry's errors on the Role Video involved the selection of event distractors on non-reversible items. This may hint at some difficulty in identifying the core nature of these events (*slicing* versus *mashing* and *ironing* versus *tearing*).

A dissociation between the ability to process 'core' semantic and relational information may possibly also underlie some of Harry's difficulty on the Picture Attribute Knowledge Test. Difficulty in processing core semantic features was also strongly indicated by his performance on the Kissing and Dancing Test, where he made ten errors, well below the range of non-brain damaged controls. This score also contrasted strongly with Harry's perfect performance on the Pyramids and Palm Trees Test, suggesting that his difficulty was confined to the semantic features of actions. As with the Picture Attribute Knowledge Test, it was possible that his difficulties derived from a strategy of trying to access verb labels for the actions. The Kissing and Dancing Test was therefore re-administered six weeks later with the picture stimuli supported by written cues. Now Harry performed flawlessly. It seemed likely that he had been trying to draw links between the actions by means of frequently inaccessible verbs. Providing him with the relevant orthography clearly helped him to access the appropriate constellations of semantic features, perhaps in part thanks to the verbs' 'framing' or 'paring down' properties.

Given Harry's difficulty in accessing verbs and the pattern of responses he demonstrated on the Kissing and Dancing Test, his low score on the Event Perception Test was unsurprising. This taps exactly the skills that Harry appeared to find problematic in the previous task, requiring stimuli to be matched on the basis of potential verb labels. In order to make sure that his low score here was not caused by misunderstanding unclear instructions, the Event Perception Test was also repeated six weeks later. Harry's score was very similar, and still well below that of the controls: 49/60 (81.67%). Some errors occurred on the same items, while others differed from the first administration. It seemed that Harry did indeed have significant difficulty in picking out from a visually presented situation those features that would allow an action to be described by a particular verb.

The analysis of the test items presented in section 2.6.5 yielded a similar result as for Ron. Harry selected the target picture on 33 of the 37 items for which the judges had unanimously identified a non-action based link. In addition, eight of his 12 errors occurred on the items that were predicted to cause difficulty, including both of those on which the judges had identified a clear link with the distractor. While it would be wrong to argue without further evidence that this analysis can explain Harry's performance, it is at least possible that many of his responses could be underpinned by non-action based reasoning.

In summary, Harry demonstrated normal non-verbal cognition on the Raven's SPM and unimpaired knowledge of the semantics of objects. His naming showed a strong discrepancy in favour of objects over actions, which however disappeared when phonemic cues were provided. Harry's spontaneous language contained very few content words beyond given proper names, and minimal or no verb structure. His use of non-verbal methods indicated an intact ability to sequence events within a narrative, while possibly also hinting at a preference for conveying static states over dynamic events. Harry showed intact understanding of the basic properties that distinguish events from states, and only had difficulty in analysing the role structure of events when language was involved, as in the tests of reversible sentence comprehension. However, he demonstrated some difficulty in accessing his conceptual knowledge of visually-presented actions, and possibly in precisely identifying their core semantic features. Like Carl, Jack and Helen, Harry appeared to have trouble in identifying the features of actions that link them with verbs. Unlike them, though, he was unable to make consistent judgments about the semantic features of actions without verb labels. This would naturally make verb output problematic. Harry's difficulty in linking actions with verbs without support was also evident in comprehension, although this was not impaired to the same degree. As already discussed, the conceptual 'paring down' process in comprehension is already complete, requiring Harry only to access the appropriate store of information about the meaning associated with a given word.

One interpretation of these findings is that Harry had a basic difficulty in processing core verb semantics. Where a task demanded precise or subtle semantic knowledge (for example, of the features of manner that would distinguish a *dripping* from a *pouring* event), he started to fail. These difficulties were especially evident when events were presented visually. Lexical cues improved Harry's performance on a number of such tasks, perhaps (as suggested by Dipper, 1999) by doing some of the conceptual 'paring down' for him, and by helping him to access a more fully specified array of relevant semantic features. Patterson and Hodges (1992) made a somewhat similar suggestion in relation to semantic dementia. They proposed a supportive relationship between semantics and phonology, such that phonological representations map on to constellations of semantic features. Accordingly, if semantic representations are fragmented or under-specified, access to phonological representations will be impaired. This is argued to be the case in individuals with focal semantic dementia. Conversely, phonological representations may help to 'glue' together fragmented semantic features. In Harry's case, it is possible that lexical cues worked in a similar way, by re-binding fragmented semantic information into a usable whole.

2.7.6 Melvyn

Melvyn's performance on the Picture Attribute Knowledge Test was well within the normal range. His score on the Event Video, on the other hand, was strikingly low. Though still above chance, the large number of errors made here invites an artefactual explanation. For example, Melvyn may have misunderstood the task, or he may have adopted a biased response mode. There is some evidence for the latter suggestion, since his errors included six 'false positives' (i.e. static states classed as events) and only one 'false negative' (an event classed as a non-event). Three of Melvyn's false positive responses arose from classing the scene as an event on the basis of the camera's movement. The others were more idiosyncratic. For example, he classed a scene in which a plate is shown on a drying rack as an event, on the grounds that 'Somebody has started to wash up'. This may indicate some difficulty in identifying event boundaries; for instance, while he was aware of the general context (washing up), Melvyn may have found it harder to constrain his judgment to the exact situation shown. Alternatively, he may simply have approached the task in an odd way.

Melvyn also fared surprisingly poorly on the Role Video, where he achieved the lowest score of all the participants with aphasia, selecting four role and two event distractors. This recalls his errors on the RSCT and may indicate a similar uncertainty about both core meaning and role information. This uncertainty seemed to be highlighted in less constrained contexts. Non-linguistic tasks such as the Role Video were therefore more problematic for Melvyn than those where language could help constrain his interpretation of the stimulus. This 'constraint hypothesis' also appeared to be supported by Melvyn's response to the Kissing and Dancing Test, which pointed to greater difficulty in judging the semantic features of actions than of objects. If constraint were the key factor, a slight general semantic deficit would show up more clearly in relation to actions, whose semantic referents are less clearly constrained or bounded than those of objects. However the fact that, despite instructions to the contrary, Melvyn consistently named each action suggests that the degree of constraint was not the whole story. Less constrained tasks clearly did not prevent him from accessing the specific semantic information needed for verb production. However, they may have offered more scope for his rather odd reasoning to 'run riot'. For example, unlike Harry, naming the actions in the Kissing and Dancing Test did not consistently help Melvyn to judge their semantic features. Sometimes he still made selections on the basis of features of the objects involved. For example, one picture shows a person washing a baby. Here the target picture shows a person drying a dish while the distractor shows a person peeling a banana. Melvyn curiously selected the latter on the grounds that 'I suppose a baby is more like a banana'. At times his choice of correct targets was supported by similarly tangential reasoning. For instance, he correctly matched a roaring lion to a barking dog rather than to a dog biting, because 'This one has the mouth open like the lion'.

It is difficult to know exactly what was happening here, other than that the Kissing and Dancing Test betrayed Melvyn's generally slightly odd approach, and his tendency to use unusual reasoning whenever the task permitted. The less constrained action-based tests naturally offered more scope for this than more constrained object-based or comprehension tasks. Melvyn's score on the Event Perception Test was unsurprising in the light of this analysis. This test would again highlight his slight difficulty in judging the semantic features of actions as well as any difficulty in accessing their lexical labels. The relatively unconstrained nature of the task (with choices only constrained by the nature of the distractor items, and the decision-making process not tapped) would also be likely to lead to errors.

In summary, Melvyn presented a confusing picture. His scores on the tests of non-verbal cognitive ability were within the range of non-brain damaged controls. His naming, while fairly strong all round, still showed a significant discrepancy in favour of objects. He appeared to have some degree of semantic difficulty, which unsurprisingly was more marked in action-based than in object-related tasks. Melvyn's performance on the event processing tests also pointed to a number of difficulties. These arose not only in making judgments about the semantic features of actions but in accurately judging their outcomes, in drawing links between actions that could be described by the same label, and even in distinguishing representations of events from states. On the other hand Melvyn's own language output contained a large number of verbs as well as a range of verb-argument structures. His verb comprehension was also strong and his understanding of reversible sentences, while not perfect, was probably better than would be predicted for someone with this level of difficulty in the basic event-analysis tasks. This was a very different pattern from that presented by the other participants, and did not fit easily with the proposed task hierarchy.

One possibility was that Melvyn's lower scores may reflect later stage executive or performance difficulties, rather than a basic lack of event knowledge. (A similar proposal was made by Linebarger, McCall and Berndt, 2004.) However such difficulties would presumably also have affected his performance on other tests imposing heavy executive demands, such as the Raven's SPM or the Picture Attribute Knowledge Test, on which Melvyn performed well. As noted above, Melvyn generally had an unusual approach to tasks, involving slightly odd patterns of reasoning. These were more evident where the task format provided less constraint to his thinking. Action-based tasks were more likely to cause errors than those based on the naturally more constrained processing of objects. Similarly, tasks that involved judgments based on reasoning, such as the Kissing and Dancing Test, were more problematic than those that simply required matching of a stimulus to a target. It was possible that even Melvyn's naming might reflect the same pattern. Action stimuli might encourage his tendency to divergent thinking and a degree of verbosity more than objects, leading to a discrepancy in favour of object naming. The same characteristics are also reflected in Melvyn's narrative. A previous study of Melvyn's naming of noun/verb homonyms (Kuehn, 2001) offers a small amount of supporting evidence. Here his production of nouns describing actions (e.g. *yawn*) was found to be less successful, and more like his verb naming, than his naming of nouns describing objects (e.g. *watch*). Perhaps this was a result of the relative lack of conceptual constraint attached to such nouns, like that afforded by verbs describing the same events.

Melvyn's profile is problematic for the hypothesis that event processing difficulties will be associated with problems in producing and comprehending verbs. Unless it *is* possible to talk about events in certain circumstances despite difficulties in processing them non-verbally, Melvyn's performance on the event-related tasks must have been affected by some other factor. Moreover this factor must not have influenced his response to the earlier tests or his narrative. This might suggest that the event processing tests are not very successful at precisely identifying event processing deficits, as it is possible to make errors for unconnected or unidentified reasons. This possibility must also be borne in mind in relation to the analysis of Ron's and Harry's performance.

2.8 General Summary

The preparatory tests were used first of all to identify people with verb and sentence difficulties who had the necessary skills to take part in more detailed investigations. To fit this profile, a person needed to demonstrate:

1. No significant general cognitive difficulties or visuo-perceptual problems
2. Significantly greater difficulty in naming actions than objects
3. Limited verb production in connected speech

4. Limited sentence structure, particularly in the signalling of verb-argument structures
5. Some difficulty in verb comprehension, without corresponding difficulty in comprehending nouns
6. Some difficulty in comprehending sentences, especially reversible structures

Six people scored within the range of non-brain damaged controls on tests of non-verbal cognitive ability and semantic judgments of objects. They also demonstrated significantly greater difficulty in naming actions than objects. Five of the six showed an impaired ability to signal verb argument relations in continuous speech, though their impairments differed in severity. All also had some difficulty in comprehending verbs or sentences, though in Jack's case this was very minor. Melvyn had access to a much larger range of verbs and verb-argument structures than the rest of the group, despite the discrepancy between his verb and noun naming on confrontation testing.

The second aim of the preparatory testing was to form hypotheses about those people who may have underlying difficulty in processing events in the way required for language. This aim was approached through a range of tests aiming to tap specific event processing skills. Carl, Jack and Helen made a significant number of errors only on the Event Perception Test, where they were required to match actions on the basis of their potential linguistic description. They also showed a very consistent pattern of strengths on the non-verbal tasks, despite different language production impairments. These three individuals were therefore considered unlikely to have primary difficulties in conceptualising events. They also importantly demonstrated that performance on such tests is not simply reflective of the severity of a person's language impairment. Carl and Jack in particular showed that this kind of test is achievable, even by people who have very limited language output. Melvyn performed differently, making errors on the event-related tasks despite his linguistic strengths. A later stage executive difficulty, particularly affecting his responses on less constrained tasks, may partly explain Melvyn's performance, but leaves open the question of why he did not fare similarly badly on some of the earlier tests.

