An investigation of the relationship between conceptualisation and non-linguistic communication: evidence from drawing production in severe aphasia

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ABSTRACT

Many people with aphasia have difficulty understanding and producing the language of events, i.e. verbs and sentences. One proposal is that language production difficulties in some individuals may reflect impairment to the processes that construct event representations in a language-appropriate way. This has been termed "thinking for speaking" (Slobin 1996), or "conceptual preparation" (Levelt, Roelofs & Meyer 1999).

This study aims to extend understanding of the relationship between event conceptualisation, event communication and language impairment in severe aphasia. Evidence from a number of sources suggests that several aspects of conceptual preparation may be shared by linguistic and non-linguistic communication modalities. This thesis examines the ability of seven individuals with severely restricted linguistic output to communicate about events using the non-linguistic medium of drawing.

The experimental investigation involves a detailed statistical and qualitative analysis of event drawing in response to short video clips and linguistic descriptions. For each participant, event drawing performance was compared with control data and with the results of other event processing and language assessments. Five participants showed problems with conceptual preparation, reflecting difficulties in the schematisation of events for the purpose of communication in general. This suggests that event conceptualisation difficulties should be considered as a possible underlying source of deficit for these individuals. Two participants showed intact event conceptualisation, suggesting a linguistic source of their difficulties.

The findings also revealed a correlation between event conceptualisation problems and the nature and extent of individuals' language impairments, suggesting that there may a reciprocal relationship between the two. The theoretical and clinical implications of these findings are discussed.

This study extends understanding of the consequences of impaired event processing on event communication and suggests a novel and theoretically motivated means of examining the underlying event conceptualisation and communication abilities of people with severe aphasia.

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* **Dyscover** is a registered charity based in Epsom, Surrey, which provides long-term support for people with aphasia.

Chapter 1

INTRODUCTION TO THESIS

1.1 Background

Aphasia is an acquired disorder of language resulting from brain damage, most commonly following a stroke. Approximately 20% – 38% of people who have strokes experience aphasia immediately post-stroke, with 19% of all those who have strokes continuing to have aphasia at 6 months. The incidence of stroke in the UK population has been estimated at 2 per 1000 population per year. The prevalence of aphasia is approximately 150 per 100,000 of the population i.e. 0.15%[1]. These figures do not include aphasia resulting from conditions other than stroke.

The term aphasia is an umbrella term, which covers a variety of language difficulties and a range of severity. Most people with aphasia will have some impairment in all language modalities, but the form these impairments take and the degree to which each modality is affected will vary. The term "severe aphasia" is used here to characterise individuals whose spontaneous verbal or written language production is either completely absent, or is restricted to a few words or over-used phrases. The current usage of the term therefore encompasses a range of language comprehension abilities. It is not to be confused with the diagnostic label of "global aphasia", which implies severe problems with language comprehension, even at the single word level.

One of the major challenges facing clinicians and researchers in the field of severe aphasia is how to assess underlying conceptual and residual linguistic capabilities in circumstances where linguistic output is almost non-existent (Marshall, Pring & Chiat 1993; Varley 2000; McCall, Shelton, Weinrich & Cox 2000). A number of problems continue to hamper progress in this area. Firstly, people with severe aphasia may have problems that stem not only from language difficulties, but also from attendant cognitive, perceptual or other involvement arising from brain damage. These difficulties might interact with

1 Figures taken from The Royal College of Speech and Language Therapists, Clinical Guidelines for Aphasia, 2005.

the language impairment itself to affect performance on assessment and therapy tasks. This may be particularly evident in the domain of event conceptualisation and communication, where there is not a straightforward one-to-one relation between concepts and the linguistic forms that express them. Events involve relations between a number of perceptually distinct entities and may therefore require more complex processing (Black & Chiat 2000). This will be discussed more fully in Chapter 2.

Clinical research has highlighted a relationship between the ability to conceptualise events and language impairment in aphasia. Problems with processing and conceptualising certain communicatively-relevant aspects of events might result in difficulties producing and understanding language that describes events, but equally, the language impairment itself might compound problems in the conceptualisation of events for the purpose of communication (Marshall et al 1993; Byng, Nickels & Black 1994; Dipper 1999; Black & Chiat 2000, 2003a; Dipper, Black & Bryan 2005). A better understanding of the relationship between event conceptualisation and language impairment in aphasia is the primary goal of the current research.

In particular, the research aims to inform our understanding of the processes that 'translate' between conceptual representations of events and their communication. Evidence from a number of sources indicates that event conceptualisation for the purpose of communication, regardless of output modality, involves the 'paring down' of complex information into a highly schematic form (Jackendoff 1983; Talmy 1996, 2000; Zacks & Tversky 2001; Gershkoff-Stowe & Goldin-Meadow 2002; Dipper et al 2005). The term "thinking for speaking" (Slobin 1996, 2003) has been adopted to describe this process in relation to language production. This approach highlights the role of language in the conceptualisation of experience, not in an absolute sense ('linguistic relativity'), but when that experience is organised for communication. The forms and structures available in one's language guide or constrain the aspects of an event or situation we attend to during the 'message level' or 'conceptual preparation' stage of language production (Garrett 1980, 1992; Levelt, Roelofs & Meyer 1999, Roelofs 2000). This thesis aims to extend the ideas behind "thinking for speaking" to non-linguistic forms of communication, specifically drawing. A more general term, "thinking for communication", is therefore adopted, which is discussed more fully in Chapter 2, Section 2.1.

The research was designed to test the hypothesis that, in the context of severely restricted or absent linguistic output, drawing offers a potential source of insight into the event conceptualisation abilities of people with severe aphasia. The investigation focuses on caused change of location events, which are discussed in detail in Chapter 2. A number of distinct aspects of these events are identified that are crucial for their conceptualisation and communication. Some of these aspects can be regarded as "modality-general", i.e. they are communicatively-relevant regardless of the eventual modality of output, while others are more specific to linguistic communication (see Chapter 2, Sections 2.1.1 and 2.5). Clinical evidence suggests that these aspects of event processing can be separably or multiply impaired in aphasia, with consequent effects on message preparation and language production (Marshall et al 1993, Byng et al 1994, Dipper 1999). This evidence is reviewed in Chapter 3. The current study aims to identify whether similar problems with message preparation and production occur even when no linguistic communication is involved. If similar patterns of difficulty occur in drawing and in language, this would argue for a deficit with aspects of conceptual preparation affecting the schematisation of events for the purpose of communication in general. If, on the other hand, problems are limited to aspects of events particular to linguistic communication, this would argue for a problem specific to language.

Black and Chiat (2000) point out that, in order to explore the mapping between conceptualisation and language fully, we need to also to consider "thinking for listening", i.e. how we form conceptual representations of events from linguistic input. This requires the integration of a number of sources of information: syntactic, semantic and conceptual. This is discussed more fully in Chapter 2, Section 2.2. People with aphasia may have a problem with one or more of these sources of information, and/or with the integration process (Byng et al 1994; Berndt et al 1997b; Marshall, Black & Byng 1999; Dipper et al 2005). The potential of drawing as a means of gaining insights into the language comprehension abilities of people with severe aphasia is also examined in this thesis.

1.2 Non-linguistic assessment and the diagnostic potential of drawing

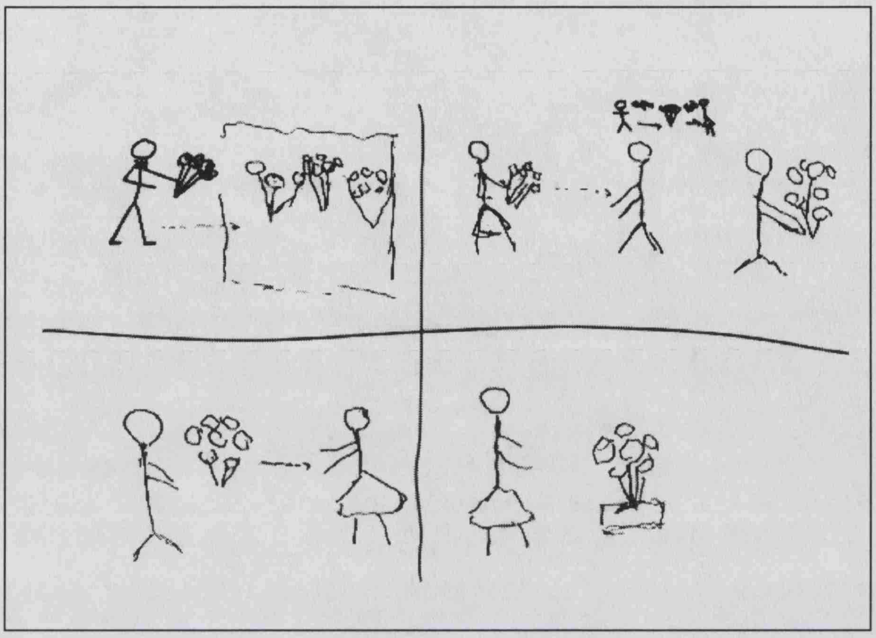
A barrier to assessing the processes involved in "thinking for communication" in severe aphasia is the paucity of meaningful linguistic output (McCall et al 2000). For individuals with some spared linguistic output, analysis of their descriptions of events can provide some insights into this process (Marshall et al 1999; Black & Chiat 2003a). When only limited, unreliable or, in some cases, no linguistic output is available, researchers and clinicians have relied on assessments that focus on input, such as sentence-to-picture matching tasks, or, less frequently, on non-linguistic picture-matching or selection tasks that target specific aspects of event processing (Marshall et al 1993; Dipper 1999). These tasks can provide valuable information about the language and event processing abilities of people with severe aphasia and some of them have been used in this study to provide comparative evidence for the main experimental task. Details of these tasks are provided in Chapter 4, Section 4.3.

Other researchers have bypassed the problem of reduced linguistic output through the use of non-verbal communication modalities. Investigations into the use of graphic symbol systems or computerised graphics, for example, have demonstrated some intact linguistic processing abilities in people with non-fluent and global aphasia and provided some insights into the underlying causes of their language impairments (Funnell & Allport 1989; Goodenough-Trepagnier 1995; Crerar, Ellis & Dean 1996; Shelton, Weinrich, McCall & Cox 1996; McCall et al 2000). In their review of alternative and augmentative communication (AAC) in aphasia, Fox and Fried-Oken (1996) suggest that studies that explore the relationship between AAC and underlying language processes offer a potentially significant contribution to our understanding of aphasia, as well as clinically relevant information about appropriate remediation methods and approaches. The current study aims to contribute to the above body of evidence, by using the non-linguistic output medium of drawing to investigate event conceptualisation and linguistic processing in severe aphasia.

The communicative benefits of drawing as a compensatory means of expression for people with severe aphasia have been well-documented (Lyon 1995; Pound, Parr, Lindsay & Woolf 2000; Sacchett 2002; Sacchett & Lindsay, in press). The diagnostic potential of drawing, particularly at the level of the event, has been less thoroughly investigated. Lyon (1995, p 34) suggests that "*drawing may represent the most direct route to inner thought and its expression*" in severe aphasia. He proposes that the conceptual underpinnings for language and non-linguistic communication are shared, regardless of expressive form. This proposal is based on evidence that intact lexical-semantic processing was a good predictor of drawing performance in aphasia (Gainotti, Silveri, Villa & Caltagirone 1983; Swindell, Holland, Fromm & Greenhouse 1988; Kirk & Kertesz 1989). However, these studies all focused on the quality of drawings of *single objects*. Thus Lyon's proposal remains to be tested at the level of event conceptualisation and communication.

Some evidence about the event-drawing abilities of people with severe aphasia is available from drawing therapy studies. There have been several reports of improvements in individuals' ability to communicate events using drawing, in the context of continuing severe language impairments. These include the ability to depict problem scenarios, tell stories, convey recent or witnessed events, depict changes over time and convey complex transactions (Hatfield & Zangwill 1974; Lyon & Helm-Estabrooks 1987; Morgan and Helm-Estabrooks 1987; Yedor & Kearns 1987; Ward-Lonergan & Nicholas 1998; Lyon & Sims 1989; Sacchett, Byng, Marshall & Pound 1999). For example, one of the participants in Sacchett et al's (1999) study, GJ, was able to produce sophisticated and structured drawings depicting complex transactional events following a twelve- week period of drawing therapy (see Figure 1.1 overleaf). These kinds of events would have been incommunicable by GJ through any linguistic code, even at the end of the therapy programme.

Figure 1.1
A drawn sequence produced by GJ, a man with severe aphasia, recounting an event in which a man buys some flowers and gives them to his wife[2]



Most of these drawing therapy studies focused on measuring general or functional improvements in communicative drawing and there was no attempt to relate the findings to event conceptualisation or linguistic processing. Neither were there any controls with regard to event type or complexity. Nevertheless the finding that, for several individuals, the ability to communicate events using drawing is far in advance of their ability to communicate similar events linguistically suggests that drawing might be a useful means of providing further insight into their event conceptualisation, and possibly also their language processing, abilities. The current study aims to test this hypothesis by investigating event-drawing abilities in a group of people with severe aphasia under more controlled conditions, and comparing them with evidence from other assessments of language and event-processing.

The stance taken in this thesis is that drawing can supplement and complement other assessment procedures. Firstly, as an output modality, drawing may be more informative about how an individual's conceptualisation of events interacts

[2] Figure 1.1 from Sacchett, Byng, Marshall & Pound (1999). Drawing together: evaluation of a therapy programme for severe aphasia. *International Journal of Language and Communication Disorders, 34,* 265-289. The initial drawing of the man holding a bunch of flowers in the first panel was produced by the clinician, and GJ was asked to complete the story.

with her/his ability to prepare and construct messages about them, which relates directly to “thinking for communication”. In input-focused tasks, responses are usually limited to selecting from among two or three alternatives, none of which may actually match a particular individual's conceptualisation of or perspective on the events portrayed. Secondly, in comparison with other graphic communication systems, drawing is relatively unconstrained and therefore permits individuals more freedom in how they choose to depict relations in events and which aspects of an event they choose to foreground. This is important in the current study, where the participants' conceptualisation of the event is itself the focus of investigation. However, drawing is not a totally constraint-free modality. Research has identified a number of visuo-graphic constraints that might affect how an event is communicated in drawing (Van Sommers 1984, 1989; Tversky 1995; Chaterjee, Southwood & Basilico 1999). These constraints are discussed more fully in Chapter 2 (Section 2.4) since they inform both the design and the interpretation of this study.