Ron and Harry demonstrated some difficulty across a range of the event-related tasks. For the purposes of the present study, this was enough to suggest that further investigation of this area was warranted. However, for a clinician needing to know where best to target intervention, more precise guidelines would be required as to when a hypothesis of event level difficulties is appropriate. It is clear that none of the available assessments can individually be considered 'diagnostic'. However, a pattern of errors on the Role Video, Kissing and Dancing and Event Perception Tests seems most likely to be associated with difficulty in conceptualising events. A person with severe difficulty in analysing situations might also make errors on the Event Video. They would not necessarily be expected to make a large number of errors on the Picture Attribute Knowledge Test, however, since this test in theory at least taps aspects of event knowledge that are not specifically language-related.

However, it is also clear that the available assessments cannot identify people with this level of difficulty with absolute certainty. For example, the analysis of the Event Perception Test demonstrated that it was at least possible to select a large number of correct targets without any detailed analysis of the actions involved. This offered a potential explanation for Ron's, and possibly Harry's, performance. Similar criticisms can be raised against other tests – unsurprisingly so, since they aim to probe thinking at a level that is not normally conscious, and without demanding any language production. By forcing people to select between stimuli they may lead to guessed errors, or encourage choices on the basis of unintended reasoning, which remains hidden from view unless additional investigations are used. To some extent, such tests remain necessarily 'gross'; they do not tap very subtle deficits in thinking about events and cannot precisely probe individual difficulties. Any one is therefore likely only to furnish a picture of 'moderate impairment', with no participant performing at a chance level.

One way to deal with this would be to cut our losses and run. Another is to try to design better tests, or ones that are more precisely targeted to individuals' skills, exploiting their strengths and probing their deficits. The hypotheses about Ron's and Harry's specific event processing skills were therefore further explored through a number of novel assessments, in the hope of bringing further evidence of any difficulties to light. These new assessments were designed to capitalise as much as possible on each individual's strengths. As a consequence, not all were suitable, or even possible, for all six of the participants with aphasia. Chapter 3 kicks off the discussion of the new assessments with the Order of Naming Test, which was designed to probe Ron's event focus through his naming of the people and objects involved in pictured situations.

Chapter 3 The Order of Naming Test[2]

3.1 Introduction

The Order of Naming Test takes a novel approach to investigating the links between conceptual organisation and talking about events. By asking people to do something rather unnatural - name the entities they see involved in pictured situations - it aims to uncover something of the interplay between our perception of an event's causal structure and the construction of a linguistic description. The use of naming was particularly relevant to Ron, whose object naming far exceeded his ability to produce verbs or sentences. In addition, he often tended to produce unlinked strings of object names. In this he recalled MM (Marshall et al, 1993), EM (Dean and Black, 2005) and the people with verb impairments reported by Kemmerer and Tranel (2000), all of whom named extraneous noun phrases that did not refer to core event participants. One possible reason for this pattern may be a difficulty in adopting a focus over situations that is appropriately structured for language. If such a difficulty may underlie trouble in describing events, then we need to find a way of exploring event focus that does not rely exclusively on description - the very skill that is impaired. The Order of Naming Test represents an attempt to design such a task.

As discussed in Chapter 1, event perception occurs in a principled manner. It is also fundamentally constrained by attention, which is sensitive to a range of both perceptual and conceptual factors. Entities are foregrounded when attention is drawn to them, with foregrounded entities most often taking a syntactically prominent role in descriptive sentences. The Order of Naming Test explores whether the same principles that govern the organisation of entities in sentences also extend to naming when no sentence is required. The test compares the order in which the entities involved in situations are named in three conditions. In the first, no relational language is required. Here participants simply name the entities they see involved in pictured scenes. In the second condition, the same entities are named, but this time they are presented in unrelated arrays. Here neither the presentation of the entities nor the task itself would be hypothesised to encourage relational thinking. In the third condition participants produce sentences to describe the same scenes as in condition 1.

If we find a strong relationship between naming and sentence order, this may suggest that language plays a role in constraining attention, even when no description is required.

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[2] This work was previously reported in Cairns, Marshall, Cairns and Dipper (2007).

However, this finding might also reflect the influence of some other more basic conceptual factor constraining both naming and sentence construction. A good candidate would seem to be the very powerful natural bias towards causal agents. As discussed in Chapter 1, this is particularly influential in constraining both children's and adults' attention over situations. One element of the test therefore looks specifically at the effect of causal agency on the naming order of the entities. Another possibility is that naming is most strongly influenced by some factor that bears *no* relation to language. The test probes for the effect of one such non-linguistic factor: the position of the entities within the stimulus pictures. If attention is most strongly constrained by page position, then this should be reflected in a closer relationship between page position and naming order. This is the pattern that would be expected in relation to naming from the unrelated arrays, where we would not expect relational language to exert any influence. Following Sridhar (1988), we might hypothesise that the arrays would be most naturally named from the top downwards. The test aims to control as far as possible for the effect of other non-linguistic factors, such as the size and visual salience of the entities within each scene. It also takes account of the potential influence of lexical variables. Although it does not control for every possible candidate, the frequency and familiarity of the entities within each scene are matched.

Attention might also be expected to influence the choice of predicate and the selection or omission of sentence arguments. The Order of Naming Test does not consider the specific factors governing verb access, since it is designed as a tool to investigate event perception in people for whom verb production is particularly problematic. It does however relate to the selection of arguments, as it analyses the number of entities named in the different conditions. If the same constraints act upon attention in both naming and description, then only entities that play sentence argument roles should be mentioned in both the naming and sentence production conditions.

Like Sridhar's (1988) study, the Order of Naming Test uses a production task. Sridhar argued that the sentence production methodology introduced few confounding variables, and therefore allowed more direct access to participants' thinking than a selection task. Unlike Sridhar's task, however, the Order of Naming Test is designed to be accessible both to non-brain damaged speakers and to some people with aphasia, specifically to those with better object naming than verb and sentence production. A task that relied entirely on sentence production might not provide a true reflection of participants' thinking for speaking, since good thinking for speaking might be masked by lexical or syntactic difficulties. For two of the three test conditions, therefore, the only language demanded is naming of single objects.

The Order of Naming Test can perhaps be regarded as lying somewhere between the sentence production tasks and non-verbal methods such as event segmentation and eye tracking. Its aim is similar to that of the eye-trackers, in that it explores the conceptual preparations for talking about events, but its method is simpler, cheaper and more accessible. As described in Chapter 1, the studies of eye tracking identified an initial apprehension phase, during which people appeared to conceptualise an event's basic causal structure. Because the Order of Naming Test uses naming rather than eye fixations, it cannot tap the same very early phase of event conceptualisation. Instead it aims to probe the way in which the product of this initial event construal is translated into language. Differences between individuals with aphasia and non-brain damaged controls at this stage may offer useful pointers to the difficulties that can underlie trouble in talking about events. If the naming of non-brain damaged speakers is already influenced by potential sentence structure, then it is possible that a person whose naming does not show the same influence may have trouble in organising their thinking in a language-relevant way. Conversely, if people with sentence level difficulties nevertheless name in a sentence-like order, this might point to some preserved skills in event construal. If we can establish the relationship between the different factors involved in naming for control participants, therefore, we can usefully investigate the extent to which individuals with aphasia differ from this pattern.

3.2 Pilot test

A pilot version of the test was first carried out in order to establish the feasibility of the task with non-brain damaged speakers and with Ron, and to investigate the most suitable stimulus type and format. It was hoped that the pilot would also provide some preliminary pointers as to whether speakers do indeed naturally focus on entities of high 'human interest', and whether these entities are subsequently found in sentence subject position.

Six non-brain damaged individuals (five women, one man; age range 31-70; mean age 49.17) took part in the pilot. These were not the same as the control participants for the final Order of Naming Test, and so were not specifically matched to the participants with aphasia. They were shown twelve black and white line drawings of simple scenes involving either one or two animate entities and a range of objects. In the first instance the participants were asked simply to name what they could see in each picture, without trying to describe what was happening. The first five entities named were recorded. On a later occasion they were asked to produce a single sentence to describe what was happening in each picture. The order of naming in each condition was then compared, in order to ascertain whether participants' naming may have been influenced by a possible sentence frame.

The pilot stimuli were not closely controlled. For example, the entities involved in the scenes were not matched on non-linguistic factors such as size or visual salience. These may certainly have influenced the focus of participants' attention. Nor were the names of the entities matched on linguistic criteria such as frequency, either within or across items. However, in all cases the animate participants could be adequately named using only very high-frequency words such as 'man', 'woman', 'child' and 'dog'. The situation types selected were also not controlled for complexity or for the number of entities involved. Three situations involved two animate participants. Two of these were reversible (a man selling a car to a woman and a boy borrowing a book from a librarian) and one non-reversible (a man feeding a dog). The remaining nine situations showed a person acting on an object. Six of these also involved an instrument (burning a pair of trousers with an iron, putting up streamers with a hammer, drying hair with a hairdryer, cutting a pair of trousers with scissors, cleaning a window with a cloth and cutting bread with a knife). The final three scenes did not involve an obvious instrument, although each included additional objects (a diver finding a treasure chest, a man carrying a leaking bucket and a woman making jam).

3.2.1 Results of pilot test: Non-brain damaged speakers

In the naming condition, the non-brain damaged participants named an animate entity first on a mean of 66.67% of items. This was surprisingly low, given that we had expected a 'pull' towards conceptually salient entities of high 'human interest' or potential causal agency. Two items were found to account for a large proportion of the unexpected responses. Here participants appeared to experience a strong 'pull' towards inanimate entities. These items showed a boy borrowing a book from a woman in a library and a man putting up streamers. In both these scenes, the background context was depicted in considerable detail. For example, in the library scene, where the background was filled with bookshelves and books, all six participants named either 'library' or 'bookshelves' before any of the entities involved in the borrowing event. The second item was clearly intended to represent a Christmas scene, with Christmas tree, balloons and paper chains drawn in a very visually salient manner. Again, four out of the six participants first named either 'Christmas' or 'Christmas decorations'. If these two items are removed from the analysis, 78.3% of the remaining ten items elicited names of animate entities first.

In the second (sentence production) condition, animate entities were unsurprisingly placed first in the vast majority of sentences (mean = 95.83%). If the two problematic items are again removed from this analysis, animate entities were still named first in a mean of 95% of responses. Looking further at the sentences produced, 43/72 (60%) mentioned the same entity first as was named first in the previous condition. Twenty two sentences (30.56%) also went on to mention the same entity in second position. If the two problematic items are removed, 42 of the 60 remaining sentences (70%) named the same entity first as in the naming condition. 21 (35%) also included the same entity in second position. These results pointed to a degree of relationship between naming order and a language frame, though this relationship was clearly not absolute. Since there was some time interval between the two conditions, it is of course possible that the participants' naming was influenced by a different sentence frame from that produced in the sentence condition.

It is not surprising that non-brain damaged speakers focused first on animate entities when describing events. However it is interesting that there was a similar but less marked tendency even when no sentence was required. While the results did not universally support the hypothesis of a relationship between naming and sentence orders, they revealed a pattern that was close enough (particularly given the uncontrolled stimuli) to warrant further investigation, both with non-brain damaged speakers and with Ron.

3.2.2 Results of pilot test: Ron

Ron completed only the naming condition of the pilot test. He named animate entities first on only two of the 12 items (16.67%). These were not the items that had proved distracting for the control participants. If those items are removed, therefore, Ron's score was 2/10.

Ron seemed not to show the same 'pull' towards animate entities as the control participants. One possible explanation for the difference was that he was not influenced in the same way by a potential sentence frame, and so was not drawn initially to name thematic agents, or potential sentence subjects. It was also possible that Ron was waylaid by a specific focus on inanimate entities. Alternatively, he may have had a particular difficulty in naming animate entities. A number of individuals have shown animacy effects in their naming, with inanimate objects being named more successfully than living things (e.g. Warrington and Shallice, 1984; Sartori, Job, Miozzo, Zago and Marchiori, 1993; Farah, Meyer and McMullen, 1996; Funnell and De Mornay Davies, 1996; Gainotti and Silveri, 1996; Moss, Tyler and Jennings, 1997; Lambon Ralph, Howard, Nightingale and Ellis, 1998; Capitani, Laiacona, Mahon and Caramazza, 2003). However, it is worth pointing out that most people who have shown this pattern have been investigated following herpes simplex encephalitis rather than CVA. Indeed, when category effects are found after CVA, they tend to show the reverse pattern – better naming of living than of non-living things (e.g. Sacchett and Humphreys, 1992). The possibility of an animacy effect in Ron's naming was followed up with a further test.