1.3. Description of the current study

The current study describes the detailed investigation of seven individuals with severe aphasia, selected on the basis of the paucity of their linguistic output. Three participants were unable to produce any spoken or written output, while the remaining four had severely restricted spontaneous output, lacking in verbs and sentence structure. All participants also had some difficulty with sentence comprehension, although the extent and nature of these difficulties varied. Details of the participants are provided in Chapter 4, Section 4.2.

The investigation focuses on these individuals' ability to process specific aspects of visual and linguistically-described events for the purpose of communication. A number of targeted tasks are used, with a view to
(a) identifying potential sources of underlying deficit for each individual,
and (b) analysing the effects of particular deficits on the ability to understand and communicate about certain kinds of events. Some of the tasks were used by previous investigators, while others were developed specifically for the current study. Full details of the assessments used are provided in Chapter 4, Sections 4.3 and 4.4.

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The main experimental investigation compares individuals' ability to process and communicate caused change of location events via drawing, under different stimulus conditions: drawing from visual input (short video-clip), and drawing from linguistic description. The visual condition provides information about their ability to process communicatively-relevant aspects of visual events and 'translate' them into a form suitable for communication. Because no linguistic encoding is involved in this condition, performance can more certainly be attributed to conceptual processing and preparation for communication. Performance in the verbal condition provides information about the individuals' ability to form conceptualisations of events from linguistic descriptions, which may give additional insight into the source of their language comprehension difficulties. The design of the task takes account of a number of perceptual, conceptual and linguistic variables that have been shown to influence event conceptualisation and sentence comprehension in both aphasia and normal language processing. A detailed qualitative analysis of the process and product of each individual's event drawing performance was carried out and compared to the performance of a group of matched non-aphasic controls. Full details of the experimental event drawing task and the analyses are provided in Chapter 4, section 4.4.

Results from the control study are of theoretical interest in their own right, since they shed further light on the interaction between input and output modality factors that influence event conceptualisation for the purpose of (graphic) communication. In particular, the findings highlight the importance of congruence between perceptual, conceptual and output related factors in the ease of conceptualisation and communication of events. The control study results are reported in Chapter 5. The results for the individual participants with aphasia are reported in Chapter 6, in the context of their performance on the other event processing and language processing assessments.

Chapter 7 draws together the main findings of the investigation. Comparisons between participants and across the two conditions provide information about how specific communicatively-relevant aspects of event processing can break down in aphasia. The results confirm the findings of previous investigations, which suggest that the conceptualisation of visual events for the purpose of communication involves a number of separable processes that can be differentially or multiply affected in aphasia (Marshall et al 1993; Dipper 1999). They also extend these findings to provide information about the effects of specific event-processing impairments on the ability to communicate about events.

The results of the current study also provide information relevant to the conceptualisation of linguistically-described events, which contributes to our understanding of the relationship between event conceptualisation and language impairment in aphasia. More specific hypotheses about this relationship will be provided at the end of the following chapter (Section 2.5), which reviews literature from a number of sources relating to event conceptualisation and communication.

Chapter 2

EVENT CONCEPTUALISATION AND COMMUNICATION

The aim of this chapter is to specify in more detail the relationship between the conceptualisation of events and their communication, bringing together evidence from a range of different sources. The first part of the chapter will elaborate on the concept of "thinking for communication" introduced in Chapter 1, which refers to the processes involved in turning abstract conceptual representations into a form suitable for expression. This will be followed by a discussion of how conceptualisations of events are formed from linguistic descriptions, i.e."thinking for listening" (Black & Chiat 2000, Dipper et al 2005). The third part of the chapter will define and describe event structure, drawing on recent semantic theories and analyses of verb meaning, and linking these with evidence from event structure perception. The focus in this section will be on events involving a caused change of location, with the aim of identifying a number of specific aspects of this type of event that are crucial for their conceptualisation and communication in both linguistic and non-linguistic modalities. The fourth part of the chapter explores the link between event perception and event communication in more detail, with a particular focus on how perceptual and conceptual constraints on attention affect perspective-taking and foregrounding in communication. Throughout the chapter, the relevance of the evidence to event conceptualisation and communication in aphasia will be highlighted.

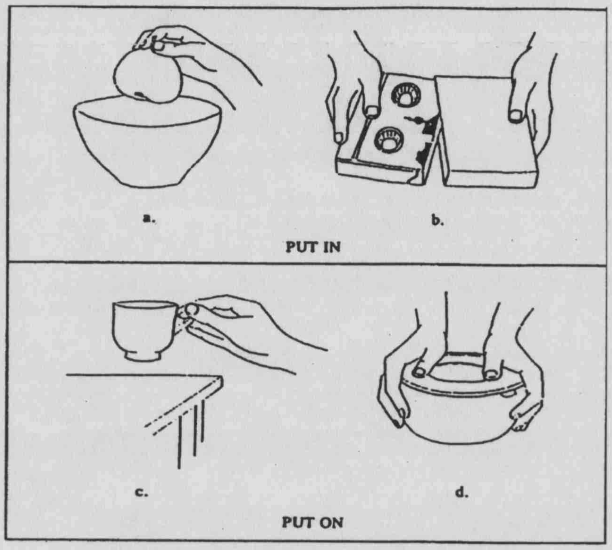
2.1 "Thinking for communication"

Conceptualisation has been described as the process through which humans organise and structure potentially infinite information and experience so that it can be "housed in a finite brain" (Jackendoff 1993). This process of abstraction and structuring is referred to as schematization. Schematization is a naturally occurring feature of human cognitive activity across all domains (Jackendoff 1983; Talmy 1996, 2000; Zacks & Tversky 2001). It involves, firstly, the decomposition and segmentation of low-level perceptual information into parts, and secondly, reintegration and unification of these parts to provide conceptual coherence. Talmy refers to this as a "boiling down" process, which reveals the "network of connections" that binds individual components of a scene together (Talmy 2000, p 246). The schematization process must involve selective attention. If our intention is to communicate about what we see, then we have to pay attention to certain communicatively-relevant aspects of a situation. Thus intent to communicate can itself constrain or structure the process of schematization, since our conceptualisation must be pared down even further to yield a form compatible with the communication system that we intend to use.

Evidence from normal language production indicates that this paring-down process is multiply driven by the speaker's attentional focus and perspective and by constraints from the language itself. When conceptualising a scene for *linguistic* communication, the forms available in one's language guide or constrain how attention is directed over that situation. This has come to be known as "thinking for speaking", a term first coined by Slobin (1996). Motivated by cross-linguistic observations of children's descriptions of motion events, Slobin suggests that, during the process of language production, speakers must direct attention to those aspects of experience that their language typically encodes. For English speakers, manner of motion is a habitual target of attention, since English motion verbs typically conflate manner and motion, e.g. "*She limped into the room".* Spanish speakers, on the other hand, are not constrained by their language to attend systematically to Manner, since Spanish motion verbs typically express Path, using optional adverbial phrases to indicate Manner, resulting in sentences equivalent to *"she entered the room, limping"* (see also Talmy 1985; Naigles & Terrazas 1998; Gennari, Sloman, Malt & Tecumseh Fitch 2002).

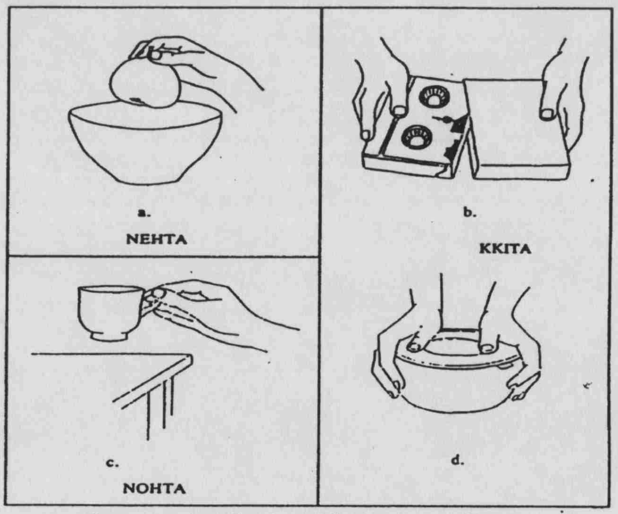
Another example of this comes from Choi's (1997) study (cited in Black & Chiat 2000) of differences in the way English-speaking and Korean-speaking children categorise the same situations. In English, events involving the movement of one object relative to another are often expressed by the verbs *put* or *take,* together with a prepositional phrase indicating direction of movement. For example, the events pictured in Figure 2.1 (overleaf) would be all be described by the verb *put*, but would be distinguished by the prepositions *in* and *on* as indicated[3]. In Korean, however, the distinction between these events relates to the tightness of fit between the two objects involved. This results in a different categorisation of the events from that in English, as shown in Figure 2.2 below.[4] Events b) and d) would both be described with the verb *kkita,* roughly meaning *"tightly in/on",* while events a) and c) would be described by the verbs *nehta* and *nohta* respectively, roughly meaning *"loosely in/on".*

Figure 2.1. ENGLISH



Semantic classification of four actions in English

Figure 2.2 KOREAN



Semantic classification of four actions in Korean

[3] [4] Figures 2.1 and 2.2 from Gumperz, J.J. & Levinson, S.C. (Eds) (1996) Rethinking linguistic relativity. Cambridge University Press.

The differences in the way these events are expressed in the two languages require that speakers of those languages attend to particular features of the events when they are viewing them for language-related purposes such as description or categorisation. Korean speakers have to attend to the specific physical features of the objects involved to decide which verb to use to describe them, whilst English speakers must attend to whether the spatial/directional relationship between the objects is one of containment (*in*) or contact (*on*). This does not, however, imply that speakers of different languages are not aware of the differences that are picked up in other languages. For example, English speakers do process physical features of objects so as to distinguish one object from another. However, not all of these features figure in their conceptualisation of the scene when they are selecting a verb to describe it, or classifying it as a particular kind of event.

The "thinking for speaking" view therefore highlights the role language plays in directing attention to specific aspects of experience *when our intention is to communicate about that experience.* Slobin (2003) points out that, in order to talk, write or sign about an event, one must pay attention to linguistically-relevant components of that event. If our thoughts and experiences are intended for *linguistic* expression, they must be "*... filtered through language into verbalised events*" and organised in a language-appropriate way. Therefore language imposes further schematisation on conceptual representations, requiring them to be "pared down" into a skeletal linguistically-relevant representation, expressible in linguistic forms (i.e. words and combinations of words). This process itself depends to some extent on how meanings are "packaged" into linguistic labels in one's language, in particular verb labels, and also on how these meanings interact with linguistic structure (Langacker 1987; Pinker 1989; Jackendoff 1983, 1992, 2002; Pustejovsky 1995; Talmy 2000). Access to the range of verb labels available to express relations in the event guides conceptualisation to focus on one relationship and its relevant participants, backgrounding other participants in the situation, and effectively "stripping away" other aspects of the scene or situation that are not encoded in the selected verb label (Dipper et al 2005).

Reduced access to verbs and verb meanings is a common feature of aphasia (Berndt et al 1997a, 1997b; Marshall et al 1999; Druks 2002; Marshall 2002; Black & Chiat 2003b) and this may therefore have an effect on the schematisation or 'paring down' process itself, resulting in difficulties organising and structuring conceptualisation during attempts at linguistic communication of events (Black & Chiat 2000; Dipper et al 2005). What is not clear is whether similar effects would occur in the non-linguistic communication of events, particularly graphic communication, where there is no equivalent to a verb label. This will be discussed more fully in Section 2.1.1 below.

In models of language production the process of schematisation occurs at a stage prior to linguistic encoding. In Garrett's model (1980, 1992) this stage is known as the "message level", whilst in Levelt's model, it is referred to as the "conceptual preparation" level (Levelt 1989; Levelt, Roelofs & Meyer 1999). During conceptual preparation, a speaker decides on the information that is going to be expressed and uses this to generate a "message", i.e. a conceptual representation that is ultimately going to be formulated in language. In Levelt et al's model, WEAVER ++, the output or "terminal vocabulary" of this message consists of lexical concepts, which are concepts for which there exists a word in the target language. These lexical concepts are then used to retrieve a word's lemma, which is a representation of the syntactic properties of the word, crucial for its use in sentences. There is no one-to-one relationship between concepts and meanings, however. The same concept can be referred to in different ways, depending on one's perspective and other pragmatic, context-dependent considerations such as discourse-related factors (Levelt 1989, 1996). Lexical concepts constitute only a subset of all concepts represented, since there are more concepts than words available to express them in a language. Because many lexical concepts are language-specific, the effects of language on "thinking for speaking" are explicitly acknowledged by Levelt and colleagues (Levelt et al 1999, Roelofs 2000). Roelofs states:

> *"to the extent that languages differ in their lexical concepts, language should influence thinking and conceptual preparation for expression should depend on the language of expression"* (p 26).

Roelofs (2000) also discusses the WEAVER ++ model in relation to data from aphasia. He suggests that, in a one-lexical-level model which does not separate meaning and concepts, there is one "obvious locus for impairment" in aphasia, namely the concept-to-lemma connections (p 26). In other words, there is an assumption that the conceptual preparation level itself is intact, but that the problem occurs in going from this conceptual level to the lexical level.

However, as Levelt and his co-workers acknowledge, what remains underspecified in their model is the process by which a speaker gets from the notion or information to be expressed to a message that consists of lexical concepts. This leaves room for an alternative hypothesis in relation to the source of language production deficits in aphasia, namely a problem at the conceptual preparation stage itself, i.e. a problem in "translating" concepts into lexical concepts. Difficulties at this level would result in an inability to pare down the full set of conceptual responses to a complex situation into a language-specific schematic form (Dean & Black, in press). Under this hypothesis, problems with producing linguistic descriptions of events, which is a common feature of aphasia, could reflect impairment to the processes that construct event representations in a language-appropriate way.

Bearing in mind the earlier cross-linguistic evidence that the forms available in one's language influence the process of conceptual preparation, the possibility also exists that reduced access to the meanings and forms of language might affect an individual's ability to generate a message at the conceptual preparation level. Some researchers have suggested that the language impairment itself could affect the process of "thinking for speaking", by reducing the influence of linguistically-mediated constraint procedures (Black & Chiat 2000; Dipper et al 2005). This would result in the construction of messages not optimally organised as input to the linguistic system, leading what Black and Chiat call a "spiral of impairment" in production. This view would imply a bi-directional interaction between the message or conceptual preparation level and language, involving both feedback and feed-forward mechanisms.