3.2.3 Naming of living and non-living things

Ron was asked to name a set of line drawings of 36 living and 36 non-living things developed by Hughes, Woodcock and Funnell (2005) for a study of children's knowledge of object properties. The set was further divided into four sub-categories: animals, fruit/vegetables, implements and vehicles. Each category was matched for age of acquisition, with equal numbers of objects for which either the name or semantic knowledge is typically acquired by children in the following age groups: under 3, 3-5, 5-7, 7-9, 9-11 and after 11. Other factors such as frequency and familiarity were not controlled, however, leaving open the possibility that these may have influenced Ron's naming (although his response to the Object and Action Naming Battery suggests that this was unlikely). The items were presented in random order, and Ron's naming was timed with a stopwatch. Table 3.2.3 shows the number of correct responses in each category and a breakdown of Ron's response times. As the timing system was rough, these are simply divided into three bands: responses taking less than 5 seconds, those taking between 5 and 9 seconds and those incurring a delay of 10 seconds or more.

Category	Correct responses	Responses of less than 5 sec.	Responses of 5-9 sec.	Responses of 10+ sec.
Living things:				
Animals (N=18)	11	7	1	3
Fruit/vegetables (N=18)	13	9	2	2
Total (N=36)	24	16	3	5
Non-living things:				
Implements (N=18)	11	7	2	2
Vehicles (N=18)	10	6	2	2
Total (N=36)	21	13	4	4

Table 3.2.3 Results of living/non-living things naming task

There were 25 items on which Ron was unable to produce a response, and two on which he produced an error. Two approximations to the target were accepted: [klɒklɜz] (*binoculars*) and [saɪdʒskəʊp] (*microscope*). Ron's naming clearly did not show a category effect in favour of non-living things. In fact he was slightly more successful overall on the living than the non-living items (24 versus 21 correct responses). There was also no difference in the number of items stimulating prolonged naming delays. Ron's apparent focus on inanimate objects in the pilot Order of Naming task therefore seems not to have been caused by a disproportionate difficulty in naming living entities.

3.2.4 Summary of pilot test

The pilot test demonstrated that it was possible for non-brain damaged speakers to name the entities involved in an event without producing a description of that event. Ron also showed that he was able to achieve the naming aspect of this task, although he was not asked to complete the sentence condition. Supplementary tests showed that Ron's naming was not influenced by animacy, which might have affected his response to the final test.

The pilot also provided useful information about the most appropriate type and style of stimuli for such a task. It indicated clearly that a picture containing much background detail tended to distract people from focusing on the main participants in the target event. The final version of the test eliminated such detail. The pilot responses also confirmed that, when not distracted in this way, non-brain damaged speakers were drawn in most cases to focus first on an animate entity when naming. (This was so even though the stimuli were not carefully matched for lexical factors or situation type.) Moreover, in around 70% of cases this first-named entity was on a later occasion foregrounded to sentence subject position. Reversible situations that can be readily described from the perspective of each of the main participants were potentially problematic, and were avoided in the final test.

The Order of Naming Test built on the findings of the pilot by examining more explicitly the relationship among three factors. These were: the order in which the entities involved in a situation are mentioned in a naming task, the order in which the same entities are named in a sentence, and their physical ordering on the page.

3.3 Order of Naming Test: Participants

The Order of Naming Test was designed specifically for Ron. Because of the particular language skills demanded, it is difficult to gain significant control data from other people with aphasia. Few people who have comparable difficulties with verbs and sentences have sufficiently strong object naming to be able to complete the test. Of the participants in the present study, Helen's language profile most closely matched Ron's, but without Ron's hypothesised event processing difficulty. She therefore acted as a control for Ron. Difficulty in accessing single nouns effectively excluded Harry, Jack and Carl. Despite there being no time constraint on responses, it was important that participants should be able to name single objects with reasonable ease, so that naming difficulties alone would not cause a shift of focus. For example, if someone had great difficulty in naming a particular entity this might cause them either to linger on that entity for longer than natural, or else to shift their attention to another entity whose name was more accessible. In either case this would alter their focus. We tried to minimise this risk by matching the stimuli and using a 'rehearsal' mechanism (see below), but the possibility still remained that lexical difficulties might interfere with naming order. Melvyn's profile suggested that he may have been able to complete the test, but in practice he found the instructions too confusing. He was unable to confine himself to naming individual entities, consistently trying to produce a sentence in response to all conditions. The test was therefore abandoned with him.

Twenty non-brain damaged control participants also completed the test. Of these, six were men and 14 women, aged 36-75 (mean = 57.1, S.D. = 11.4). All were native English speakers. The age at which they had left full-time education ranged from 12 to 22 years (mean = 17.6, S.D. = 3.02). They were not informed about the purpose of the experiment before they completed the test. Full data on the control participants is presented in Table 3.3.

Participant	Age	Sex	Age on leaving full-time education	Most recent occupation
1	36	F	22	Charity worker
2	43	F	16	Office administrator
3	45	M	18	Building surveyor
4	46	F	18	Security guard
5	47	F	22	Student
6	49	F	15	School caterer
7	50	M	19	Facilities manager
8	50	F	20	Charity worker
9	52	M	16	Company director
10	56	F	18	Hospital administrator
11	58	F	15	Personnel officer
12	59	F	16	Teacher
13	62	M	16	Teacher
14	66	M	18	Local government administrator
15	67	F	18	Secretary
16	67	F	12	Housekeeper
17	71	M	22	Pensions manager
18	71	F	22	Housewife
19	72	F	17	Bank manager
20	75	F	12	Clerical worker
Mean	57.1		17.6	
S.D.	11.34		3.02	

Table 3.3 Control Participants

3.4 Test design and protocol

The main stimulus for the test was a series of 33 simple action scenes. Each scene involved three main entities[3]. Fifteen scenes showed a person acting upon another person with an

[3] The term 'entity' is used to denote both complement arguments and adjuncts such as instruments.

instrument, while eighteen showed a person acting upon an object with an instrument. Examples of each type are illustrated in Figures 3.4 (a) and (b).

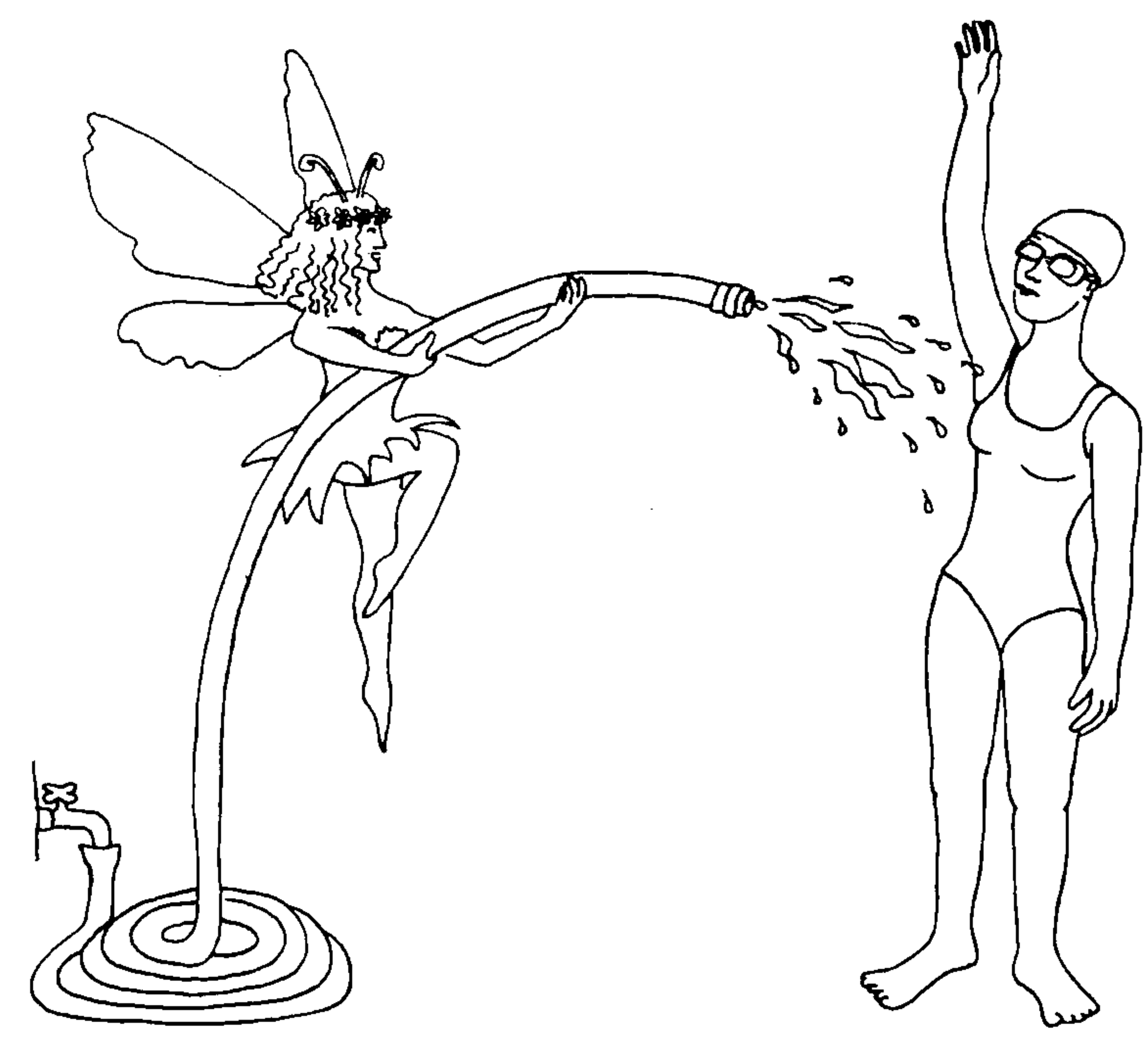

Figure 3.4 (a) 'The fairy sprays the swimmer with a hose'

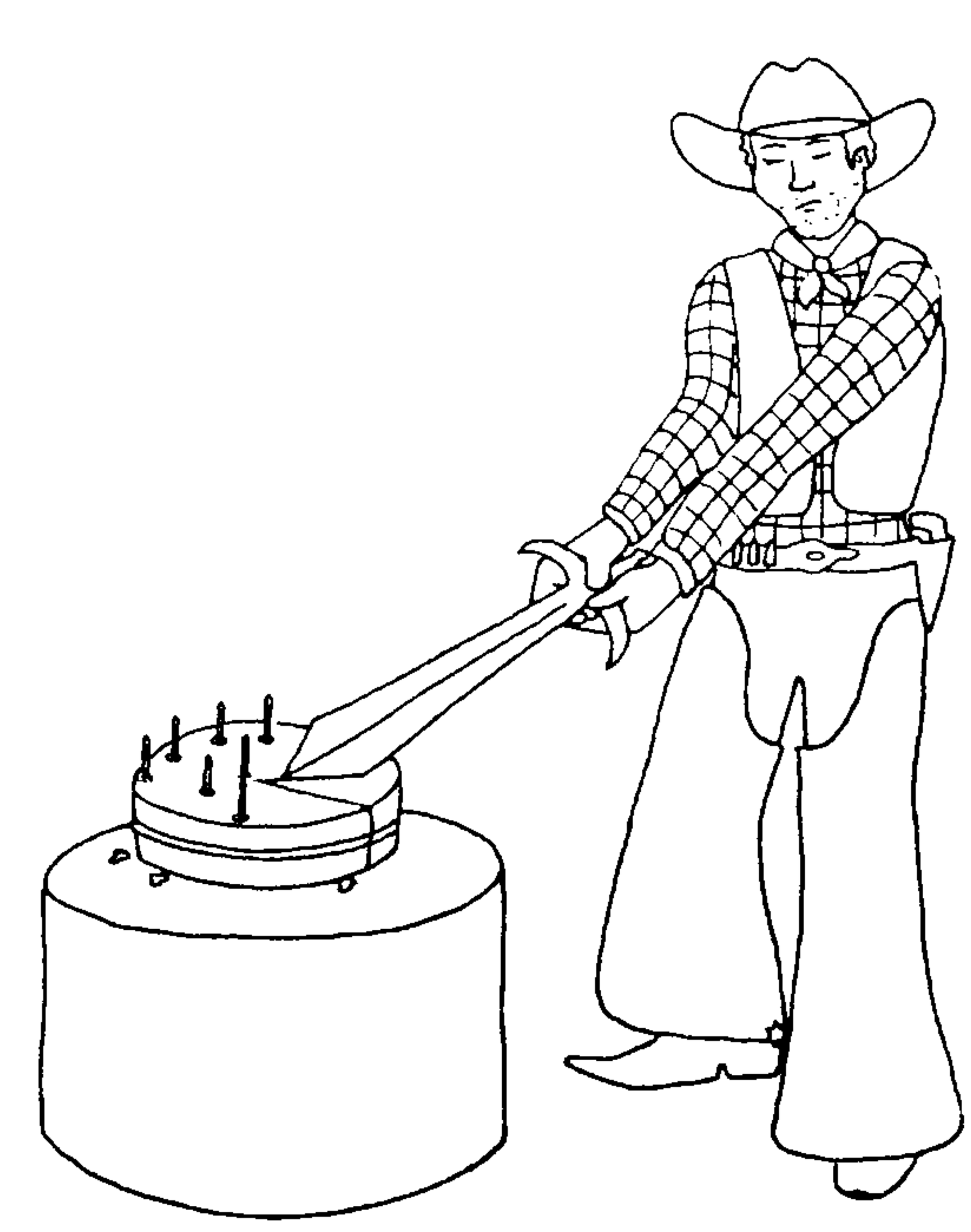

Figure 3.4 (b) 'The cowboy cuts the cake with a sword'