2.1.1 Non-linguistic communication

The “thinking for communication” stance adopted in this thesis extends the ideas of “thinking for speaking” to non-linguistic forms of expression. Schematisation is a feature of all forms of communication and it is therefore likely that certain aspects of an event are communicatively-relevant, regardless of the eventual output modality (van Sommers 1984; Tversky 1995; Talmy 2000; Gershkoff-Stowe & Goldin-Meadow 2002). If one wants to communicate what is happening in an event, one needs to be able to identify, minimally, who or what is involved, how these entities are related, and the process of change that has occurred. For certain kinds of events, one would also need to understand how that process of change came about and possibly also the result of the change. These aspects of the event are critical to its communication, whether that be through language, graphic symbols or drawing, and can therefore be thought of as “modality-general”. In other words, some aspects of conceptual preparation are assumed to underlie both linguistic and non-linguistic forms of communication (Lyon 1995; Weinrich et al 1997, 2002; Loncke, Lloyd, van Balkom & Arvidson 1999)

However, just as language-specific differences influence conceptual preparation for expression, there might also be modality-specific differences that affect this process. These differences might influence how attention is directed to aspects of a scene or situation. Of particular relevance to event conceptualisation are differences in the forms and structures available to express relational meaning in non-linguistic and linguistic communication modalities. In linguistic communication, several of the above aspects of events are “packaged” together into a single verb. The meaning of the verb also encodes information about specific features of the event, such as the manner of the action. Thus the requirement to select a verb label in linguistic communication may direct a speaker’s attention to these features of the situation. These aspects of the event may therefore be specific to linguistic communication and may not be so relevant to graphic communication of events, where there is no graphic equivalent of a verb label.

In the case of drawing and other forms of graphic communication, actions cannot be represented separately from the participants involved in those actions. Furthermore, evidence suggests that the depiction of specific features of the action is particularly difficult in the graphic output modality (van Sommers 1984; Tversky 1995; Sutton, Soto & Blockberger 2002). Certain graphic strategies are available to indicate certain features of the event, such as the direction of the action or movement (Tversky 1997; Gershkoff-Stowe & Goldin-Meadow 2002). However, these may not be sufficient to differentiate between similar events that differed only in terms of the manner of the action (e.g. *grab* and *take*). These modality-specific graphic constraints and their potential influence on the graphic communication of events will be discussed more fully in Section 2.4.3 of this chapter. In terms of aphasia, these modality-specific factors might interact with the language impairment to influence how people approach the task of communicating events via drawing. Of particular interest is the interaction between reduced access to verb information in aphasia and the absence of a graphic equivalent of a verb label. The combination of these two factors might result in an increased focus on aspects of the event not directly related to the action or temporal structure. However there may be variation amongst participants, depending on the underlying nature of their verb impairment. This will be explored more fully in Chapter 3.

2.2 "Thinking for listening"

The discussion so far has focused on the production side of communication, i.e. how we talk or communicate about what we see. However, understanding the relationship between conceptualisation and communication also requires an appreciation of what is involved in "thinking for listening", i.e. how we form conceptualisations of events that we hear described in language (Black & Chiat 2000; Dipper et al 2005). Dipper et al (2005) suggest that production and comprehension involve distinct forms of interaction between thought and language. As discussed above, production imposes further schematization onto conceptualisation, paring down the full meaning of a situation into a highly schematized skeletal structure. In comprehension, on the other hand, the starting point for conceptualisation is the linguistic form of the sentence, which provides a source of information that is already pared down and highly schematic. For full comprehension, there needs to be 'enrichment' of the skeletal linguistic meaning with other aspects of meaning, such as conceptual information, pragmatic and encyclopaedic knowledge, situational information and other contextual and discourse-related factors (Black & Chiat 2003b, Dipper et al 2005). Thus "thinking for listening" requires the integration of different sources of information: semantic, syntactic and conceptual/pragmatic. However, the relative contribution of these sources of information will vary from sentence to sentence and this may affect the ease with which the meaning of the sentence is interpreted.

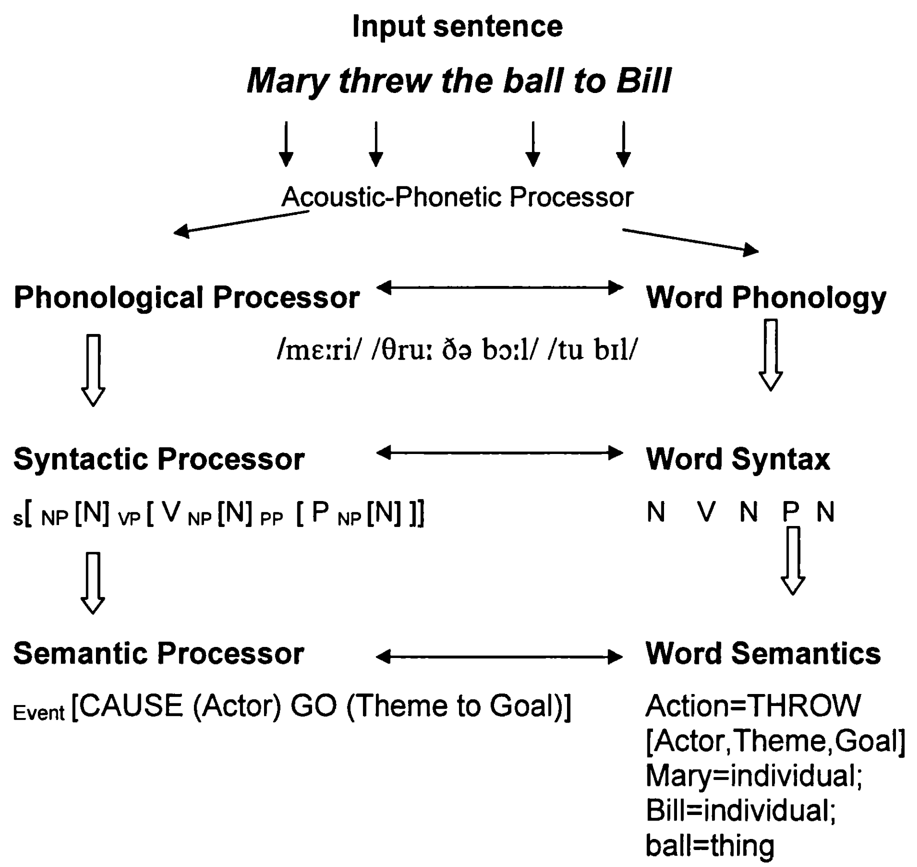
Compare for example the two sentences:

a) *Mary threw the ball to the dog.*
b) *Mary threw the ball to Bill.*

These sentences are the same in terms of semantic and syntactic structure, yet the first sentence is more easily interpretable on the basis of semantic and pragmatic information. The second sentence is more dependent on linguistic sources of information, in particular the integration between the structure of the sentence and its meaning. This becomes clear if we consider the processing involved in the comprehension of these sentences.

Most of the literature on sentence processing assumes a frame/item or 'slot/filler' approach, in which the interpretation of sentences is the joint product of 1) general procedures that build frames or 'slots' and 2) the lexical information that fills these slots and guides the building of frames (Levelt 1989; Levelt et al 1999; Harley 2001). Structure-building procedures and processing of lexical content proceed in parallel and must be integrated to enable interpretation of the linguistic meaning of the sentence. The lexical forms of the nouns and verbs in the sentence trigger access to syntactic and semantic information, which confirm initial procedure-based decisions about syntactic and semantic structure (see Figure 2.3 below). At the syntactic level, the verb's representation includes subcategorisation frame information, which determines the structural arrangement of the arguments around the verb. The subcategorisation frame therefore links syntactic position with thematic roles assigned to these arguments in the semantic specification. The semantic representation of the verb provides information about the nature of the event, the number of participants involved and their roles in the event. Thus the semantic representation for *throw* includes 'core' information that enables us to distinguish a *throw* event from other similar events involving the same participants, such as *pass* or *give*. It also includes verb-specific thematic information, i.e. that it describes a volitional act on the part of one participant (Actor) resulting in the transfer of a second entity (Theme) to an end-point or recipient (Goal). With a verb like *throw*, linguistic realisation of the Goal argument is optional, but the Goal is implicit in the semantic structure of the verb. The selectional restrictions of the verb may also provide some specification of the most likely participants in these roles, for example a human Actor, a small and portable Theme.[5]

Figure 2.3.
Diagrammatic representation of processing requirements for sentence comprehension (adapted from Black 2004, course lecture)



[5] This is not always the case, for example *"The horse threw the woman"*, *"The team threw the match"* *"That idea completely threw me"*. However, these refer to specific usages of the verb *throw*, rather than its more typical meaning.

In sentence (a) above, *Mary* is the only human participant and is therefore the most likely candidate for the role of Actor. Pragmatic knowledge about the likely relations between humans, balls and dogs would also constrain the interpretation of role information in this sentence. In sentence (b) however, the meanings of the noun phrases do not provide any clues as to which of the two human participants, *Mary* or *Bill*, has the role of Actor and which the role of Goal. Interpretation of this sentence relies much more on the integration of the lexical content with the structure of the sentence. The thematic structure of the verb combines with general mapping information to confirm that the role of Actor is assigned to the first noun phrase in this sentence. Thus the main clue to thematic information in this sentence is the order of the noun phrases around the verb. Crucial to the integration process for this sentence, therefore, is keeping the content of the noun phrases in registration with the syntactic structure, i.e. that the noun *Mary* fills the sentence-initial NP slot. This in turn depends on maintaining a record of the phonological form and sequence of the relevant noun phrases in the sentence (Jackendoff 1992, 2002; Harley 2001).

It is not just the presence of two human participants that causes difficulties in the interpretation of this sentence, but rather the fact that the meanings of the noun phrases expressing these participants offer no semantic or pragmatic clues to role interpretation. For example, the sentence '*The lifeguard threw a rope to the swimmer*' also involves two human participants, but in this case pragmatic knowledge would constrain our interpretation: a scenario in which a swimmer throws a rope to a lifeguard is possible, but pragmatically far less plausible.

These examples demonstrate that the particular conceptual representation created by hearing a sentence is the product of a complex interaction between the meaning of the verb, the meanings of its complements and information from other conceptual and pragmatic sources. The relative contribution of these different sources of information varies from sentence to sentence, however, and this is relevant in the context of sentence comprehension in aphasia. People with aphasia are hypothesized to have problems only with linguistic sources of meaning, while conceptual and pragmatic skills are said to be intact (Dipper et al 2005). Thus pragmatic and conceptual information might in some cases compensate for problems in integrating structural and semantic information or problems in linking of phrasal order with thematic roles.

The above examples also highlighted the crucial role of the verb in the integration process. The semantic structure of the verb provides access to an idealized conceptual schema of the event, specifying the nature of the event, the participants involved and their roles in the event (Pinker 1989; Jackendoff 1990; Pustejovsky 1995; Talmy 2000; Ferretti et al 2001; McKoon & McFarland 2002; Black & Chiat 2003a). In the following section, the notion of event schemas will be further elaborated, drawing on literature from event structure perception and linguistics.

2.3 Event structure and event conceptualisation

2.3.1 Subcomponents and schemas

Events are language-independent concepts that are represented within the conceptual system or, as Zacks & Tversky (2001, p 3) put it in their detailed discussion of event structure perception: *"events are in the mind of the beholder".* Conceptualisation involves the structuring of complex environmental input in order to provide *conceptual coherence.* Conceptualisation of an event therefore requires an understanding of how the different subcomponent parts of the event combine to form a coherent conceptual unit that corresponds to a stored *schema*, sometimes referred to as an event template or event frame (Croft 1998; Langacker 1998; Talmy 2000). An event is therefore a schematized construal of activities or occurrences in the real world.

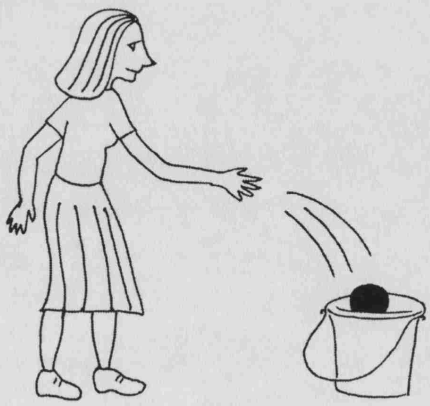
The subcomponent parts of an event are a) the entities that participate in the event and b) the subcomponent actions or changes that link these entities. Thus one of the key features of events that distinguish them from other conceptual units such as entities[6] and states is the presence of change. In states, the relationship between entities is a static one, in both space and time.

[6] In some cognitive linguistics theories, the term "entity" refers to an item that is perceived or conceived of as a coherent unit, and events are therefore included under this heading (Jackendoff 1983, Talmy 2000). For the purposes of this thesis, however, the term "entity" will be used to describe concrete individuated units i.e. usually referring to objects or human individuals, while the term "event" will be used to describe certain kinds of relations between these entities.

No action or change is involved: nothing is done and nothing happens. A state therefore provides a *"snapshot of the world at a given moment"* (Black & Chiat 2003a, p 128). It is temporally uniform and stretches over time without change. In events, on the other hand, the individual entities are related by some change that occurs. This change involves not only movement through space, but also involves a number of sub-processes that unfold over time. Shaw and Pittenger (1978), cited in Tomlin (1997), define an event as *"a change of some specified type wrought over an object or object-complex within a determinate region of space-time".* Crucial to the conceptualisation of events, therefore, is an appreciation of their temporal structure (Langacker 1998; Tomlin 1997; Zacks & Tversky 2001; Black & Chiat 2003a). This requires identification of not only the individual entities that participate in the event, but also how these participant entities are related through some action or process of change. Event conceptualisation therefore requires integration of a number of spatially and, crucially, *temporally* discrete units into a relational whole or *schema.*

An event schema is an idealized abstract representation of what a particular event entails and is formed by repeated exposure to a particular event category or situation (Rumelhart & Ortony 1977; Langacker 1987; Zacks & Tversky 2001). Schemas include information about objects, situations and sequences of situations (Ferretti et al 2000). Recognising whether a perceived scene matches a stored event schema requires the ability to bring selective attention to bear on a scene or situation in order to abstract out irrelevant perceptual details. For example, the most likely conceptualisation of the scene below (Figure 2.4) would be as a *throwing* event.