Two versions of the test were prepared. The first consisted of the action scenes presented as black and white line drawings on separate sheets of A4 paper (the 'event version'). The second consisted of the same entities, in the same combinations, but arranged in triangular arrays (the 'array version'). The position of the entities within the arrays was balanced, so that agent, theme and instrument each occupied the top position in one third of the items. Figure 3.4 (c) shows an example of an array.

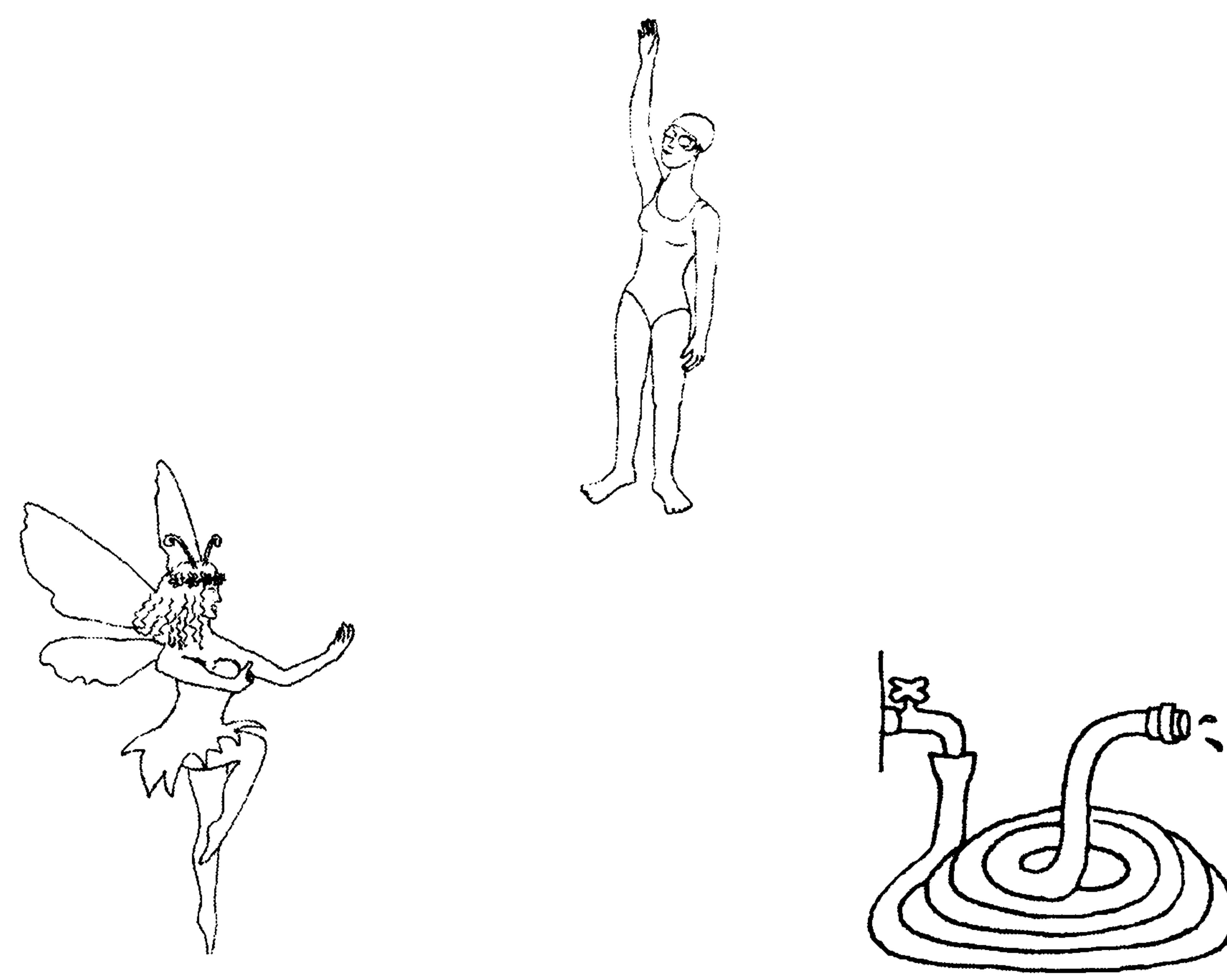

Figure 3.4 (c) Array version of 'fairy/swimmer/hose' item

Participants took part in two testing sessions, held at least one week apart. In the first session, they were shown the event version of the test and were asked to 'Name the things that you see'. They were specifically requested not to offer a description of the events. In the second session, they saw the array version of the test, and were again asked to name what they could see. Finally, they were shown the event version once again. This time they were asked to describe each picture with a simple sentence, with the instruction, 'Say what is happening in each picture'. In each condition, the order in which participants named the three target entities was recorded. Table 3.4 summarises the administration of the test conditions.

Session no.	Task	Stimuli	Rehearsed?
1.	1. Naming from Events	Event version	Yes
2.	2. Naming from Arrays	Array version	Yes
	3. Sentence description	Event version	No

Table 3.4 Test conditions and stimuli

A 'rehearsal' mechanism was also included before the test. This aimed to maximise naming agreement. Names were rehearsed before both Naming from Events and Naming from Arrays. The test items were sub-divided into blocks of four (and one block of five). Before each block was presented, participants were shown cards with pictures of the individual entities involved in those events, and their names were spoken aloud. Thus before each block either 12 or (in one case) 15 names were rehearsed. The order in which entities' names were rehearsed within each block was randomised, so as to minimise any influence on participants' focus within the test. We were careful not to rehearse entities relating to the first item in each block immediately before that item appeared.

3.4.1 Control of test stimuli

The stimuli were controlled in various ways. First, a number of measures aimed to control the accessibility of the entities' names. Any difference in accessibility between words of different grammatical class was controlled by requiring participants to name only nouns. Frequency and familiarity were also controlled, given that these factors are known to affect ease of access (Oldfield and Wingfield, 1965; Forster and Chambers, 1973; Jescheniak and Levelt, 1994). Within each item, the three main entities were matched for frequency using Francis and Kucera (1982), and as far as possible for familiarity using Toglia and Battig (1978). Full details are given in Appendix 7. In order to achieve frequency-matched triads, it was important that animate entities should not be named simply as 'man', 'woman', etc. Their target names were therefore much more specific, either being related to their intrinsic nature (e.g. *wizard, fairy*), or to their occupation (e.g. *cowboy*). In either case the entities needed to be easily identifiable. It was also important that they should be recognisable without props, which participants might name in preference to the targets. So, for instance, a fireman was shown without a hose, and a painter without an easel.

As the test aimed specifically to uncover the relative influence of sentence structure and page position on participants' focus, it was also important to try to control for other aspects of visual salience that might constrain their attention. This was especially important if the test was to provide information about the event focus of people with aphasia, who may be even more reliant on visual cues to the structure of events. Target entities were therefore depicted as (as far as possible) of similar size. In a few cases this proved impossible, as the resulting scenes would have been very unrealistic and therefore have biased responses. For example, one item showed a dancer opening a box with a key. Here an unnaturally large key would have been likely to capture participants' attention, making it more likely to be named first. In these cases, we relied on presenting the instrument as clearly and prominently as possible.

The left-right orientation of the scenes was also balanced. Agents appeared on the left and right hand sides in equal numbers of items, and the direction of the action was balanced between left-to-right and right-to-left.

3.4.2 Exclusion of items from the final set

One item was removed from the analysis because of a lack of agreement over which of the animate entities was the agent. Two different sentence frames proved equally popular within the controls' responses, causing difficulty for the analysis of the modal sentence (see below). There were also some items on which control participants failed to name all three target entities consistently, either because they omitted an entity, or because they used a different name. Items were removed from the analysis if this occurred on 10% or more of control responses over all conditions (i.e. on six or more occasions overall). Five items were excluded in this way.

Two exceptions were allowed to the exclusion rule:

- A number of accurate sentence descriptions were produced that did not mention the instrument. This was judged to be a normal way of describing actions in English, on the grounds that instruments, unlike agents, are not obligatory complements of the predicate. For these items participants were credited with having implicitly named the instrument in the final position (e.g. 'The magician cuts the trousers [with scissors]'). This exception accounted for 179 of the total 540 sentences (33.4%). The range was 0-21, with a mean per participant of 8.95.

- Synonyms of the target names were credited. A word was judged to be a synonym if it appeared under the same heading in Roget's Thesaurus of English Words and Phrases (1962). In practice only 27 synonyms were permitted, accounting for 147 responses over all three conditions (9.07%). The complete set of permitted and excluded alternatives is given in Appendix 8.

Frequency values were established for each substitution, using Francis and Kucera (1982). This was in order to ensure that targets were not automatically being replaced with higher-frequency, more easily accessible alternatives. In fact only eight of the 27 permitted synonyms were of higher frequency than their targets, and higher frequency words were used on only 33 occasions overall (22.4%). It was also not the case that targets were consistently replaced with shorter words. It can be seen from Appendix 8 that only seven of the 27 substitutions contained fewer syllables than the target, and several were longer (e.g. 'professor' in place of *teacher*).

The final stimulus set therefore consisted of 27 items, each involving three target entities. Fifteen items showed a person acting upon an object, and 12 showed one person acting upon another. The full list of final stimuli is given in Appendix 9.

Analysis and Results

Three main analyses of the data were performed, focusing on the number of entities named, the number of agents named first and the order of naming in the different conditions. The following sections present the method and results of these analyses, first for the control participants and secondly for Helen and Ron.

3.5 Results for control participants

3.5.1 Number of entities named

The mean number of entities named per item in each of the three conditions was first calculated. The control participants varied little in the number of entities they named in any condition. In the event condition the mean number named per item was 3.01 (S.D. = 0.03). In the array condition it was 3 (without exception). In the sentence condition it fell to 2.69, with S.D. of 0.27. Figure 3.5.1 illustrates these responses.

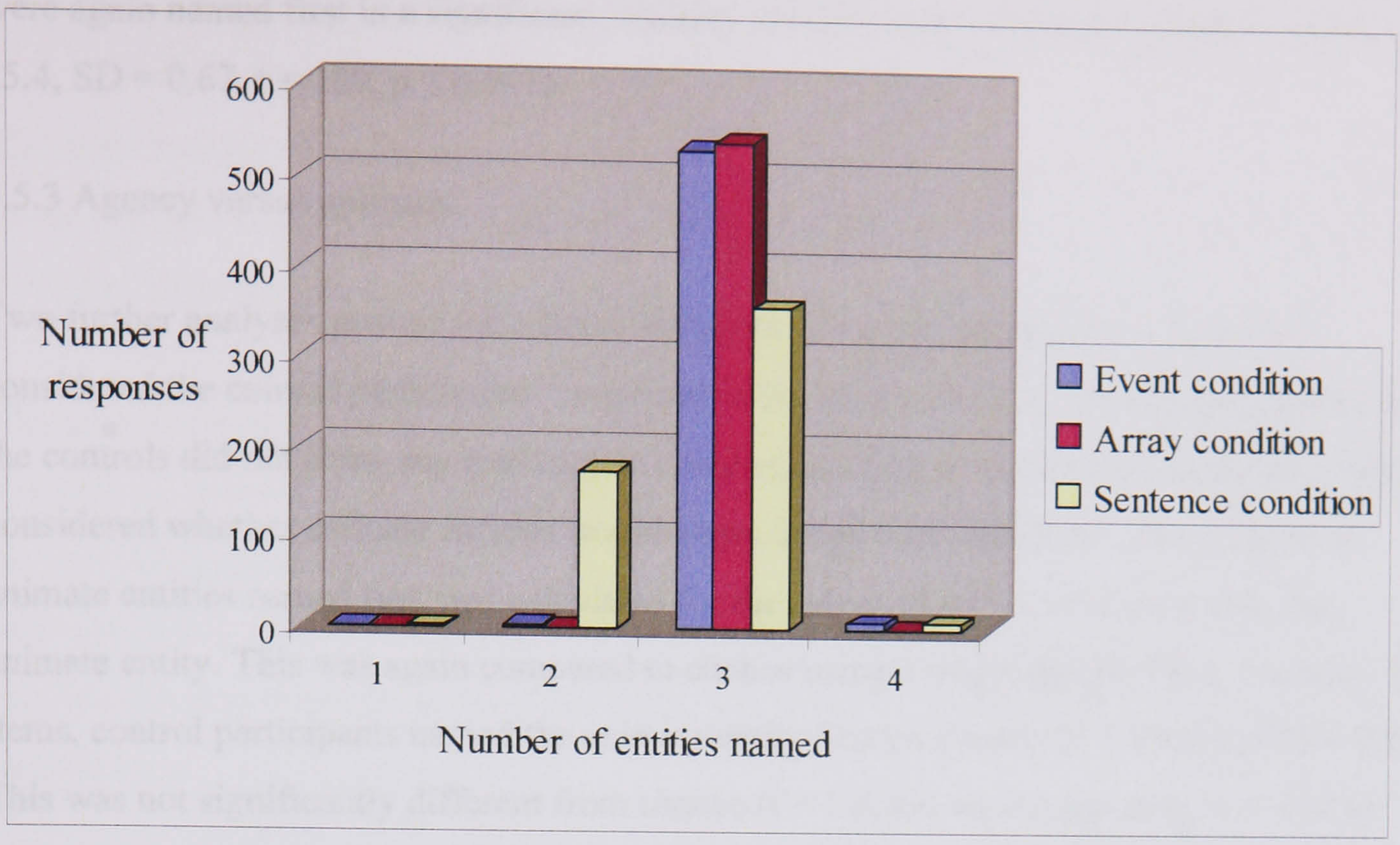

Figure 3.5.1 Number of entities named per item by controls

3.5.2 Agency

The responses were secondly analysed to determine the influence of agency on naming order. The number of items on which agents were named first in each condition was calculated. This was then compared to chance, using a single sample t test. The results are presented in Table 3.5.2.

	Naming from Events	Naming from Arrays	Sentences
Mean score	18.8	9.25	25.4
Standard deviation	3.90	0.72	0.67
Standard error	0.87	0.16	0.15
Expected score	9	9	9
t	11.2	1.56	109
Level of significance	$p \leq 0.001$	not sig.	$p \leq 0.001$

Table 3.5.2 Number of agents named first by controls (N=27)

The controls named agents first on approximately two thirds of the event items (mean = 18.8, SD = 3.90). This was significantly above chance ($t = 11.2$, $p \leq 0.001$). In naming from arrays the number of agents mentioned first was close to chance (mean = 9.25, SD = 0.72). Agents were again named first in a significant majority of items in the sentence condition (mean = 25.4, SD = 0.67, $t = 109$, $p \leq 0.001$).

3.5.3 Agency versus animacy

Two further analyses probed the relative influence of agency and animacy. The first considered the control participants' responses in the array condition. Having established that the controls did not show any tendency to name agents first in the arrays, this analysis further considered whether animate entities would be preferred over inanimate. The number of animate entities named first was calculated for the subset of arrays involving only one animate entity. This was again compared to chance using a single sample t test. On these 15 items, control participants named the animate entity first on a mean of 5.4 items (SD = 0.99). This was not significantly different from chance ($t = 1.8$, not sig.) suggesting that, just as with agency, there was no particular 'pull' towards animate entities in the array condition.

The final analysis in this section aimed to tease apart the influence of agency and animacy. This analysis considered only the subset of 12 items involving two animate entities. The number of first-named agents in each condition was calculated and once again compared to chance using a single sample t test. Results of this analysis are presented in Table 3.5.3.

	Naming from Events	Naming from Arrays	Sentences
Mean score	7	3.80	11.8
Standard deviation	2.05	1.06	0.64
Standard error	0.46	0.24	0.14
Expected score	4	4	4
t	6.54	0.85	54.3
Level of significance	$p \leq 0.001$	not sig.	$p \leq 0.001$

Table 3.5.3 Number of agents named first by controls in two-animate entity items (N=12)

This analysis confirmed that when naming from events or describing them in sentences, the controls were strongly predisposed to mention agents first, even when there were two animate entities present in the picture. As before, there was no tendency to name agents first in the array condition.

3.5.4 Order of naming

The main analysis then focused on the order in which participants named the target entities in the various conditions. This aimed to identify whether order of naming was related to a possible language frame (sentence order) or to a non-linguistic factor (page position).

The assessment had yielded the order in which participants had named the target entities in the three conditions. These orders of naming were then compared, two by two. For each comparison, a score was derived for each participant that reflected the closeness of fit between their orders of naming in the two conditions. The group's mean score for this relationship was then compared to the score that would be expected by chance, using a single sample t test.

Seven comparisons were made, as follows:

1. Each participant's order of naming from events was first compared with their order of naming in their own sentences. The null hypothesis was that order of naming from events was not related to sentence order.

2. Each person's order of naming from events was also compared with the group's modal sentence order for each item. This was in order to account for the possibility that an individual might be influenced by one language frame when naming from events, but by a second frame when producing sentences. The null hypothesis here was that order of naming from events was not related to the modal sentence order.

3. Order of naming from events was then compared with the page position or left-right order of the entities, in order to probe a possible effect of English reading order. The null hypothesis was that order of naming from events was not related to English reading order.

4. Order of naming from events was finally compared with the right-left order of the entities. This investigated the possibility that people might name in a way that was principled, but related neither to language nor to reading. In this case the null hypothesis was that order of naming from events was not related to right-left order.

5. Each person's order of naming from arrays was compared with their own sentence order. The null hypothesis was that order of naming was not related to sentence order.

6. Order of naming from arrays was also compared with English reading order. As the entities were here presented in a triangular pattern, English reading order was taken as top-down and left-to-right. The comparison was therefore with the order of the entities in top-left-right positions. The null hypothesis was that order of naming from arrays was not related to reading order.

7. Order of naming from arrays was finally compared with the top-right-left order of the entities in the array pictures. Like comparison 4, this was included to probe for any right-to-left bias in naming order. The null hypothesis here was that order of naming from arrays was not related to right-left order.

The method of scoring for each comparison of naming orders was based on the calculation for the Kendall Rank Order Correlation Coefficient (Siegel and Castellan, 1988). In this calculation, each pair of entities is considered in the two conditions being compared. A mark is added to the score for each pair that occurs in the same order in the two conditions. Scores are therefore given for the closeness of 'fit' between the orders of naming in the two target conditions. For a comparison of three entities there are three distinct pairs to be considered: a versus b, a versus c and b versus c. For each item, the score is therefore out of a maximum of 3. This system is illustrated in Table 3.5.4.

Order of entities in condition 1	Order of entities in condition 2	Score
abc	abc	3
abc	acb	2
abc	cab	1
abc	cba	0
abc	bca	1
abc	bac	2

Table 3.5.4 Scoring system for comparison of orders of naming

Since there were 27 items, the total possible score for any condition was 81 (i.e. 3 x 27). For each item, there were six possible orders of naming. The chance score for any item was therefore 1.5 (the sum of possible scores divided by 6). The chance total score for each pair of conditions being compared was 40.5 (i.e. 1.5 x 27).

It might be argued that a Bonferroni correction should be used, to counteract the effect of the number of t tests performed. This is analogous to the treatment of unplanned comparisons in an Analysis of Variance. Against this, we might argue that the analysis only considers a subset of the total possible set of comparisons, four of which relate to the order of naming from events while three consider naming from arrays. These might therefore be considered in the same light as planned rather than unplanned comparisons in an Analysis of Variance. In this case the Bonferroni correction would not be required. In response to this dilemma the results are discussed both with and without a Bonferroni correction. Results that did not reach significance when the Bonferroni correction was applied are marked with an asterisk.

3.5.5 Results of order of naming analysis

Table 3.5.5 (a) presents the results relating to the control participants' naming from events. This indicates that order of naming from events was highly significantly related both to the controls' own sentence order and to the group's modal sentence order. (The two are clearly correlated.)

	Naming from Events vs. Own Sentences	Naming from Events vs. Modal Sentences	Naming from Events vs. Left-Right order	Naming from Events vs. Right-Left order
Mean raw score	51.3	52.3	47.3	32.5
S.D.	8.02	7.06	10.78	11.65
Standard error	1.79	1.58	2.41	2.60
Expected score	40.5	40.5	40.5	40.5
t score	6.02	7.48	2.82	3.07
Level of significance	$p \leq 0.001$	$p \leq 0.001$	$p \leq 0.05$ *	$p \leq 0.01$

Table 3.5.5 (a) Controls' scores for comparisons between order of naming from events and sentence order or page position

The modal order used for the majority of sentences was that of agent/theme/instrument. This pattern was preferred for 23 of the 27 items, and was used in over 75% of all the sentences produced. Agent/instrument/theme was the modal order for the remaining four items. The order theme/agent/instrument was used once each on four items.

At first glance Table 3.5.5 (a) suggests that page position was also exerting an influence over order of naming from events. However, this may be deceptive. The relationship between order of naming and the right-left order was significantly *below* chance, indicating that this was a very unlikely order of production. The relationship between order of naming and left-right order was only just significant, and in fact was no longer so when a Bonferroni correction was applied. This rather inconclusive result stimulated an additional analysis exploring the influence of page position. This analysis considered the control group's responses to the 15 items in which a person was shown acting upon an object. Of these, seven showed the agent on the left acting on an object on the right (left-to-right items) while eight showed the opposite configuration (right-to-left items). Figure 3.5.5 shows an example of each type.