Figure 2.4



The event schema for *throw* specifies at least two entities, one of which must be animate[7], and a particular relation between them that entails an action on the part of the animate entity resulting in a change of location for the other entity. Specific features of the manner or path would also be entailed in the schema, for example that throwing usually involves a launching movement from the hand, resulting in the trajectory of an object through space away from the launcher. However, much of the perceptual detail in the scene is filtered out. For example although we may be perceptually aware of the various sub-movements that the woman makes in the act of throwing, e.g. raising her arm, letting go of the ball, the schema for *throw* abstracts these details. Likewise, some perceptually salient properties of the object may not be relevant, while others must be. We can throw an object which matches the force properties of the arm, but not a very heavy or a very light one: thus, we can throw a tennis ball, a beach ball, a bottle or some water, but not a feather or a heavy lead weight (see Talmy 2000).

Thus each event schema includes certain kinds of conceptual material and not others. Categorizing a scene or situation as a particular event type requires an awareness of which aspects of the scene are relevant to that event schema and an ability to focus on those aspects and to background others. Of particular importance are the relational aspects of the scene. Failure to appreciate how the entities in a scene are related would effectively prevent its conceptualisation as a particular event. This would have direct consequences on one's ability to communicate about the event, both in terms of "labelling" the event and in terms of deciding which entities in a scene are relevant. In linguistic production, the resulting utterances might lack a main relational item, such as a main verb, and might also include entities that are not relevant to the particular event, even though they are present in the scene (Dipper et al 2005). The utterances produced by people with non-fluent aphasia often show this pattern (Nickels, Black & Byng 1991; Marshall et al 1993; Breedin, Saffran & Schwartz, 1998). For example, MM, the individual reported by Marshall et al (1993), described a picture of a woman dusting shelves as "woman... books... duster... blue... shoes" and a man cutting bread as "man... yellow... shirt" (Marshall et al. 1993, p. 181). In both descriptions MM omitted the verb and included information that,

[7] Though see note 5 above.

although visible in the stimulus picture, is not central to the main event depicted. In the second case she also omitted information central to the event (bread).

The above discussion has identified three separable but interlinked abilities that are integral to event conceptualisation and communication. These are:

1) characterisation of the temporal structure of the event, i.e. that there is a change
2) identification of the subcomponent entities that are involved in the event
3) appreciation of how these entities are related in space and time, i.e. the roles they play in the event.

2.3.2 Caused change of location events

In order to appreciate the relationships and roles of the individual entities, it is not sufficient simply to be aware that a change has occurred. One also needs to know what that change involves and how it came about. For example, to conceptualise the scene in Figure 4 as a *throwing* event, one would have to recognize that the process of change, i.e. the movement of the ball, was initiated by the woman. The final outcome of the change, or resultant state, i.e. where the ball ends up, might also form part of our conceptualisation. Thus three separate sub-situations: the woman's triggering act, the resulting movement of the ball, and the ball's final position or end state must be linked together by a continuous causal chain and integrated into a conceptual whole (Talmy 1988b, 2000; Jackendoff 1993; Black & Chiat 2003a). This can be represented schematically as:

ACT ⟶ PROCESS   STATE

X acts on Y   Y changes   towards Z   Y is in Z

⟶

Beginning point   Path   End Point

(From Black & Chiat (2003a) p 169)

Typical examples of caused change of location events are situations involving caused change of position, as in the *throw* example above, or caused change of possession, for example a *give* or *buy* event. Jackendoff (1987b) points out parallels in the conceptual form of these two kinds of events, suggesting that possession change events represent the generalization of spatial concepts to abstract domains. According to Croft (1998), caused change of location events correspond to the prototypical causal event, in which a volitional act on the part of the agent (the X that acts) brings about a complete change of state to the patient or Theme (the Y that changes). The Theme cannot undergo further change within that event and there is therefore a natural end point to the event. Thus a feature of caused change of location events is that they are bounded in time and space, in other words they have a clearly defined beginning and end point. The beginning point corresponds to the initiating act on the part of the agent and the end point corresponds to the final location of the Theme (Talmy 1988b, Langacker 1990). In this respect, caused change of location events map consistently onto the archetypal event identified in the literature on event structure perception, which is defined as *"a segment of time at a given location that is conceived by an observer to have a beginning and an end"* (Zacks & Tversky 2001 p 3; see also Hanson & Hirst 1989).[8]

Another feature of caused change of location events that provides a link between language and perception is their hierarchical structure: the semantic structure of the whole event is a combination of the general structures of each of the component situations. Each component situation has an internal structure of its own, with its own participant roles, but each functions in turn as a component structure at a higher level of organization (Langacker 1998; Zacks & Tversky 2001; Black & Chiat 2003b). The structure of the whole event potentially involves all the participant roles of the component situations that it includes. The structure of the Act sub-component involves two participants, with the first participant (X) exerting some kind of force on the second participant (Y) (Talmy 1988a). The structure of the Process subcomponent involves someone or something changing (Y), a beginning point of the change, an end point of the change (Z) and a trajectory or path of the change. What is particularly interesting is that this tripartite structure of caused change of location events, developed on the basis of linguistic analyses of many different languages, bears a strong resemblance to the typical composition of coarse-

[8] However, not all events have perceptual boundaries. For example if we see a person running, we would still conceive of that activity as an event, even though we do not see her reaching her goal. Only bounded events are investigated in this thesis.

grain temporal units identified in perceptual experiments involving event segmentation (Zacks, Tversky & Yvers 2001; Black 2003).

In these experiments, observers were asked to view videotapes of activities such as making a bed or assembling a saxophone, and to segment them into event units at different levels of temporal grain. "Coarse-grain" units correspond to the "largest natural and meaningful unit" observed, and "fine-grain" units to the smallest natural and meaningful unit. Like previous researchers (Newtson 1973, Hanson & Hirst 1989), Zacks and his co-workers found that there was considerable consensus among observers as to what corresponded to a coarse unit and what to a fine unit, i.e. most observers marked unit boundaries, or breakpoints in activity, at similar points in the video. They also found that coarse unit boundaries were also likely to be small unit boundaries, and, importantly, that the *ratio* of fine-units to coarse-units was relatively stable across individuals. The modal pattern of decomposition across temporal grains was to break each coarse unit into roughly three fine units. This is interpreted by the authors as evidence of a partonomic hierarchy in the structure of events and also as indicating that the schema *"beginning, middle, end"* may have perceptual priority (see also Hanson & Hirst 1989).

This similarity between the way language 'carves up' these kinds of caused change of location situations and the way in which events are perceived from ongoing activity is one of the main reasons for the selection of these particular event types for investigation in this thesis, since it highlights the links between event perception, event conceptualisation and event communication.

Some researchers have suggested that the hierarchical structure of caused change of location events may increase their complexity, making them more difficult to conceptualise and communicate (Black & Chiat 2000, 2003a, 2003b; Dipper et al 2005). Conceptualisation of the whole structure of these kinds of events requires more constructional effort, since information from the three different sub-situations must be integrated into a conceptually coherent whole. This requires that the causal connection between the situations be appreciated, in particular how the ACT component connects to the process of change. In visual events, perception of causality is influenced by the interaction of a number of perceptual and conceptual factors and may therefore vary as a function of specific features of the stimuli. This is discussed in more detail in Section 2.4.2 below. In linguistically described events, the causal connection between the three subsituations must be "unpacked" from the meaning of the verb, and this might add to their complexity in input. Thus we can add a further requirement to the list of abilities that are integral to the conceptualisation and communication of these kinds of events, namely **appreciation of their causal structure**, which in turn is linked with appreciation of the whole situational focus of the event or the verb used to describe it.

Communicating about a caused change of location event may be further complicated by the fact that the situations themselves offer a number of alternative viewpoints or focus options, due to the large number of participants and relations involved (Black & Chiat 2003a, 2003b). When deciding how to communicate the *throwing* event depicted in Figure 2.4, for example, one could adopt a narrow focus by homing in on one aspect of the situation, or the focus could be widened to include other aspects of the situation. One might focus on the end state of the event, describing the scene as *"The ball is in the bucket"* (Figure 2.5a overleaf). This gives no indication of the sub-events leading up to that state, in other words the Act and Process components are backgrounded. One could choose to widen the focus to include the process of change that resulted in that state, i.e. focusing on the movement of the ball, for example by using a sentence like *"The ball fell into the bucket"* (Figure 2.5b). Once again there is no indication of how that process was initiated or caused, so the Act component remains unexpressed. In order to express an external cause, one would have to widen the focus even further to include the triggering Act, using a sentence like *"The woman threw the ball into the bucket"* (Figure 2.5c). Following Black & Chiat (2003a), the three different focus options for communicating these events could be represented diagrammatically as:

ACT →	PROCESS	STATE
		The ball is in the bucket
	The ball fell into	the bucket
The woman threw	the ball into	the bucket

Figure 2.5a)

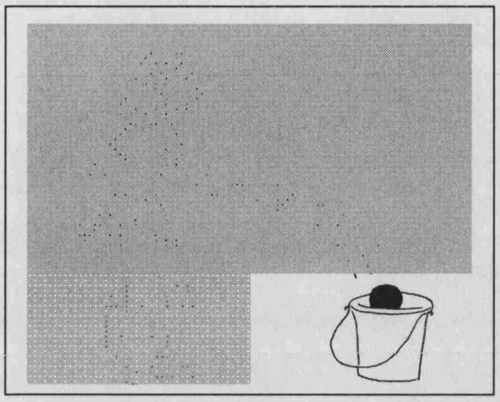


Figure 2.5b)

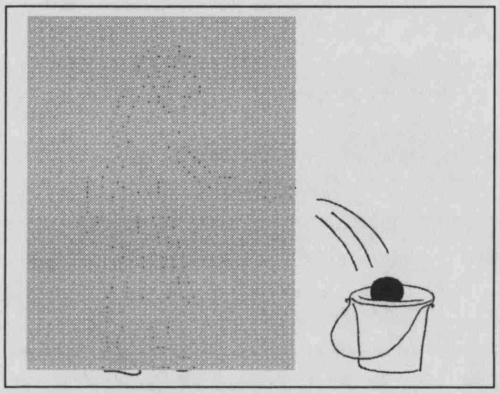
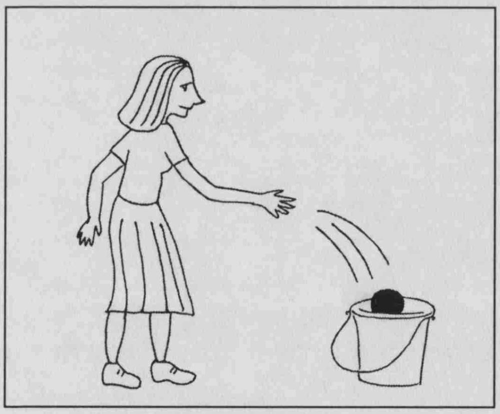


Figure 2.5c)



As can be seen from the above examples, language offers a convenient way to indicate different construals on the same event. This is related to the notion of conceptual alternativity which allows us to adopt different viewpoints on the same scene or event, and importantly, to communicate these different viewpoints to a third party (Langacker 1998; Talmy 2000). Thus language can function as an attention-directing device, shaping the listener's perception or construal of the situation (Black & Chiat 2003a). The linguistic forms one uses can direct attention to either individual subsituations, as in the STATE focus description above, or to combinations of subsituations, as in the "wide focus" description incorporating all three subcomponents (Talmy 2000, Black & Chiat 2003a). The number of situations that can be packaged together in language appears to be limited to the three situation types identified above: ACT, PROCESS and STATE. As Black and Chiat (2003a, p167) say:

> "*We can think about longer causal chains but we cannot package all the meanings into one verb and express them linguistically with one sentence.*"

Communicating about an event using a single verb in a simple sentence therefore forces us to present it from a particular viewpoint and to adopt a particular focus, foregrounding some aspects at the expense of others. While this process may be constrained by pragmatic considerations, other perceptual, conceptual and linguistic factors can influence one's choice of focus. When describing an event linguistically, choosing one's viewpoint or focus depends in part on access to the range of verb meanings and focus options available in one's language (Black & Chiat 2000; Dipper et al 2005). Choosing to focus on causation, direction or end state of the situation requires knowledge that three different verbs exist that can encode these different focus options. Reduced access to linguistic information, as in the case of aphasia, might therefore affect an individual's ability to decide what to focus on and give prominence to in a situation or scene, which would result in problems deciding how to communicate it. This might in turn affect identification all of the subcomponent situations in the event, resulting in an unusual focus being taken.

One possibility is that people with aphasia might show an increased reliance on non-linguistic features of the visual event, such as spatial and directional aspects. This might result in a focus on the process of change or on the end state or outcome of the event, while the causation aspect of the event might be backgrounded. Black & Chiat (2003a) cite the case of CP, a young woman with aphasia, whose linguistic descriptions of causal events tended to focus on just one aspect of the causal chain, usually the outcome or endpoint, but rarely included the ACT component of the situation. This was despite the fact that her syntactic resources were adequate to give full expression to the whole causal chain. Examples are provided below:

Target	*Response*
A woman dressing a boy	"Boy has jumper"
A man giving books to a woman	"Woman holds the books"
A woman lifting a child up	"Child in the air"

The focus one adopts on an event determines which participants or entities are included in one's description of that event. CP's descriptions above fail to include the initiator of the event, who plays the crucial causal role. Similarly the process and end-state focus descriptions of the *throwing* event above do not include all of the participants in the event. When communicating events non-linguistically, the inclusion or non-inclusion of particular aspects or entities may provide an indication of the focus that has been adopted on the event. In drawing, for example, an end-state focus might be signalled by the inclusion of only the ball and the bucket in their relative positions at the end of the event, leaving out the woman and the ball's trajectory (cf the blacked out sections of the pictures in Figures 2.5a and 2.5b). Problems in interpreting the whole focus or structure of a caused change of location event might also be apparent in people's drawings of events, particularly in terms of which aspects of the event they include and foreground.