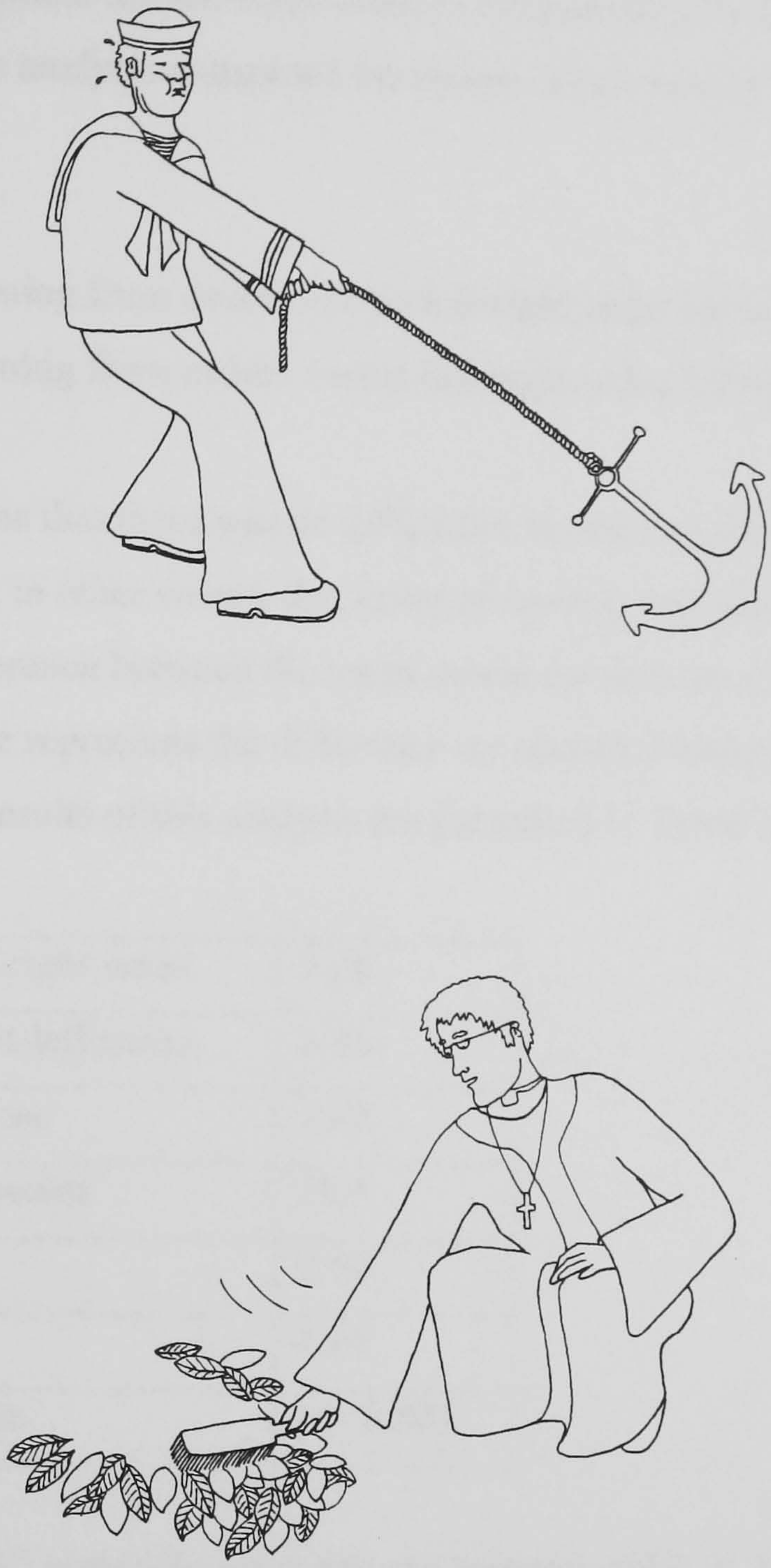

Figure 3.5.5 One-animate entity items: left-to-right and right-to-left orientations

Analysis of these items allowed the degree of influence of left-right page position over naming order to be determined. If left-right page position influenced production, there should be a relationship between naming order and left-right order for all items. If another factor relating to the direction of the action were dominant, this would not be so. In this case there should still be a relationship between naming order and left-right order for left-to-right items (where the direction of the action was congruent with left-right order). However this should not hold for right-to-left items.

The analysis of the one-animate entity items therefore considered the controls' order of naming from events against the left-right order of the pictures, for both left-to-right and right-to-left items. The analysis compared the means of two sets of scores, using a correlated groups t test:

- Order of naming from events versus left-right order for left-to-right items
- Order of naming from events versus left-right order for right-to-left items

The null hypothesis was that there was no difference in order of naming between left-to-right and right-to-left items; in other words, that order of naming was not related to the direction of the action. The difference between the mean scores for the two subsets was compared to chance. A chance score represents the difference we should achieve if the null hypothesis were upheld (i.e. 0). Results of this analysis are presented in Table 3.5.5 (b).

Mean score for left-right items	2.26
Mean score for right-left items	0.86
Mean difference score	1.40
Sum of difference scores	29.4
Standard deviation	0.80
t	7.84
Level of significance	$p < 0.001$

Table 3.5.5 (b) Controls' scores for comparisons between order of naming from events and left-right order in one-animate entity items

The difference between the mean scores for the two subsets was 1.40, which was significantly different from chance ($t = 7.84$, $p < 0.001$). Mean scores for the left-to-right items were higher than those for the right-to-left items. This suggests that participants' naming was significantly related to the direction of the action. A left-to-right order of naming was evident only for pictures involving a left-to-right direction of action.

The next part of the analysis explored the controls' order of naming from arrays. The results of the comparisons with order of naming from arrays are summarised in Table 3.5.5 (c)

	Naming from Arrays vs. Own Sentences	Naming from Arrays vs. Top-Left-Right order	Naming from Arrays vs. Top-Right-Left order
Mean raw score	39.2	68.15	46.15
S.D.	2.61	12.29	15.65
Standard error	0.58	2.75	3.50
Expected score	40.5	40.5	40.5
t score	2.23	10.06	1.61
Level of significance	$p \leq 0.05$ *	$p \leq 0.001$	not sig.

Table 3.5.5 (c) Controls' scores for comparisons between order of naming from arrays and sentence order or page position

The table reveals one positive significant relationship, between order of naming from arrays and the top-left-right order ($t = 10.06$, $p \leq 0.001$). It seems that the controls participants adopted a reading-like order when naming the entities in an array. The comparison between array naming order and sentence order was also significantly different from chance. However, here scores were *lower* than chance and the significance did not survive a Bonferroni correction. There was no relationship between the order of naming and top-right-left order.

3.6 Results for participants with aphasia

3.6.1 Number of entities named

As for the controls, the number of entities named per item in each condition was counted. In Ron's case, this was done twice. In the first analysis the total number of nouns produced was counted. Repetitions were discounted, but where two or more synonyms were produced that clearly related to the same entity, these were separately credited. The second analysis was stricter. This included only names of entities that were visible in the picture and did not credit either repetitions or synonyms. Results are presented in Table 3.6.1, with a summary of the control data for comparison.

Participant		Naming from Events	Naming from Arrays	Sentences
Helen	Mean	3.07	2.96	2.63
Ron	Mean (all nouns)	4.93	5.33	5.44
	Mean synonyms per item	0.33	0.63	0.78
	Mean (visible entities only, without synonyms)	4.11	4.44	4.22
Controls	Mean	3.01	3	2.69
	S.D.	0.03	0	0.27

Table 3.6.1 Number of entities named per item by Helen and Ron (N=27)

Helen named a very similar number of entities to the controls in all three conditions. Like them, she focused purely on the agent, theme and instrument. Ron, in contrast, produced more nouns in every condition, even in the more stringent analysis.

3.6.2 Agency

Table 3.6.2 shows the number of agents named first by Helen and Ron in each condition, with comparative control data. Both participants performed similarly to the controls in that they tended to mention agents first whenever they were responding to event pictures. No such primacy was seen in the array condition. When producing sentences, Helen and the controls were particularly likely to start with the agent. This pattern was also evident, though less strongly, in Ron's sentences.

		Naming from Events	Naming from Arrays	Sentences
Helen		22	9	24
Ron		18	5	17
Controls	Mean	18.8	9.25	25.4
	S.D.	3.90	0.72	0.67

Table 3.6.2 Number of agents named first by Helen and Ron (N=27)

3.6.3 Agency versus animacy

As with the controls, a further analysis then considered Helen and Ron's response on the 12 items that involved two animate entities. Table 3.6.3 shows the results of this analysis, indicating that even on these items they were still likely to name agents first.

Participant		Naming from Events	Naming from Arrays	Sentences
Helen		8	3	10
Ron		8	2	8
Controls	Mean	7	3.80	11.8
	S.D.	2.05	1.06	0.64

Table 3.6.3 Number of agents named first by Helen and Ron in two-animate entity items (N=12)

3.6.4 Order of naming

As with the controls, the analysis of naming order first aimed to determine whether Helen and Ron's order of naming from events mirrored sentence order. Their order of naming from events was therefore compared with their own sentence order and with the control group's modal sentence order. It was also compared with left-to-right (reading) order and with the right-to-left order of the pictures. The scoring method was the same as that used with the controls. The chance score for each relationship was 40.5. Helen and Ron's scores were also transformed into z scores in order to determine whether they were significantly different from the mean of the controls. These results are presented in Table 3.6.4 (a), with control data for comparison.

Participant		Naming from Events vs. Own Sentences	Naming from Events vs. Modal Sentences	Naming from Events vs. Left-Right order	Naming from Events vs. Right-Left order
Helen	Raw score	59	54	32	43
	z score	0.96 (not sig.)	0.24 (not sig.)	-1.42 (not sig.)	0.90 (not sig.)
Ron	Raw score	36	38	27	26
	z score	-1.91 (not sig.)	-2.03 ($p \leq 0.05$)	-1.88 (not sig.)	-0.56 (not sig.)
Controls	Mean raw score	51.3	52.3	47.3	32.5
	S.D.	8.02	7.06	10.78	11.65

Table 3.6.4 (a): Helen and Ron's scores for comparisons between order of naming from events and sentence order or page position

Taking Helen first it is clear that she performed similarly to the controls. There was a strong relationship between her order of naming from events and sentence word order. This is signalled by the high raw scores for both sentence comparisons (own sentences: 59; control modal sentences: 54). These are both comfortably above chance. Page position did not seem to drive Helen's order of naming, since the score for the comparison with left-right order was below chance. That for the comparison with right-left order was above chance, but not markedly so. None of Helen's z score comparisons reached significance.

Unlike the controls and Helen, Ron's naming from the event pictures bore no relationship either to his own sentence order or to the controls' modal sentence order. Scores for both of these relationships were at chance (36 and 38 respectively). The comparisons with left-right and right-left order were particularly low, indicating that page position was not influencing Ron's order of naming. Turning to the z scores, only one reached significance - that for the comparison with modal sentence order. This was significantly lower than the controls' mean.

It was possible that Ron's scores were adversely affected by difficulty in producing the target names, which might cause him either to omit targets or to make naming errors. This prompted a further analysis relating to Ron alone, which considered only those items on which he had named all three targets. Results for this analysis are presented in Table 3.6.4 (b). The chance score now varied among the different comparisons, as different numbers of items had to be excluded in the event and sentence conditions.

		Naming from Events vs. Own sentences	Naming from Events vs. Modal sentences	Naming from Events vs. Reading order	Naming from Events vs. right-left order
Ron		33	34	21	24
Controls	Mean	30.9	34	29.8	20.6
	S.D.	4.72	4.91	7.77	8.19
Chance score		24	25.5	25.5	25.5

Table 3.6.4 (b) Ron's scores for comparisons with order of naming from events: errorless items

Ron now scored close to the controls' mean on both of the comparisons of naming from events against sentence order. His scores for the comparisons between naming from events and both reading order and right-left order were still close to chance.

As with the controls, the participants' order of naming from arrays was then compared with their own sentence order, the top-left-right order of the entities (reading order), and the top-right-left order. As before their scores were also transformed into z scores. The results are presented in Table 3.6.4 (c), with control data for comparison.

Participant		Naming from Arrays vs. Own Sentences	Naming from Arrays vs. Top-Left-Right order	Naming from Arrays vs. Top-Right-Left order
Helen	Raw score	35	76	53
	z score	-1.61 (not sig.)	0.64 (not sig.)	0.44 (not sig.)
Ron	Raw score	24	45	64
	z score	-5.82 ($p \leq 0.001$)	-1.88 (not sig.)	1.14 (not sig.)
Controls	Mean raw score	39.2	68.15	46.15
	S.D.	2.61	12.29	15.65

Table 3.6.4 (c) Helen and Ron's scores for comparisons between order of naming from arrays and sentence order or page position

Helen, like the controls, showed no relationship between her order of naming from arrays and her own sentence order, achieving a raw score of 35. Her scores for the relationships with page position order were also similar to the controls. That for naming from arrays versus top-left-right order was particularly high (76), suggesting that this was a very dominant pattern for Helen. The score for naming from arrays versus top-right-left order was also considerably above chance, but suggested a less close relationship than with English reading order. Once again, none of Helen's scores was significantly different from the controls' mean once transformed into a z score.

Ron's naming from arrays was unrelated to his own sentence order, achieving a comparison score of 24. His naming was more strongly related to reading (top-left-right) order, with a raw score of 45. However it showed the closest fit with the opposite order (top-right-left), a clockwise pattern that was used very little by the controls. Here Ron achieved a raw score of 64. Only one z score was significantly lower than the mean of the controls. This was the score for the comparison of naming from arrays with Ron's own sentence order.