Appreciation of the causal structure of these events also provides access to information about the roles of the various entities in the event, in particular the action-related roles. As discussed above, caused change of location events involve a number of different core participants, who each have a specific role in the event. The structure of the whole event potentially involves all the participant roles of the component situations that it includes. In linguistics, these roles are typically defined by means of thematic role labels, although the importance of thematic roles has been challenged in recent accounts of verb and sentence semantics (Jackendoff 1990; Butt & Geuder, 1998; Croft 1998; Tenny & Pustejovsky 2000). These linguistically-based labels provide a useful shorthand for referring to the core participants in a situation, and have therefore been adopted (and adapted) for use in this thesis, in order to make the link between roles in a visual cognitive event and roles in a sentence as transparent as possible. The only difference in usage will be the replacement of the more common thematic role label Actor by the label Cause, as this is felt to be more appropriate to a visual cognitive event. Caused change of location events potentially involve the following roles:

- the Actor (Cause): the initiator of the event (the X that acts)
- the Theme: the participant that changes (the Y that changes)
- the Source: the beginning point of the change
- the Goal: the endpoint of the change
- the Path: the trajectory of the change

It is important to note that one perceptual entity can play more than one role in these kinds of events. In the *throwing* event depicted above, the woman has the role of Actor/Cause, the ball has the role of Theme, and the bucket, the role of Goal. In this situation, the woman also has the directional role of Source, since she is the beginning point of the ball's movement. However, in a similar but not identical situation, for example the woman *removing* the ball from the bucket, the roles of Actor/Cause and Theme would remain the same, but the Source would now be the bucket, and the woman would have the dual role of Actor and Goal, i.e. she would be the end point of the ball's movement in this particular scene.[9] These two events have the same semantic structure: the

[9] Of course, in real life, the scene could be part of a larger event, for example one in which the woman removes the ball from the bucket and hands it to a third party, who would then become the Goal. For the current purpose, let us assume that she keeps hold of the ball.

woman's initiating act triggers the movement of the ball from a start position to an end point, represented as:

Actor Act $\longrightarrow$ Theme changes from Source to Goal via Path

However, they differ in terms of how the directional roles of Source and Goal are assigned to the entities in the event:

The woman threw the ball into the bucket
Cause Theme Goal
Source

The woman took the ball out of the bucket
Cause Theme Source
Goal

The roles of Source and Goal can be thought of as directional roles, since they define the direction of the Theme's movement relative to the other entities. Appreciating directionality in these kinds of events is crucial to their conceptualisation and communication, since it permits differentiation between similar events. Directionality refers here to both direction through time and direction through space. Knowing whether to describe a situation as *"The woman put the ball in the bucket"* or *"The woman took the ball out of the bucket"* requires that one processes the difference between the ball's location at the start of the event (time 1) and its location at the end of the event (time 2). Thus a further level can be added to the list of abilities required for the conceptualisation and communication of these types of events, namely **appreciation of directionality**.

Directional aspects of a visual scene or situation are communicatively relevant, but they are also important to other attentional systems, such as vision for action (Jackendoff 1987b, 1990; Talmy 1988a). Jackendoff (1987b) proposes that notions such as PLACE and PATH play a role in both the representation of visual perception and conceptual representation. He suggests that these kinds of spatial relations are more likely to be represented in an imagistic way, in the form of "image schemas". It may therefore be the case that these aspects of visual events are less vulnerable to language impairment (Dipper 1999). In linguistically described events, directionality is implicit in the meaning of the verb and the prepositional phrase. The meaning of the verb in these sentences provides information about the direction of the Theme's movement relative to the Actor/Cause. Verbs like *put* and *give* encode movement away from the Actor, thus focusing the beginning point or Source of the transfer, while *take* and *pick* encode movement towards the Actor, focusing the end point of the transfer, i.e. the Goal. The meaning of the preposition provides information about the direction of the Theme's movement relative to the final noun phrase in the sentence. Prepositions like *on(to), in(to),* and *to* are Goal-focused, i.e. identify the final NP as the endpoint of the Theme's trajectory, while prepositions like *off, out of*, and *from* are Source-focused, i.e. identify the final NP as the beginning point of the Theme's trajectory. In the case of aphasia, reduced access to specific aspects of verb and/or prepositional meanings might result in a failure to appreciate the directional roles assigned to the noun phrases in the sentence.

In addition to directional differences, other features serve to distinguish one event from another, similar event. For example one can differentiate between *throwing*, *dropping* and *placing* events in terms of the manner of the action that occurred. Likewise *selling* can be differentiated from *giving* on the basis of the process of change, the former involving a money transaction, rather than a simple transfer. In language, this kind of event-specific information is encoded in the meaning of the verb. Thus access to the precise semantics of the verb is crucial for interpreting these events from linguistic input. In terms of output, these aspects of events are highly relevant to linguistic communication since they influence verb selection. However, these aspects of events may be less relevant, or less easy to encode, in non-linguistic communication modalities such as drawing (Tversky 1995), where there is no equivalent to a verb label. This is discussed more fully in Section 2.4.3 below.

2.3.3 Foregrounding and perspective-taking

As discussed in the previous section, decisions about which aspects of an event are foregrounded and which backgrounded depends to some extent on one's choice of focus on the situation. This determines not only which of the participant entities are included in one's communication of the event, but also the relative prominence given to those entities. By placing an entity in a position of prominence, this indicates the "viewing point" or perspective from which the situation has to be understood, and directs listeners or observers to attend to that entity before attending to others in the sentence or scene (Black & Chiat 2003a).

Although speakers have a choice of how to present a situation, once they have adopted a particular focus, their choice of which participant to foreground is fairly restricted. In caused change of location events, the participant that is foregrounded is the "X that acts", or the Actor/Cause and the situation is then presented from the perspective of that entity. Another participant receives secondary foregrounding in these events - the one towards which the act is oriented, i.e. the Y that changes, or the Theme.

In language, foregrounding is achieved by the grammatical device of mapping the foregrounded participant(s) in the event structure onto positions of greater syntactic privilege or pragmatic prominence (Langacker 1998, Talmy 2000, Black & Chiat 2003a). In a simple active transitive sentence in English, the Actor is always mapped onto the position of primary prominence, i.e. in the Subject position, and the Theme is usually mapped onto the position of secondary prominence, i.e. the Object position. Thus foregrounding is crucial to shaping messages into a form suitable for linguistic output, since it provides a means of mapping the semantic structure of the event onto the structure of the language used to express it. In English, the order of the words in a sentence is one of the primary devices available to speakers to express the roles and relations of various participants in an event i.e. who does what to whom. The linear structure of language itself therefore imposes asymmetry on one's communication (Flores d'Arcais 1987; Langacker 1998; Talmy 2000).

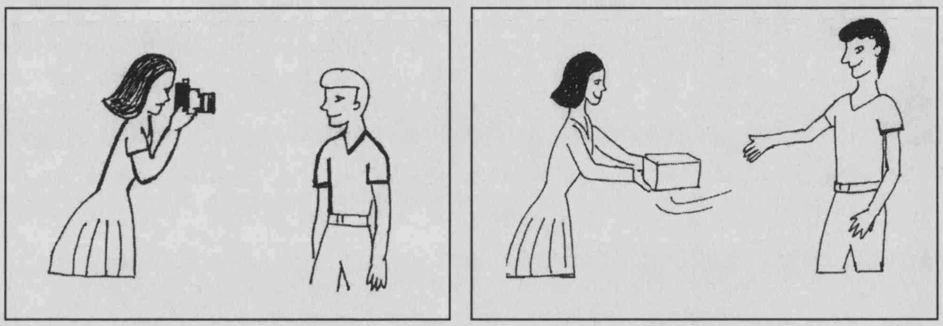
Linearisation is also a feature of non-linguistic communication systems such as gesture (Gershkoff-Stowe & Goldin-Meadow 2002, Hammond & Goldin-Meadow 2002), graphic symbol communication (Sutton, Soto & Blockberger 2002) and drawing (van Sommers 1984, Tversky 1995). As in language, the entities in a scene are isolated and represented by individual 'forms', which are then combined into sequential strings to express the relations between them. Thus foregrounding in non-linguistic communication might also be achieved by means of the temporal order in which entities in a scene are gestured, selected or drawn. For example, it is possible that drawing a particular entity first would place it in the position of prominence and thus give a clue as to the focus or perspective one has taken on an event – at least when the receiver of the 'message' is present during the drawing.

The above discussion highlights the close links between choice of focus, foregrounding and perspective-taking in the conceptualisation and communication of events. Perspective-taking is a feature of many cognitive domains, as many psycholinguists have pointed out (Jackendoff 1983, 1997: Langacker 1997; Levelt 1996; Pinker 1989) and is central to "thinking for communication", since it influences how we attend to aspects of events and construct messages about them (Slobin 1996; Black & Chiat 2003b). Communicating about an event forces us to take a perspective on that event and to present it from a particular viewpoint, foregrounding some aspects at the expense of others. While perspective-taking is influenced by a number of different factors, there are some perceptual and conceptual constraints on the perspective humans are likely to take on an event. These constraints will be discussed more fully in Section 2.4 below. These are related in part to the characteristics of the entities involved (Sridhar 1988, Langacker 1998, Black & Chiat 2000, 2003b). In situations where there is one animate entity acting on an inanimate object, e.g. a caused change of position event like *throwing*, the scene is more likely to be viewed and presented from the perspective of the animate entity. This is because the animate entity in these situations can clearly be identified as more agentive and is therefore more likely to be the "anchoring point" for interpreting and communicating the scene (Black, Nickels & Byng 1991, Langacker 1998). Presenting such a scene from the perspective of the inanimate entity is possible, as can be seen by the Process-focus description of the *throwing* scene (*The ball fell into the bucket,* Figure 2.5b). However, this description does not convey the whole of the event, since the causal Act component is omitted and the role of the animate entity backgrounded. Another alternative would be to use a passive construction, i.e. *the ball was thrown into the bucket by the woman.* However, this is far less frequent and subject to considerable semantic and pragmatic constraints (Bock 1986; Black & Chiat 2000).

Situations that involve two animate entities, on the other hand, might offer more choices in perspective, since they can be viewed from the point of view of either of these entities. However, even here, visual-conceptual clues to agentivity play a role (Black & Chiat 2000). Compare, for example, the two situations in Figure 2.6 below.

Figure 2.6

a) b)



Both of these situations involve two animate participants, but in the first several conceptual and pictorial cues are likely to identify the female character as more agentive. To describe the situation from the perspective of the male character, one would have to use either a passive construction (*The man is being photographed by the woman*) or a construction with *get* or *have* (*The man had his photo taken*). In the second scene, however, the two characters are roughly equal in conceptual agentivity. Perceptually, the scene involves one individual with an object moving her hand & another individual moving his hand to end up with that object. The situation could equally be conceived of either *giving* or *taking/receiving*, depending on whose perspective one takes. In order to communicate about the event, one must select one or other perspective.
In language this involves selecting between, or understanding the different perspectives encoded by, the two verbs *give* and *take,* since there is no single verb that refers to entire event regardless of perspective or incorporating both perspectives. Situations that offer a greater choice of perspective, such as caused change of possession events, may involve additional complexity in their conceptualisation for communication (Black & Chiat 2000; 2003b). The effect

of increasing perspective options on the conceptualisation and communication of events is specifically investigated in this thesis by comparison of performance across caused change of position events and change of possession events.

Difficulty in taking a perspective on an event would clearly affect the ability to describe the event, but might also affect performance in certain comprehension tasks typically used in the assessment of aphasia, for example sentence-to-picture matching tasks. This might interact with difficulties in interpreting the perspective information encoded in the verb label to result in a "processing double whammy" (Black & Chiat 2000). Indications in the aphasia literature suggest that perspective-related aspects of events and verb meaning do influence the performance of people with aphasia in both comprehension tasks and production tasks (Black et al 1991; Haendiges, Berndt & Mitchum 1996; Breedin & Martin 1996; Marshall, Chiat & Pring 1997; Dipper 1999). Difficulty interpreting perspective information in an event might also be expected to affect non-linguistic communication of the event, particularly in terms of foregrounding choices. As suggested above, there may be an increased reliance on non-linguistic features of the stimulus, in particular perceptual or conceptual features that increase the salience of one or more of the entities by directing attention to them. The following section will discuss these perceptual and conceptual constraints on attention and their interaction in more detail, with a focus on how this affects perspective-taking and foregrounding in communication.

2.4 Perceptual and conceptual influences on foregrounding

Evidence from a number of sources indicates that foregrounding decisions in event communication are influenced by bottom-up perceptual factors and top-down conceptual factors, both of which affect the distribution of attention over an event. The suggestion is that a number of these factors may compete or combine to increase the attentional salience of one or more of the entities involved (Tomlin 1997). When a number of these cues converge on one entity, this increases its likelihood of becoming the focal object, i.e. "the entity whose characteristics & fate are of concern" (Talmy 2000; Langacker 1998). 1998). This entity is more likely to be foregrounded in communication about the event.

2.4.1 Visual prominence and salience

Increasing the visual prominence or perceptual salience of one of the entities in a scene has been shown to influence foregrounding choices in event descriptions. This can be achieved by direct attentional cuing (Tomlin 1997), by manipulating certain perceptual characteristics of the entities themselves, such as relative size or animacy (Flores d'Arcais 1987, Sridhar 1988), or by manipulating their relative positions in the scene (Flores d'Arcais 1975, Hartsuiker & Kolk 1998). This increased prominence has the effect of attracting attention to a particular entity, thus giving it focal status (Tomlin 1997).

Tomlin (1997) provided convincing evidence that overtly directing attention to a particular entity in a scene can override prototypical foregrounding decisions in language. He describes an experiment in which observers were asked to describe dynamic animated scenes in which one fish (the "agent") eats another fish (the "patient"). Shortly before they began their descriptions, their attention was cued to one of the two fish by means of a flashing arrow. Most participants consistently produced active sentences when the "agent" fish was cued and passive sentences when the "patient" fish was cued. Thus the focused entity was assigned to sentence subject position, rather than the more typical "agent first" assignment.

In the absence of overt attentional cuing, other perceptual features of entities might have an effect on their relative salience in a scene. Flores d'Arcais (1987) reported that observers showed a preference for mentioning the larger object first in their descriptions of events involving two moving objects. He suggests that larger objects are coded more easily perceptually and this affects their early lexical selection. Similar effects of size, and also of increased 'animacy', were reported by Sridhar (1988). He describes an experiment in which these features were directly manipulated so as to increase the perceptual salience of one of the entities in a video-taped scene. This resulted in alterations in the structure and content of observers' linguistic descriptions. Here again, the more perceptually salient entity tended to be mentioned first.