3.7 Discussion

The discussion is divided into four sections. The first considers the performance of the control participants, drawing some tentative conclusions about the way in which non-brain damaged speakers process events. Helen's response is then discussed, highlighting the degree of similarity between her and the controls. The third section considers Ron's performance, including both aspects in which he differed from the controls, and those in which they were alike. Some apparently latent event processing skills that emerged through Ron's performance on the test are also highlighted. The final section discusses various implications of the findings along with some potential applications to aphasia therapy.

3.7.1 Control participants

The control data revealed four main findings:

- across all conditions, naming was restricted almost entirely to the three main entities (agent/theme/instrument)
- when naming from and describing events, controls had a strong tendency to mention agents first
- page position strongly influenced naming from arrays but only minimally influenced naming from events (if at all)
- the order of naming from events was strongly related to sentence order

Each of these findings will be discussed in turn.

The first finding showed that the controls' naming was highly constrained. This was hardly surprising, given the visual presentation of the stimuli and the rehearsal procedure that preceded the test. It did, however, confirm that the controls were able to focus only on entities involved in the main action, with no tendency to name additional or peripheral objects, such as items of clothing or component parts of the instruments and themes. In the array condition the degree of constraint was even stronger than in the events, as there was even less scope for naming inferred entities related to the situation. Interestingly, there was still a high degree of consistency in the number of entities named in the sentence condition. Any variation in the number of entities named here was mainly accounted for by the omission of instruments.

The second finding suggested that non brain-damaged speakers pay particular attention to the entity in the role of agent, even when simply naming rather than producing sentences. This adds to the evidence that agency is a key concept in our thinking about events. The data confirm that agency, rather than animacy, was the crucial factor, given that agents were named first even when the picture contained two animate entities. They also suggest that agents were not simply named first because they were in some way more visually salient, since naming from arrays showed no such effect. Indeed, when naming from arrays the control participants did not show any particular 'pull' towards animate entities at all. When only those arrays involving a single animate entity were considered, there was no significant tendency to name the animate entities first. Agents were unsurprisingly named first in almost all of the controls' sentences. The small degree of variation was mostly caused by occasional use of passive sentences.

The third finding was that page position only influenced naming order when participants were dealing with arrays. Here participants typically named in a reading-like order, in that they started with the top item then progressed from left to right. The left-right order was much less evident in naming from events. Indeed, the analysis of the subset of event items involving one animate entity showed that order of naming was more powerfully influenced by the direction of the action than by the left-right order of the entities. Where the direction of the action was clearly contrary to the left-right order (where agents were shown on the right of the page acting on objects on the left), naming virtually abandoned the left-right order.

The final and most important finding was the relationship between naming from events and sentence production. This indicated that the order in which participants named the entities in the event pictures bore a strong relationship to the word order in the sentences they eventually produced to describe those pictures.

What determined the order of naming? One possibility is that it was influenced by the accessibility of the entities' names. Frequency and familiarity may be dismissed, as both were controlled in the design of the stimuli. However, it was simply not possible to control for every possible lexical factor, given the difficulty of selecting matched items to feature in even vaguely plausible (and picturable) situations. Frequency and familiarity were therefore selected as being supported by a range of robust evidence, while other factors including age of acquisition, word length and imageability remained uncontrolled. Still, the fact that a different naming order emerged in the array condition suggests that the accessibility of the targets was not the prime determinant of naming order. Had this been so, its influence would be expected to manifest equally across all conditions. The finding of a different naming order in the array condition similarly challenges visual salience as an explanation. Although there were inevitably some differences between the entities in terms of visual factors such as size, prominence and degree of detail, any effect on naming order should again have been evident across all three conditions.

An alternative explanation is that naming was influenced by the event or role structure of the scenes. In other words, when faced with a picture of an event, participants may automatically engage in conceptual level processing that uncovers the main actors and their roles. This processing will be reflected in their order of naming, even when they are not explicitly constructing sentences. So, in the types of events used here, naming typically progressed in a sentence-like order, beginning with the agent, followed by the theme and finally the instrument. This explanation concurs with the evidence from eye tracking experiments (Griffin and Bock, 2000; Meyer and Dobel, 2003), showing that when people examine events their order of focus is related to the events' role structure, and indeed to the word order used in their event descriptions. The Order of Naming Test suggests that, in the process of construal *for naming*, the product of the initial conceptual apprehension is already organised in a way that is closely related to sentence structure. These organising principles are also rather similar to those uncovered by Zacks et al (2001), where notions of goals and causation were seen to drive non-verbal event segmentation and description. The Order of Naming Test does not involve temporal segmentation, but it similarly suggests that people respond to a basic sense of goal-directed activity. Participants only named entities involved in the main causal activity rather than peripheral items, while their naming order suggested that their attention was driven by a goal structure, with agents typically named before the people or objects undergoing change.

A couple of caveats need to be acknowledged. First, it is possible that participants could still remember the stimuli from the first session when they came to produce sentences, despite the fact that the sessions were held at least a week apart. This might account for some of the closeness of relationship between the order of naming from events and sentence order. However, between these two conditions participants completed the naming from arrays, where naming order was not related to sentence order. If their sentence production was indeed influenced by memory of the event condition, this influence must have been 'put on hold' during the intermediate processing of the same entities in the array format.

The second caveat involves a slightly different account of the naming process. It is possible that, when looking at the event pictures, the control participants had internally constructed full sentences *before* isolating the relevant nouns for the naming task. This would inevitably lead to a naming order that mirrored sentence production. (This clearly was not the case in the array condition.) This possibility poses something of a 'chicken and egg' dilemma, which is difficult to resolve. Similar uncertainty was expressed by Meyer and Dobel (2003) in relation to the results of their eye tracking experiment. There, viewers' early fixation on the object of an action might either represent the time taken to identify the event's structure, or the selection of an appropriate verb.

Teasing apart the influence of conceptual and linguistic factors is difficult and would require a different method. One possibility would be a cross-linguistic comparison between languages with different canonical word orders. For example, one might examine whether speakers of languages that typically use an OSV or OVS structure show the same tendency to name agents first. However, such an investigation is beyond the scope of this thesis, and would overstep the main aim of the Order of Naming Test, which was to compare the performance of English-speaking individuals with aphasia with that of non-brain damaged speakers. Another possibility is to look further at the processing of situations that present a dilemma of perspective (for example, *giving/taking* situations). These clearly offer scope for different descriptions of the same situation. They therefore provide further opportunity for comparing the influence of conceptual constraints such as the natural foregrounding of causal agents, and linguistic constraints such as those brought by particular verb structures. The processing of perspective verbs is considered further in Chapter 4.

Whether naming is more constrained by a pre-linguistic conceptualisation of event structure or by a more fully-formed language structure, the result, at least for non-aphasic speakers, would not be very different. The Order of Naming Test suggests that when non brain-damaged speakers construe a situation for naming, their naming is not random, or primarily determined by page position. Rather it appears to be driven by the role structure of a conceptualised event. In some cases, speakers may have progressed as far in the process of event analysis as sentence formulation. In others, their construal may have remained at the pre-formulation stage. In either case, their naming is linguistically principled, and suggests that order of naming from events may provide a useful window onto conceptual processing.

3.7.2 Helen

Helen was chosen to act as a control for Ron because, of the six participants with aphasia, her profile of language abilities most closely matched Ron's, without his hypothesised difficulty in conceptualising events. In particular, Helen's ability to name single objects was in line with the particular skill that the Order of Naming Test was designed to exploit. Helen was predicted to perform differently from Ron on the test, and more in line with the control participants. Her response proved to be very much in line with this prediction. All of the key findings from the controls' data were also present in hers. In all conditions she only named the three main entities, showing that she was focused on the agent, theme and instrument. Like the controls, she showed a strong bias towards agency, in that when responding to event pictures, but not arrays, she tended to name the agent first. This pattern was evident even when the scene involved two animate entities.

Helen's order of naming was influenced by page position only when she was dealing with arrays. Here, like the controls, she tended to follow a reading-like order. In contrast, her naming from events was oblivious to page position but, again like the controls, showed a strong relationship to sentence order. This suggested that Helen was able to analyse the role structure of the situations and that her naming was driven by this analysis.

One possibility was that Helen's language – and particularly her ability to access verbs – may have constrained her naming in a similar way to the controls. For instance, by accessing a verb she may have been drawn to focus on the key entities, and perhaps to access an argument structure that drove both her naming from events and her sentence production. If so, then where she was not able to access a verb, her responses might be expected to be more disorganised and less focused on the target entities. Only three items in the sentence condition were in fact missing a verb. Here Helen did produce relatively disorganised lists of entities, though none of them was really peripheral to the main event. However, her responses still contained vestiges of propositional structure, in that they at least named the agent first:

"The fairy the hose the water in the swimmer"
"The knight is match of a flame is… the matches and the candle"
"The doctor is the flashlight… light the little girl".

The third item was ambiguous, since 'light' might be interpreted either as an uninflected verb (something Helen produced very rarely) or as a corrected naming attempt (the picture shows a ceiling light rather than a hand-held torch). In the latter case we might argue that, despite failing to access a verb, Helen's naming was still limited to the three targets.

Where Helen did produce a verb, many of her sentences were indeed fully structured. However, even her more disordered responses were still in most cases focused on the three target entities, and contained some degree of word order structure. In some cases this was achieved by building sentences round rather non-specific verbs. For example:

"The blacksmith make a horseshoe and the hammer is hammer".

It is difficult to say for sure to what extent language helped Helen to name in a 'normal' way. Accessing a verb may have helped her to focus on the three target entities, while not always enabling her to create a correct sentence structure. But even where her sentences were disorganised, she could still omit non-essential entities and could often indicate the main protagonists. Overall, Helen's performance suggested that her focus was constrained in a way that was very similar to the controls, with a 'normal' naming order emerging in both the naming and sentence conditions, even without a fully intact predicate-argument structure. Helen therefore showed that it was possible for a person with aphasia (albeit one with a mild naming impairment) to complete the test, as well as suggesting that the test may be able to highlight differences between different individuals with aphasia.

3.7.3 Ron

Ron's suspected event processing impairment was hypothesised to limit his access to the structure of events. As a result he was predicted to perform differently from the controls on the Order of Naming Test. In particular, his order of naming from events was predicted to show no relationship either with his own sentence order or with the controls' modal sentence order. Conversely, if his order of naming showed the same pattern as the controls, this might point to some intact event knowledge.

Before discussing the findings one concern has to be acknowledged: Ron may differ from the controls for reasons that are unconnected with the hypothesis being tested, an obvious candidate being word finding difficulties. Some reassurance in this regard may be gained from Helen's performance. She was clearly able to do the test, and showed a similar pattern of responses to the controls, despite some word finding difficulties. However, the possibility remains that Ron, who had more difficulty in confrontation naming than Helen, may have been affected by trouble in accessing the target names. A number of measures aimed to minimise this risk. First, targets were matched for frequency and familiarity, which are known to affect ease of naming. Although age of acquisition was not controlled, Ron's performance on the Object and Action Naming Battery had shown that this was not an influential factor in his naming. Ron's response to the Funnell naming test similarly provides reassurance that his naming was not affected by disproportionate difficulty with either animate or inanimate entities. Secondly, the rehearsal exercise was designed to help Ron's naming, with targets rehearsed immediately before each group of stimuli. Finally, the scoring criteria were generous, crediting any words listed as synonyms of the target in Roget's Thesaurus. Further, as the aim was to assess the order of focus rather than the ability to access particular words, Ron was credited with having named an animate target wherever his focus was clear. Descriptions that included either 'man' or 'woman/lady' were accepted under this criterion. For example, 'long lady, sea urchin' was credited for the target *mermaid.*

The results offered further evidence that Ron had the naming abilities to carry out the task. First, as discussed below, he tended to name *more* entities per item than the controls, including many low frequency nouns. His performance in the array condition was also reassuring. Here participants were asked to name the same entities as in the event pictures, although presented separately. In this condition, Ron behaved similarly to the controls, in that his naming order was clearly dominated by page position (although the pattern he favoured was little used by controls). It seemed that Ron's naming skills were sufficient for him to produce most of the target nouns and that, when he was not required to process events, he resembled the controls in adopting a principled ordering strategy.