The effects of increased animacy in Sridhar's experiment may be attributable to the perceptual salience of change. Research into visual and event perception indicates that observers' attention is automatically drawn to changes in the perceptual environment (Shaw & Pittenger 1978; Tomlin 1997; Zacks & Tversky 2001). Tomlin (1997) states that *"any changes occurring in one's visual field will be noticed, reacted to and ultimately reported on if required."* This is borne out by evidence from event segmentation experiments, such as those discussed in Section 2.3.2 above. The results of a range of different perceptual experiments indicated that people tend to divide ongoing activity at temporal locations that correspond to what Zacks & Tversky (2001) call *"points of maximal change"* in physical features of the action (Newtson & Engquist 1976; Newtson, Engquist & Bois 1977; Zacks et al 2001). For example, Newtson et al (1977) (cited in Zacks & Tversky 2001) asked observers to divide films of human activity into parts. They then used dance notation to code the positions of the actors in scenes. They found that the "breakpoints" marked by observers, i.e. the locations in time at which they had segmented the activity, corresponded to points at which the actors' bodies were changing most, or points at which *"the amount of biological motion is at a peak".* A moving entity is therefore likely to attract more attention than a static one, thus becoming the focal object in the scene. This is reflected in foregrounding choices in language, where a moving object generally takes syntactic precedence over the other entities, known as reference entities (Talmy 1983; Landau & Jackendoff 1993).

In addition to internal characteristics of the entities themselves, their relative positions in the scene can influence foregrounding decisions. Clarke & Chase (1972) and Flores d'Arcais (1975) both found that people were more likely to start descriptions of scenes with the entity appearing on the left. For example, when describing a spatial scene showing two objects in horizontal alignment, people were more likely to describe it from the point of view of the entity on the left, e.g. *"The star is to the left of the square"* as opposed to *"The square is to the right of the star"* (Clarke & Chase 1972). Similar effects were found by Hartsuiker & Kolk (1998) for both non-aphasic individuals and individuals with Broca's aphasia in a picture description task. Active sentences were more likely to be produced when the 'agent' appeared on the left of the picture. When the 'agent' was on the right, however, more "other" structures were produced, in which entity on the left was made the subject of the sentence, particularly if that entity was also animate. The combined or additive effects of animacy and position in this study are a good example of how perceptual and conceptual cues can converge to increase the salience of a particular entity, thus increasing its likelihood of being placed in a position of prominence in a linguistic description of a scene.

Effects of visual prominence and salience have also been found to influence foregrounding choices in the graphic communication of scenes, although the evidence base is more limited. Effects of the relative position of entities in a scene have been reported by some researchers. The entity on the left of a scene is more likely to be "foregrounded" by being drawn first (van Sommers 1984, 1989; Chaterjee, Maher & Heilman 1995; Chaterjee et al1999). This has been attributed to the "geometric constraints" of the graphic output modality (van Sommers), or a "motor bias" (Chaterjee et al), which induces most right-handed individuals to start their drawings on the left of the page and proceed in a left-to-right direction.

Effects of size and animacy have also been noted, but here there are some differences between linguistic and graphic communication. In contrast to language, animate entities are not generally foregrounded in graphic depictions of scenes. Rather, evidence suggests that more stable, inanimate entities are more likely to be drawn or selected first, both in response to a visual scene and to a linguistic description of a situation. Gershkoff-Stowe and Goldin-Meadow (2000), for example, found that stationary items were consistently foregrounded over moving items in graphic re-creations of visual events. Participants were shown video vignettes involving one moving object and one stationary, for example a doll jumping into a hoop. They had to recreate the event by ordering transparencies of line drawings depicting the individual entities in the scene. Most participants consistently selected the stationary entity before the moving one, i.e. the hoop, and then the doll.

Geminiani and colleagues found a similar effect in an image generation task (Geminiani, Bisiach, Berti & Rusconi 1995). Participants had to listen to a sentence describing an event or state involving two entities. They then had to imagine a visual scene representing that sentence, and point to the imagined location of each of the two entities on a board. When the sentences involved one moving item and one stationary, the stationary item was generally indicated first and located on the left of the board. This was so even when the stationary item occurred in sentence final position, such as *"The car has overtaken the bike".*

The above findings can be interpreted in terms of what van Sommers (1984) refers to as *"our regular visual commerce with the world".* Smaller, less stable or moving items are generally perceived as being located or moving in relation to other, more stable objects, which act as reference objects or "anchoring points" for their movement (Talmy 1983; Landau & Jackendoff 1993, Langacker 1991). In graphic or visually based communication, it seems that the reference object precedes the Theme in terms of the temporal order in which they are drawn or represented. By drawing or indicating the reference object first, this effectively "sets the scene" for the location or movement of the Theme (Hammond & Goldin-Meadow 2002).

These findings have important implications for the current investigation, since they indicate that foregrounding decisions in drawing are influenced by the interaction of perceptual and stimulus-related factors and the constraints of the graphic output modality itself. The graphic constraint of "draw reference object before Theme" might affect performance on the experimental event drawing task (see Chapter 4, Section 4.4) particularly as regards the temporal order in which the entities are drawn. In the caused change of location events under investigation here, the Theme's movement is characterized with respect to two other entities, which correspond to the start and end points of its trajectory, i.e. its Source and its Goal. Both of these entities are therefore potential reference objects for the Theme. Perceptual and conceptual factors such as the relative stability or animacy of these two entities might influence the selection of primary reference object.

The non-adherence to word order in the Geminiani et al study is also relevant since it suggests that, in certain situations, the constraints of the graphic output modality can override the strong linguistic foregrounding in input sentences. This might affect performance on the verbal condition of the event drawing task. However, other factors might also play a contributory role here, for example the roles of the entities in the event. Chaterjee et al (1995a) found that the 'agent' of an event was more likely to be drawn first than the 'patient' in response to both active and passive sentences. Thus on hearing the sentence: *"The square is kicked by the circle"*, participants were significantly more likely to draw the circle first, even though it occurred in sentence-final position. This finding suggests that "agency" might be a significant factor in determining foregrounding choices in drawing as well as language. In other words, the participant that has the role of Actor (Cause) in an event is generally placed in a position of prominence in both graphic and linguistic communication of events. The relative prominence of this participant can also be attributed to the interaction of bottom-up perceptual factors and top-down conceptual factors, as the following section will show.

2.4.2 Perceptual and conceptual clues to causality

Evidence from visual event perception research suggests that the relative prominence of the Actor may be attributable, at least in part, to perceptual factors. Verfaillie and Daems (1996), for example, argue for the "privileged status of the agent at the level of perceptual processing". This claim is based on their finding that, during visual perception of "canonical" causal events, people were significantly faster at identifying the 'agent' than the 'patient'.
In their experiment, observers were presented with visual events involving contact between two moving objects, resulting in some change in either the movement or direction of one of the objects. Identification of the 'agent' was faster in scenes where causality could be directly perceived. These scenes involved 'pushing off', in which one object stops at the moment of contact and the other starts moving, or 'pushing forward', in which one object changes direction at the moment of contact and is pushed along in same direction as the other object (see also Michotte, Miles & Miles 1963).

Verfaillie and Daem's results suggest that perception of causality may vary as a function of specific features of the causal interaction. As they point out, causality is only perceived at the moment of contact between the two objects (see also Zacks & Tversky 2001). Up until that point, either of the two objects could take the role of Cause or 'agent'. In real-life events, other aspects of the situation might provide clues about potential agency, for example the relative animacy of the entities involved. However, even in situations that involve an animate entity acting on an inanimate, directional differences may affect perception of causality. Compare, for example, a situation in which a person puts a cup on a table, and one in which she takes a cup off the table. In the former, perception of causality coincides with the moment she initiates the event, since this automatically results in the movement of the cup (which she is holding at the start of the event). However, in the second situation, the person initiates the event by moving towards the cup or table, but perception of causality is delayed until contact has been made with the cup. Chaterjee et al (1999) found such directional effects in a sentence-to-picture matching task. Participants were shown simple drawings of actions involving one stick-figure acting on another, and had to decide whether an accompanying sentence matched the picture. Response times were faster when the direction of the action moved away from the 'agent' as opposed to towards it, i.e. a *push* scene as opposed to a *pull* scene, particularly when the agent occurred on the left of the scene. Although this experiment does not deal specifically with perception of causality, the results seem to indicate that causal interactions are easier to process when perceptual features such as direction and position of the agent in the scene line up.

A perceptual explanation for the increased attentional salience of the actor or Cause is also considered by Zacks et al (2001). They suggest that moments of causal interaction in visual events may be perceptually more salient because they coincide with moments of maximal change in physical features of the scene (see Section 2.4.1 above). In their event segmentation experiments, they found that the "breakpoints" identified by observers tended to coincide with moments at which causal interactions were taking place. According to Zacks et al, the attentional salience of the entities that are involved in these interactions might also be increased, i.e. the initiator of the interaction and the entity affected by it. This attentional prominence is then transferred to the communicative arena, resulting in the foregrounding of these entities. In Zacks et al's view, this argues strongly for a bottom-up perceptually-driven component to foregrounding of the Actor role in event communication.

However, other aspects of their findings indicate that top-down conceptual factors also play a role. Specifically they found that communicative intent appears to increase the attentional salience of causal interactions. When people were asked to describe the events immediately after segmentation, there was a stronger hierarchical effect, i.e. an increased alignment of coarse-grain and fine-grain units. According to Zacks et al, actively describing an event invokes activation of top-down knowledge structures or event schemas, and requires a greater awareness of causal and intentional, or goal-directed, relations. They suggest that *"using language, and perhaps language itself, biases away from raw perceptual statements and toward causal and intentional ones".*

Recent findings by Griffin and Bock (2000) support this view. They monitored eye movements when people viewed a scene involving one entity acting on another under several conditions. There were two speech conditions: description of the scene, and preparation for description, and two non-speech conditions: simple inspection, where no specific instructions were given, and patient identification, where the goal of the task was to identify the entity affected by the action. In both the non-speech conditions, initial eye movements were skewed toward the entity that was affected, e.g. the entity that was sprayed with water, and only later toward the initiator of the change. In contrast, in both the speech conditions, initial eye movements were skewed toward the initiator of the event, i.e. the Actor or Cause. The authors suggest that perceptual salience alone is not sufficient to account for typical foregrounding choices in language. Rather, it seems that communicating or intending to communicate about an event increases the attentional salience of causal interactions, and leads us to seek out and foreground potential Causes.

When perceptual cues about causality converge with conceptual cues, as in situations where an animate entity acts on an inanimate, foregrounding choices are relatively straightforward. However, in certain situations perceptual cues may conflict with conceptual cues, and this might affect foregrounding decisions. One example is the effect of direct attentional cuing in Tomlin's (1997) experiment discussed above (Section 2.4.1), where increasing the perceptual salience of the 'patient' overrode the conceptual prominence of agency.

Another example comes from the Hartsuiker & Kolk (1998) study. In this case, however, conceptual cues to agentivity appeared to be stronger than perceptual cues. Some of the scenes used in their study involved an 'inanimate agent' acting on an 'animate patient', for example, lightning hitting a golfer, or a train running over a woman. Here perceptual and conceptual cues to agentivity are in conflict. Perceptually, the inanimate entity is the Cause of the event, i.e. the one whose "action" affects the animate entity. However, the animate entity is conceptually more agentive (Langacker 1998). When asked to describe these scenes, both non-aphasic and aphasic individuals tended to foreground the animate entity over the inanimate, either by producing a passive sentence construction, e.g. "*The golf player was struck by the lightning*", or by producing 'alternative' structures. In the case of individuals with aphasia, this resulted in implausible sentences, such as *"The golf player hit the lightning",* or changed the nature of the event, for example *"The woman .... commits suicide".* However, as noted above, the effect of animacy in this experiment was additive to that of position of the entities in the scene. These kinds of alternative structures generally occurred in response to scenes in which the animate entity appeared on the left of the picture. This suggests that, when the identification of the Cause entity in a scene is less straightforward, there may be an increased reliance on other perceptual cues, e.g. cues that increase the visual prominence of one of the entities.

The evidence reviewed above has implications for the current investigation, since it suggests that several attentional systems may compete when we are trying to sift through the mass of information from which we derive a 'message'. What we attend to depends in part on aspects of the stimulus itself. However, it also depends to a large extent on what we want to do with the information. If our intention is to communicate about the event, we have to pay attention to communicatively-relevant aspects of that event. Thus performance on the experimental event drawing task, in particular with regard to foregrounding choices, is likely to be affected by the interaction between bottom-up perceptual factors and top-down conceptual factors.

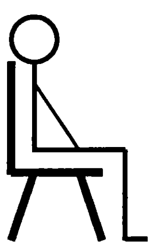
In developing the visual stimuli for the task, perceptual factors, such as the position of entities on the screen and direction of movement of the Theme, were counterbalanced with conceptual factors, such as the number of animate entities and the perspective options offered by the situation (see Chapter 4, Section 4.4). The convergence or conflict between these factors is particularly relevant to the ease of identification of the Cause entity and consequently may affect perspective-taking and foregrounding. The above findings suggest that an increased reliance on perceptual factors might be predicted in scenes where conceptual cues to causality are less clear-cut, even for people with no language impairment. However, individuals with aphasia might also show an increased reliance on perceptual factors in their foregrounding choices in scenes with strong conceptual cues to causality. This pattern of performance would imply a failure to focus on or identify the role of the Cause entity as initiator of the event. This would in turn imply reduced attention to the causal structure of the events and a problem with adopting a focus on the events, both of which are crucial for their effective communication, regardless of output modality (see Section 2.3.2 above). Increased reliance on perceptual factors across all scenes in the visual condition of the event drawing task would therefore provide strong evidence in support of a problem with the schematisation of events for the purpose of communication.

2.4.3 Graphic depiction of action and relations

As discussed in Section 2.4.1 above, perceptual and conceptual factors also interact with factors or constraints specific to the graphic output modality. The effects of graphic output constraints on foregrounding choices in drawing have already been highlighted. An additional constraint of the graphic output modality is the relative difficulty inherent in the graphic depiction of action and relations (van Sommers 1984; Tversky 1995; Sutton et al 2002). This arises primarily from the fact that these aspects of a situation cannot be separated from the entities involved in that action or relation. This contrasts with linguistic communication, where information about specific features of an action and about spatial or directional relations are expressed by a verb and/or preposition, which are separated lexically from the entities involved (i.e. the noun arguments).

This “blurring of grammatical category boundaries” (Sutton et al 2002) has been found to affect graphic utterance construction by users of graphic symbol communication systems, even those whose language is intact. Smith (1996) found that pre-school children produced very restricted Picture Communication System (PCS) utterances despite intact receptive and expressive skills. They often produced a single-term PCS utterance at the same time as a complex spoken utterance. For example, in a picture description task, one child produced the PCS utterance SIT alongside the spoken description “A girl sitting on a chair”. Smith attributes this to the fact that almost all the information required to describe the target picture is contained in the single PCS symbol for SIT (see Figure 2.7). Conversely, Soto (1997) found that, in many instances, verbs were omitted altogether in graphic symbol utterances. This may also be related to the inclusion of potential Actors and Themes in verb symbols, which reduces their generalisability. For example, in the C-VIC communication system, used by some researchers with people with aphasia, the symbol representing the verb *shoot* is represented by a bullet coming from a gun, thus it would be difficult to generalize it to other situations, for example a boy shooting an arrow. Precisely these kinds of difficulties with the comprehension and generalisation of C-VIC verb icons have been reported amongst individuals with aphasia (Goodenough-Trepagnier 1995; Shelton et al 1996, McCall et al 2001).

Figure 2.7. PCS symbol for SIT



The inherent difficulty in conveying relational concepts such as actions extends to drawing (van Sommers 1984, Tversky 1995). Drawing does allow for more generalisability than the graphic symbol systems discussed above, since the same action can be represented with a range of different actors, themes and instruments. However, representation of specific features of the action, such as manner or direction, may be problematic. These action-related aspects of events are often captured in drawing by specific graphic strategies such as arrows or lines. Tversky (1997) describes arrows as a "special kind of line, with one end marked, inducing an asymmetry" (p 118). She suggests that a primary function of arrows in graphic representations is to indicate direction, which is an asymmetric relation. Arrows are frequently used to signal direction in space, but Tversky points out that, in diagrams and other graphic depictions, arrows are also commonly used to indicate direction in time and to denote the sequence of processes. This is important in the context of this thesis since the use of arrows may be a way for people to signal temporal aspects of events in their drawings, as well as indicating specific action-related features such as manner and direction. This is the basis of one of the analyses in the experimental event drawing task (see Chapter 4, Section 4.4.4).

As discussed in Section 2.1.1 above, these graphic output modality constraints on the depiction of action and action-related aspects of events might affect conceptual preparation for communication, since they might influence how attention is deployed over a situation. It may be that attention to specific features of the action is less relevant to graphic communication, where there is no equivalent to a verb label. In terms of aphasia, these modality-specific factors might also interact with the language impairment. In particular, there may be an interaction between reduced access to verb information in aphasia and the absence of a graphic equivalent of a verb label. The combination of these two factors might result in an increased focus on aspects of the event not directly related to the action or temporal structure.

However there may be variation amongst participants, depending on the nature and extent of their verb impairment. Limited access to 'core' aspects of verb meaning might correlate with problems processing language-specific aspects of events, such as the precise manner of the action. If both 'core' and thematic aspects of verb meaning are impaired, there may be associated problems in processing structural and relational aspects of the events, such as their causal or temporal structure and the roles of the various entities participating in the event. This might in turn result in an increased reliance on perceptual and visuo-spatial aspects of the stimulus. This would provide evidence in support of the "spiral of impairment" suggested by Black & Chiat (2000), since it would indicate that reliance on bottom-up perceptual factors is increased when language is least available as a source of constraint. This is a matter for empirical investigation and is incorporated into the design of the current study, which allows for comparison across linguistic and non-linguistic modalities (see Chapter 4, Section 4.4).

In summary, the above section has highlighted that event conceptualisation for the purpose of communication involves the complex interaction of bottom-up perceptual and top-down conceptual constraints on attention. The current study aims to add to the available evidence, by providing more specific information about how these constraints interact with constraints of the graphic output modality to affect graphic communication of visual events, in the context of both impaired and intact language processing. A better understanding of the interaction between perceptual, conceptual and output-modality constraints is highly relevant to aphasia, particularly in view of the prevalence of picture-based tasks in clinical assessment and therapy (Black & Chiat 2000).

2.5 Summary of chapter

This chapter reviewed a broad range of literature relating to the conceptualisation and communication of causal events, which raised a number of issues of relevance to aphasia. The "thinking for communication" account outlined in the first part of the chapter indicated that event conceptualisation for the purpose of communication depends on a process of schematisation or 'paring down', which enables complex conceptual information to be structured into a form suitable for communication. This 'paring down' process is multiply driven by the communicator's attentional focus and perspective and by constraints from the language or output modality itself.

The second part of the chapter focused on the structure of caused change of location events. A detailed consideration of literature from both linguistics and visual event perception revealed a number of different aspects or components of this type of event that are crucial for effective communication in both linguistic and non-linguistic modalities. These were referred to as "modality-general" aspects. They are:

- Identification of the participant entities
- Appreciation of temporal structure, i.e. that a change has occurred
- Appreciation of the causal structure of the event, which affects the focus one adopts on the event and the identification of the action-related roles of participants
- Appreciation of directionality, i.e. awareness of the beginning and end of the process of change, allowing identification of directional roles of the participants.

Other aspects of these events are more specific to linguistic communication. They are:

- Appreciation of perspective differences between similar events, e.g. *give* vs *take*.
- Appreciation of specific features of the event, for example the manner of the action.

In linguistic communication, many of the above aspects of events are packaged together in the meaning of the verb. Thus access to verb meaning is crucial both for communicating about these events linguistically and for forming conceptualisations of these events from linguistic descriptions.

The final part of the chapter identified a number of attentional constraints on event conceptualisation, with particular reference to how these might affect focus and foregrounding choices in communication. Evidence from a number of sources was reviewed which confirms that the conceptualisation of events for communication is influenced by the complex interaction of top-down conceptual, and bottom-up perceptual factors.

The implications of the above findings for event conceptualisation and communication in aphasia are summarized below. These possibilities are not mutually exclusive and may, in fact, interact with one another.

1. There may be problems at the conceptual preparation level of communication which affect the schematisation of events for the purpose of communication in general. This would predict difficulties in communicating effectively about events in both linguistic and non-linguistic output modalities.

2. Problems with processing specific features of visual events might result in difficulties restricted to the linguistic communication of events, with fewer effects on graphic communication.

3. Reduced access to the meanings and forms available in one's language, in particular verbs, might also affect the process of conceptual preparation, due to the reduced influence of linguistically-mediated constraints on attention. This might result in additional problems in structuring event conceptualisation in a communicatively-relevant way.

4. This would predict a correlation between the extent and nature of the language impairment and an increased reliance on bottom-up perceptual constraints in event conceptualisation for communication. Specifically, individuals who are more impaired in those aspects of meaning relating to event structure (i.e. thematic aspects of meaning) should also show more problems with schematization and more reliance on perceptual factors in graphic communication of visual events.

5. Reduced access to the full meanings of verbs will prevent effective conceptualisation of linguistically described events.

The following chapter will consider some of the evidence from the aphasia literature that is relevant to above claims.

Chapter 3.

EVENT CONCEPTUALISATION AND COMMUNICATION IN APHASIA

The aim of this chapter is to identify links between patterns of language impairment already characterised in aphasia and aspects of event conceptualisation identified as relevant for their communication. Two main areas of language impairment are of particular importance here, namely verb and sentence processing. The focus will be on evidence that relates directly to the events and sentences under investigation in this thesis, namely the production and comprehension of simple active sentences, reversible or otherwise, where there is straightforward canonical mapping of two or three arguments onto syntactic structure. Thus literature that makes claims about syntactic aspects of processing on the basis of investigations involving complex sentences with displaced constituents will not be considered here (e.g. Grodzinsky 1986; Mauner, Fromkin & Cornell 1993; Friederici & Gorrell 1998).

There is a large and consistent body of evidence reporting that many people with aphasia have particular problems with the 'language of events', i.e. difficulties with verb and sentence processing, both in terms of production and comprehension. One common manifestation is a disproportionate problem in the retrieval and comprehension of verbs in comparison with nouns (Miceli, Silveri, Villa & Caramazza, 1984; Warrington & McCarthy 1985; Byng 1988; Zingeser & Berndt, 1990; Caramazza & Hillis 1991; Byng, Nickels & Black 1994; Berndt, Mitchum, Haendiges & Sandson 1997a). Different patterns of verb deficit have been demonstrated across a range of tasks and are not confined to any syndrome or classification of aphasia (Williams & Canter 1987; Kohn, Lorch & Pearson 1989; Berndt et al 1997a, 1997b; Marshall et al 1997). Furthermore, there is considerable variation amongst verb-impaired individuals in terms of the factors that influence verb retrieval (Kemmerer & Tranel 2000). Several of the above studies document a co-occurrence of specific verb deficits and problems with the production and comprehension of sentences. However, these problems do not always co-occur and, when they do, the causal connection between them remains inconclusive (Berndt et al 1997b; Black & Chiat 2003b). The relationship between verb and sentence processing will be discussed in more detail in Section 3.2 below.

As with verb deficits, a number of different patterns of sentence processing deficit have been documented amongst people with aphasia, which have so far proved resistant to a single explanation (Schwartz, Linebarger & Saffran 1985; Berndt, Mitchum & Haendiges 1996; Berndt, Mitchum & Wayland 1997c; Inglis 2003). Thus most reviewers caution against reductionist accounts of verb and sentence processing deficits in aphasia, since these problems are unlikely to be attributable to a single underlying cause (Berndt 1987; Berndt et al 1997a, 1997b; Druks 2002; Marshall 2002; Black & Chiat 2003b).

A variety of accounts of verb and sentence processing deficits in aphasia have been proposed, which have different implications for event conceptualisation and communication. Most of these accounts propose a linguistic source of the problem, and assume intact event level processing. However, some researchers have made explicit links between verb and sentence processing problems and problems with event conceptualisation. They propose difficulties in the processes of "thinking for speaking", i.e. the processes that translate between conceptual representations and language as the functional impairment underlying the verb and sentence production problems of some people with aphasia (Marshall et al 1993; Byng et al 1994; Dipper 1999; Dean & Black, in press). These studies are highly relevant to the current investigation and will be discussed in detail in the following section (Section 3.1).

Also relevant to this investigation are accounts that propose a semantic source of verb and sentence processing deficits. The previous chapter highlighted the crucial role of verb meaning in providing a link between event conceptualisation and communication. The verb's semantic information dictates the type of event occurring, the number and nature of the entities involved and their role in the event. Verbs also specify how thematic roles are assigned to syntactic structure, and are therefore critical to sentence comprehension and production. They provide information about what phrases are part of the same event, and how to slot phrases together meaningfully to describe the event (Marshall 1995; Black & Chiat 2003a). Problems with accessing the full meaning of the verb would therefore have significant implications for the ability to communicate linguistically about events and to conceptualise events from linguistic input. However, the consequences for event conceptualisation and communication would vary depending on the precise nature of the verb impairment. Evidence from numerous studies suggests that access to verb meaning is not all-or-none and that different aspects of verb meaning can be selectively impaired in aphasia. Individuals may have particular problems with 'core' aspects of meaning, or thematic aspects of meaning, or both (Byng 1988; Nickels et al 1991; Byng et al 1994; Marshall, Pring, Robson & Chiat 1996; Marshall et al 1997; Kemmerer 2000; Randrup-Jensen 2000; Shapiro & Caramazza 2002).

Both 'core' and thematic aspects of meaning are directly related to certain aspects of events that are relevant for their communication. 'Core' aspects of verb meaning relate to specific features of the event that differentiate it from other similar events, while thematic aspects of meaning relate to the structure of the event itself and the roles that participants play in the event. Problems with one or both of these aspects of linguistic meaning may interact with event conceptualisation, by failing to direct attention to the relevant aspects of events. In other words, the reduced influence of "top down" linguistically-mediated constraints might affect the process of "thinking for communication" itself (Black & Chiat 2000; Dipper et al 2005). Evidence from studies that implicate a semantic source of verb and sentence processing deficits in aphasia will be discussed in Section 3.2 below.

Another account of verb deficits proposed for some individuals with aphasia is a problem with the retrieval of the phonological or orthographic representation of the verbs, equivalent to the 'lexeme' in Levelt's (1989) model of speech production (Berndt et al 1997b; Marshall, Pring & Chiat 1998; Rapp & Caramazza 1998; Dean & Black, in press). A single deficit at this post-semantic stage of language production is unlikely to be linked to event conceptualisation difficulties, either in terms of input or output. Most of the individuals reported with a problem confined to this level showed intact comprehension of verbs and sentences. Dean and Black's case, MH, also showed unimpaired performance on two non-linguistic event processing assessments[10]. Although a deficit at this level would have implications for the linguistic communication of events, in terms of failure to produce a label for the event, this should not affect non-linguistic communication, where no access to phonology or orthography is required. A deficit at this level is not directly addressed by this thesis. However, this source of deficit is not ruled out for the participants in the current study and might co-occur with other sources of deficit to affect performance.

3.1 Investigations of event processing in aphasia.

The interaction between how we conceptualise events and how we communicate about them has long been an area of interest in cognitive and psycholinguistic theory, but has received relatively little attention in the aphasia literature. The empirical evidence base is limited at present to four studies that explicitly propose a problem at the conceptual preparation level of processing as a possible source of impairment in aphasia (Marshall et al 1993; Byng et al 1994; Dipper 1999; Dean & Black, in press). A difficulty at this level is said to reflect a problem with the schematisation or 'paring down' process required to structure a complex conceptual representation of an event into a form suitable for communication, i.e. a problem with "thinking for speaking" (see Black & Chiat 2000; Dipper et al, 2005). This would predict specific effects on access to language, in particular access to core and relational aspects of meaning. It might also predict problems with communicating about events non-linguistically, since, as discussed in the previous chapter, many aspects of event conceptualisation and message preparation are likely to be shared by language and non-linguistic modalities (see Marshall et al 1999).

The important thing about these four studies is the fact that they used tasks that were designed to tap the conceptualisation of specific communicatively-relevant aspects of events without recourse to language. Thus performance on these

[10] *Event Perception Test* (Marshall, Chiat & Pring 1999) and Role Video (Marshall, Pring & Chiat 1993). See Chapter 4, Section 4.3.2 for full details.

tasks can be more certainly attributed to conceptual, rather than lexical, processing. The evidence from these studies indicates that, even when the participants did not have to produce or process language, they still showed specific difficulties with certain aspects of event processing, along the dimensions identified in Chapter 2.