Ron's performance was different from the controls in a number of respects. One striking difference was in the number of entities named. Almost without exception, the controls limited their naming to the three main entities, whereas Ron named additional items in all three conditions. This was despite the fact that the names of the key entities were rehearsed before the event and array conditions. In most cases, the additional nouns were names of peripheral objects related to the main entities, such as items of clothing. However, some were not even visible in the picture, such as items of equipment typically associated with the situation depicted.

A number of explanations for Ron's hypernaming might be considered. It is possible that he misunderstood the test instructions, and simply named everything that he could see or think of. However, once again the fact that Helen was able to perform as she did at least suggests that it is possible for people with aphasia to understand what is required. Ron may also have been influenced by previous experiences of naming tests or therapy, or he may have named irrelevant entities in the process of activating the targets. One way to tease apart these possibilities would be by re-administering the test in a way that limited naming to three entities, or alternatively to ask Ron to indicate the targets non-verbally, in order to limit his focus. Nevertheless his pattern of naming is unexpected, particularly as aphasia would be predicted to reduce rather than to inflate output. An alternative interpretation is that Ron's naming was related to his event impairment. If Ron, like the controls, were focusing on the key entities within events we would expect his naming to be more constrained, particularly in the event and sentence conditions. Instead he was repeatedly waylaid by peripheral and even inferred objects. This pattern is familiar from, for example, MM (Marshall et al, 1993) and EM (Dean and Black, 2005), and also echoes Ron's spontaneous conversation. The suggestion is that, when Ron could not direct his attention in a principled manner to the main entities involved in events, his production became dominated by strings of often rather superfluous object names.

Ron also differed from the controls in his order of naming, since there was no relationship between the order in which he named the entities in the events and either his own sentence order or the controls' modal order. However, the z score transformation showed that only Ron's score for the relationship between naming from events and the modal sentence order was significantly lower than that of the controls.

Why did the second comparison, involving Ron's naming and his own sentence order, fail to reach significance? In some respects this is a problematic comparison, since it depends upon Ron's own sentence production, which is known to be very disordered. The comparison between Ron's naming from events and the controls' modal sentence order does not rely on Ron's own sentence skills, and so arguably offers a fairer assessment of the degree to which his naming was driven by the structure of the event. Another reason may lie with the control group. As a group, the controls' naming from events was very significantly related both to their own sentence order and to the modal sentence order ($p < 0.001$). However, there was considerable variation within the group, leading to high standard deviations in each case. One participant scored so low on each of these comparisons, achieving z scores of 2.53 and 2.59 respectively, that she may be considered an outlier (Hair, Anderson, Tatham and Black, 1998). If this person is removed from the control group, Ron's z scores for naming from events against the two sentence orders both prove significant: 2.47 ($p < 0.02$) and 2.66 ($p < 0.01$) respectively. In other words, Ron's order of naming was significantly less strongly related to either sentence order than that of the remaining 19 controls.

The results so far are in line with the hypothesised event processing impairment. Ron seemed to be less focused on the main entities in events than the controls, and displayed a different order of focus, indicated by the lack of relationship between his naming order and sentence structure. This suggested that, unlike the controls, his naming was not driven by the underlying structure of the event. Other aspects of the results were less in line with the hypothesis. The start of this discussion acknowledged that Ron's performance on the test might be influenced by word finding difficulties. While his naming was clearly a relative strength, it remains possible that subtle retrieval impairments were still exerting an influence. This possibility was explored through the second analysis of Ron's naming order, which only included responses in which he had named all the targets. Now Ron appeared to be much more like the controls. In the two crucial comparisons between order of naming from events and sentence order Ron's score was now at or even slightly above the controls' mean.

A number of caveats may be raised about the second analysis, however. First, the comparison takes no account of potential outliers in the control group. Secondly, as already suggested, one of the main reasons for Ron's lower score on the original analysis was that he frequently named peripheral entities, or objects not visible in the picture, in place of the main targets. The analysis of errorless items excludes all items on which he failed to name the targets – including both those on which he made a naming error, and those on which he omitted targets while naming non-target entities. By excluding the latter, we may be removing the very items on which Ron demonstrated his essential difference from the controls. The analysis is also perhaps unfairly harsh to the controls, who also made errors or omissions on a number of items that are not discounted in the scoring. Finally the scoring system does not take account of the fact that Ron often named a number of non-target entities before or between the targets. His scores rarely reflect the first three entities focused on, but give credit for target names wherever they were produced. In fact, naming of non-target entities either preceded or interrupted target names on 14 event items, 16 arrays and 15 sentences. The controls, on the other hand, generally produced only three names, and are therefore only scored for the first three entities to attract their attention.

Given the above points, the errorless analysis alone offers only weak evidence of a similarity between Ron's naming and that of the controls. However, there was a final, more striking, point of correspondence. Like the controls, Ron showed a much stronger tendency to name agents first, in both the event and sentence conditions, than would have been predicted had he been naming randomly. Moreover, he did so not only on items involving one animate entity, but also on those involving two, showing that he was not simply naming people first. Ron's tendency to name agents first suggests that, like the controls, he was paying particular attention to the cause of the event. Again, this is in line with findings from unimpaired speakers. It points to an important preservation of one aspect of event knowledge, an aspect that is central to verb meaning (Kemmerer and Tranel, 2003). If this skill were fully intact and available for conscious manipulation we might expect Ron to focus on agents even more consistently in the sentence condition. However, although he named more agents first in his sentences than would be predicted by chance, he did so no more than in the event condition. It seemed that Ron had some 'covert' sensitivity to agency. However he could not capitalise on this knowledge when building sentences – perhaps because it was not reliably linked to event labels or to the predicate-argument structures that go with them. This is in line with other evidence that people with Broca's type aphasia may have underlying knowledge of argument structure that is not demonstrated in their sentence production (Shapiro and Levine, 1990).

In summary, it is difficult to formulate cast iron conclusions from Ron's data. A number of features were different from the controls and suggestive of an event level impairment. Ron's naming was not constrained to the three main entities and did not clearly mirror sentence order, suggesting that it was not driven by the structure of the event. On the other hand, when his error items were removed a closer correspondence with the control data emerged. The test also revealed an area of preserved event knowledge; that is, an appreciation of agency.

Another dilemma should be acknowledged. Even if a person's performance on the Order of Naming Test is unambiguously different from the controls, the source of the difference is still unclear. It may originate with an impairment of event processing. This may prevent the person from analysing the structure of the depicted event and so lead to linguistically unprincipled naming. An alternative view, already proposed in relation to the controls, suggests that the construal of the event may be, at least in part, determined by the words used to describe it. Failure to access those words (and particularly the verb) would then generate the difficulty in event analysis. Ron's difference from the controls could arise because of an underlying event level impairment, or because his linguistic deficits made it difficult for him to analyse events in a language-appropriate way. In the latter case verb access, rather than event knowledge, might be the main focus of intervention. On the other hand, there is little evidence to suggest that improving Ron's verb access in isolation would improve his ability to adopt a language-relevant focus over events. While his access to verbs was certainly significantly more impaired than his object naming, it is not true that Ron had *no* usable verbs. He produced 17 verbs on the Object and Action Naming Battery, and 12 on the sentence condition of the Order of Naming Test. Accessing verbs in itself did not seem to help Ron form useful argument structures. Rather, the evidence suggests that therapy would need not only to help him access more verbs, but to link them with a greater understanding of event and argument structure.

Secondly, while much of the literature cited has been used to argue that language has a powerful influence on the way in which we perceive and manipulate situations, it has not pointed to a complete alignment between perception and description. So, for example, in Zacks et al's (2001) study of event segmentation, participants segmented events according to fundamental principles of intention and goal-achievement, whether or not language was explicitly involved in the task. However, adding language in the form of simultaneous description led to an even closer alignment between segmented units. In other words, while language surely played a part in guiding the initial non-verbal segmentation, there was room for more flexibility than in the explicitly linguistic condition. Adding language increased the degree of constraint, bringing segmentation even more closely in line with linguistic structure.

Linguistic principles were similarly evident in people's naming in the Order of Naming Test, but it is not clear that particular verb structures completely constrained both naming and sentence description. Had they done so, we might have expected a one-to-one correspondence between naming and sentence orders. This was not evident, even though the two were significantly linked. Control participants sometimes named from events in a different order from their later sentence order. Helen's performance also suggests that it is possible to perform similarly to the controls without fully intact access to verbs and verb-argument structures. Ron's response additionally shows that at least one basic conceptual factor (the bias towards causal agents) can be separated from the influence of sentence structure. Whilst clearly guided by his conceptual focus to name agents first, Ron did not demonstrate the same influence from language structure as the controls.

3.7.4 Conclusions and implications for therapy

The Order of Naming Test contributes to the battery of methods available for investigating event perception. Like Sridhar's (1988) study, it attempted to use language as a window onto event perception. Here, however, naming rather than sentence production was exploited. The control participants' results suggest that, when non-brain damaged speakers name the entities involved in simple events, their focus is strongly related to the sentences they will later use to describe those events. Even when they were not aware that they would later have to produce a description, the controls appeared to be processing the structure of the events.

Naming has of course already been the focus of much successful work in aphasia. Equally, many people with aphasia display a pattern of skills similar to Helen's and Ron's, in that they have relatively well preserved access to nouns but limited verb and sentence structure. In Helen's case the test revealed a pattern of performance that was very similar to the controls and suggested that she retained important skills in event analysis. Ron's performance was more ambiguous but hinted that his problems might originate, at least in part, with difficulties at the event level.

One of the strengths of the test is also one of its limitations in terms of direct carry-over to real-life communication. The stimuli are highly constrained line drawings, encompassing a limited range of event structures. They involve a small number of participant entities with little or no background detail. The demands imposed upon the speaker by real-life communication are clearly much greater. For example, picking apart complex situations or talking about multiple events in the way required for narrative or conversation demands a much greater imposition of constraint (see Black and Chiat, 2003a). Normal communicative contexts also require us to guide the listener over a developing story by ordering a number of propositions (Levelt's 'Macroplanning' – Levelt, 1989). One obvious question raised by the Order of Naming Test is how task materials interact with features of event structure and language to constrain a person's attention over events. In other words, how far can materials (both linguistic and visual) be manipulated to do some of the work of thinking for speaking for us? Dean and Black (2005) investigated some of these issues in relation to picture description. The Sharon and Paul Test, described in the following chapter, represents an attempt to address others in relation to the specific question of the adoption of perspective over 'perspective-dilemma' situations.

The question of the relation between task materials and conceptual/linguistic structure also has clear implications for therapy. One way in which therapy can use such materials is to support people with aphasia in adopting a conscious thinking strategy. This might help them to maintain a useful focus over events, for instance by 'anchoring' their attention while the object of focus is fitted to available language (see Marshall et al, 1993; Marshall, 1994, 1999 for similar ideas). This should help in generating more complete or comprehensible event descriptions, at least for similarly constrained events. Alternatively, therapy may serve to bring covert knowledge of thematic role structure, like that hinted at by Ron's focus on agents, to a conscious level. A possibly fruitful therapy for Ron might aim to capitalise on his knowledge of agency and develop his order of focus on the other entities involved in the event as the backbone of a potential verb structure. This approach may be useful regardless of whether the event processing impairment is seen as the originator of the problem or its consequence.

One way in which a more sentence-like order might be elicited was proposed by Caplan and Hanna (1998). Rather than focusing on naming, their study highlighted the production of particular syntactic forms. They constrained the content of their participants' picture descriptions, and the order in which they were produced, by means of a system of arrows and dots. Arrows marked the target entities to be included in descriptions, while a dot marked the entity to be named first. For example, to elicit the sentence, '*The ball was thrown to the boy by the man*', arrows marked the man, the boy and the ball, with a dot over the ball. A similar system might be useful in helping people to order their naming, and their event focus, in a more thematically and grammatically principled way.

What all these approaches share is a commitment to use what we know about the relationship between naming and sentence production in unimpaired speakers to improve the event descriptions of people with aphasia. If a person's naming of the entities involved in events can shed useful light on their conceptual focus, we may be able to manipulate that focus through their naming order. Working on a person's order of naming should, in turn, improve the communicative value of their output.