A problem with appreciating the temporal structure of events was proposed as a source of deficit for participants LC (Byng et al 1994) and LS (Dipper 1999). Both these individuals had problems differentiating between dynamic events that unfold over time, and static, temporally uniform states, when assessed on non-linguistic tasks. In the Byng et al study, the task involved sorting pictures of situations into 'events' and 'states', while in the Dipper study, the task was to decide whether or not 'something was happening' in short video scenes. Byng et al concluded that LC had a marked impairment in even conceptualising that an event was occurring, and that this underlies her problems in describing events. This conclusion was supported by gains in verb retrieval following a therapy programme which focused on improving her awareness of the structure of visual events, including the roles of the participants and the nature of the action. Byng et al attribute these gains to an improvement in LC's ability to derive a conceptual representation of an event from a picture: "*she can now perceive that something is happening and that various entities are involved in that event*" (p329).

Both LC and LS also had difficulty identifying the relevant participant entities in events. For example, LC was reported to have more difficulty processing pictures that involved non-participant entities. It was suggested that she was unable to distinguish entities involved in the event from other entities that were present in the picture but not directly involved in the event. A similar explanation was put forward by Dipper to account for LS's performance on the Role Video (Marshall et al 1993, see chapter 4, section 4.3.1). LS made a number of role errors on both reversible and non-reversible scenes. Role errors on non-reversible scenes involve selection of a distractor entity that was present in the background of the video scene, but not participant in the event. For example, in the scene showing a woman mashing a banana, the 'role' distractor is a photograph of a mashed avocado, which had been present in the background throughout the *mashing* event.

The presence of role errors on the reversible scenes in the Role Video, as demonstrated by LS and two other participants in Dipper's study, RB and RK, is similar to MM, for whom the test was designed (Marshall et al 1993). This pattern of performance was interpreted as evidence of a problem appreciating role information in visual events. The reversible scenes in the Role Video involve interactions between two people and, according to Marshall et al, success on these scenes requires the ability to process and retain the specific roles performed by these participants, for example who was the source and who the recipient of a transaction (e.g. a man giving flowers to a woman), or who was the agent and who the goal of an action (e.g. a woman tripping a man). Appreciation of the roles of participants in events is related to the ability to appreciate the structure of the events themselves, i.e. who or what is involved and the nature of the relationship between them. Its parallel in linguistic communication is the assignment of thematic roles to noun phrases in descriptions of events. Assessment of MM's language processing revealed a similar problem with thematic aspects of verb and sentence meaning.

In addition to problems interpreting role information in visual events, MM also showed difficulty with processing specific features of events, such as direction of movement or manner of contact. This was assessed using another non-linguistic assessment, the Event Perception Test (Marshall et al 1999, see Chapter 4, section 4.3.1), which required non-identical events to be matched on the basis of these common features. For example, the stimulus might show water *pouring* from a bucket, while the target might show water *pouring* from a jug (see Chapter 4, Figure 4.2, p $). MM had greatest difficulty when the distractor item was closely related to the target, differing primarily in terms of manner, e.g. *pour/drip*, or direction, e.g. *fall/rise.* Marshall et al suggest that MM's representations of events are underspecified and lack the detail that would allow her to discriminate between these kinds of events. This problem was also hypothesised to underlie MM's difficulties with verb retrieval, since these aspects of events are those that make up the core semantic features of the verb. MM's spoken output was limited almost entirely to single words, with a striking absence of verbs.

Support for an event processing explanation of MM's verb and sentence processing difficulties comes from gains in sentence comprehension and production following therapy specifically targeting the conceptualisation of events. Therapy focused on identifying the roles played by participants in visual events and the nature of the action. The therapy was wholly non-linguistic, and did not target mapping roles onto linguistic structure in any way. Despite this, MM's production of verbs and two argument sentences improved, as did her comprehension of reversible active sentences. Marshall et al suggest that therapy encouraged MM to 'translate' a visual representation of an event into a conceptual representation that is appropriately structured for language, i.e. that specifies the nature of the event, the focus to be adopted and the roles played by the participants. This then provides a specification for verb retrieval and argument structure production. This kind of therapy therefore seems to be directly targeting the processes involved in "thinking for speaking".

Another individual who showed similar problems as MM on the Event Perception Test was EM, reported by Dean and Black (in press). EM also had particular difficulties with similar events that contrasted primarily in terms of manner of movement (e.g. *pouring/dripping*) or direction of exerted effort (e.g. *pushing/pulling*). Dean and Black propose that EM's event processing impairment, i.e. a problem with decomposing and isolating aspects of pictured events, plays a causal role in her verb retrieval deficit, since these processes are also necessary to verb selection. However, EM differed from MM in that she had no problems with the Role Video test, indicating that her ability to determine the roles of participants in visual events is unimpaired.

In the manual accompanying the published version of the Event Perception Test, Marshall et al (1999) suggest that problems with this test would predict difficulties not only in the linguistic communication of events, but also in conveying event information in non-linguistic modalities, such as gesture and drawing. They do not, however, give any indication of how these difficulties might manifest. The current investigation might therefore shed some light on this proposal. The Event Perception Test is one of the non-linguistic assessments used in this study. It is used alongside other assessments of event processing, including one which specifically investigates the ability to communicate about visual events non-linguistically, namely the experimental event drawing task (see Chapter 4, section 4.4.).

One further aspect of event processing that is crucial to "thinking for communication" is the ability to conceptualise information about the perspective from which to present a scene. All the participants in Dipper's (1999) study had problems with a task that involved the selection of a verb label to match a visual event that offered a choice of perspective, even in the context of strong visual cues to perspective. The scenes were manipulated to focus on one participant over another, for example by zooming in that participant, thus biasing the choice of verb label (see Chapter 4, section 4.3.2 for full details of this task). The task was designed so that conceptualisation of the scene would be formed prior to presentation of the lexical items, so as not to constrain or aid conceptualisation. This task differs from the others discussed so far in this section, in that it is not wholly non-linguistic. However it is included here, since Dipper hypothesises a problem with the identification of perspective in the visual event as the primary source of difficulty in this task for three of the five participants, LS, RK and RB. Two further participants, JF and LH, had problems with the perspective video task, even though they had not shown any other conceptual processing difficulties on other non-linguistic tasks, and had performed well on several word and sentence comprehension tasks. For these two participants, Dipper suggests that it is not possible to distinguish between a problem with identifying the perspective of the visual events and a problem with interpreting perspective information encoded in the meanings of the verbs, or a problem with both these aspects of processing.

A problem with interpreting the perspective of a visual event would have considerable implications for communicating about that event, especially if the event offers a choice of perspectives. This is particularly relevant to linguistic communication, since one's choice of perspective can direct the lexical label selected to describe that event. For example, the lexical labels *give* and *take* could equally be applied to a transactional event involving two people, depending on whose perspective one takes. The perspective choice offered by these situations might make them more difficult to label or describe than other situations with the same number of participants but where the possibilities for different perspectives are limited (Black & Chiat 2000; Dipper et al 2005; see Chapter 2, section 2.3.2).

Black & Chiat (2003b) suggest that perspective-taking may be connected with the argument structure of the relation one is trying to express: relations with more arguments are also relations where the number of possible perspectives increases proportionally. There is evidence that for some people with non-fluent aphasia, the number of arguments affects the likelihood of verb production (Thompson, Lange, Schneider & Shapiro 1997; Kim & Thompson 2000). These researchers found that verbs with three arguments were harder to retrieve than verbs with one or two arguments, even if only the verbs had to be produced. If the likelihood of verb production were related solely to the number of arguments associated with a verb, this would predict that verbs like *put* and *give*, both of which take three obligatory arguments, would be equally difficult to produce regardless of the nature of the participants in the event. If, on the other hand, the perspective options provided by the scene itself were a relevant factor, then there may be differences in terms of production between these two verbs. However, other evidence suggests that verb retrieval in non-fluent aphasia is influenced by a variety of different factors, which might interact with the number of arguments associated with a verb (Breedin et al 1998; Kemmerer & Tranel 2000; Kim & Thompson 2000; Schneider & Thompson 2003). Thus different explanations may have to be entertained for different individuals (Black & Chiat 2003b).

The current study specifically compares communication performance on events that involve a choice of perspective, namely *caused change of possession* (transactional) events involving two human participants, and events where perspective options are more restricted, i.e. *caused change of position* events, in which one human participant acts in relation to two inanimate objects (see Chapter 4, section 4.4). Although verb retrieval is not a feature of the event drawing task, problems with interpreting perspective in visual events might affect non-linguistic communication of events, particularly in terms of which entity in the event is foregrounded (see Chapter 2, sections 2.3.2, 2.4.1 and 2.4.2).

Problems with interpreting perspective information in visual events might also affect performance on comprehension tasks that involve verb- or sentence-to-scene matching, particularly when the verbs used differ primarily in terms of perspective (Black & Chiat 2000; Dipper et al 2005). Indications from the aphasia literature that this may be the case will be reviewed in the following section, which considers evidence for problems with aspects of linguistic meaning that are relevant to event processing.

3.2 Semantic accounts of verb and sentence processing deficits

Problems with accessing the full meanings of verbs have been suggested as a primary source of deficit for several individuals with aphasia, and have been linked to difficulties producing and understanding linguistic descriptions of events (Schwartz, Saffran & Marin 1980; Jones 1984; Schwartz, Linebarger, Saffran & Pate 1987; Byng 1988; Nickels et al 1991; Byng et al 1994; Schwartz, Saffran, Fink, Meyers & Martin 1994; Haendiges et al 1996; Berndt et al 1997b; Marshall et al 1997). Whilst these studies differ in methodology and emphasis, most of them highlight a correlation between problems in accessing verb-specific thematic and perspective information and problems in producing combinations of verbs and their argument phrases and in comprehending simple active reversible sentences, which require thematic role information for their interpretation (see Marshall 1995; Marshall et al 1999; Black & Chiat 2000). This is the basis of the "lexical (mapping) hypothesis", which proposes that the sentence processing disorder is itself a consequence of the lexical deficit for verbs and verb-related information. The suggestion is that failure to access the full lexico-semantic representation of the verb, including thematic aspects of its meaning, undermines access to its arguments and their roles and to lexically-specified information about how thematic roles are mapped onto sentence structure (Marshall 1995; Berndt et al 1997b). In other words, the lexico-semantic representation of the verb is not structured in sufficient detail or in the correct way to allow access to or integration with the rest of the linguistic system (Dipper 1999). However, it is important to note that the lexical hypothesis does not exclude the possibility that there may be individuals with aphasia for whom sentence construction and comprehension fails for other reasons unrelated to verb problems.

Reduced access to thematic information encoded with the verb would result in difficulties building up the semantic structure of the event, which would affect both comprehension and production of event descriptions. In terms of comprehension, this would impact on the ability to form a conceptualisation of the event described, in particular as regards the roles of participants in the event and the relationship between them. In terms of production, a failure to access role information associated with a verb might result in problems with adopting a focus on the event when attempting to describe it. For example, failure to appreciate that a verb includes the thematic roles of Actor and Theme might result in a failure to focus on the participants who play those roles in the visual event. These participants would not then be foregrounded, i.e. mapped onto positions of syntactic prominence, in the subsequent utterance. Thus there may be a problem with mapping the conceptual roles in a visual scene onto linguistic structure. This problem is also likely to affect performance in sentence comprehension tasks that involve matching linguistic and visual input.

This source of difficulty was proposed by Byng and colleagues for JG and AER, two individuals with non-fluent aphasia, who showed severely impaired access to thematic information in the context of good understanding of the 'core' meanings of verbs (Byng 1988; Nickels et al 1991; Byng et al 1994). A problem with the retrieval of the full semantic specification for verbs, in particular lexically-specified thematic role information, was hypothesised as the primary deficit for these individuals. Both JG and AER made significant improvements in verb and sentence production and in the comprehension of simple active sentences involving 'agentive' verbs following a "mapping therapy" programme aimed at making explicit the relationship between the roles of participants in a visual event and the position in a sentence of the noun phrases expressing those participants. Byng and colleagues suggest that the therapy had an impact on these individuals' ability to form a conceptual representation of an event, by increasing their awareness of the linguistic structure that can describe that event. For AER in particular, they suggest that the therapy may have enabled him to "formulate more structured event representations which specify who is the instigator of the action". During the initial comprehension stage of the therapy, particular emphasis was placed on identifying the 'agent' in a pictured event and on locating the agent as the subject of the corresponding sentence. According to Byng et al (1994), the prominent linguistic position of the agent resulted in increased awareness of the crucial role of the causal instigator in communicating about action events. Nickels et al (1991) state:

> *"Insofar as [AER] is now more aware of linguistic structure, as a result of therapy, he is now able to use this awareness at a conscious level to impose structure on a representation of an event. It would seem that this is likely to take the form of searching for the causal instigator of the event (agent) ... This process will in itself result in a refining or boosting of the semantic specification of the verb which facilitates its retrieval." (p 194)*

This interpretation of AER's performance is relevant in the context of this thesis, since it highlights the role that language can play in directing attention to specific communicatively-relevant aspects of events. In particular, AER's pre-therapy performance links problems with accessing thematic aspects of linguistic meaning with reduced attention to certain structural aspects of events, such as their causal structure and the related Cause/Actor role of the relevant participant. As discussed in the previous chapter, these aspects of events are crucial for their communication in both linguistic and non-linguistic modalities (see Chapter 2, Sections 2.1.1 and 2.3.2).

Problems with accessing verb-specific thematic and mapping information were also hypothesised for PB, a man with fluent aphasia reported by Marshall et al (1997). In comprehension tasks, PB was able to differentiate between related verbs like *eat* and *drink*, suggesting intact access to core meanings, but he had difficulty differentiating between verbs that differed primarily in terms of the mapping of thematic roles, for example *pour/fill*, *give/take*. PB made frequent assignment errors in production, and appeared to have particular difficulties with transactional events. For example, to describe a picture of a woman selling a cat to a man, he produced: *"One woman and a cat is buying the man and* *paying the money the till".* As discussed in section 3.1 above, transactional events offer a choice in perspective and can be described by two different verbs, depending on the perspective one takes on the event. The choice of verb reflects which participant is foregrounded in the event, and also requires appreciation of the perspective differences between the two verbs, e.g. that *give* foregrounds the source of the transaction and *take* the goal. A reliable clue to the perspective of these verbs is the syntactic position of its arguments, i.e. whether the Source or Goal occupies the prominent subject position. Thus comprehension and production of sentences involving these kinds of verbs requires access to verb-specific thematic role assignment information.

Like AER and JG above, PB made positive gains in both sentence production and comprehension following a "mapping therapy" programme that aimed to emphasise the links between the roles of participants in a visual transactional event and the positions of the relevant noun phrases in linguistic structure. PB's attention was directed in particular to the direction of transfer inherent in events like *give* and *take* and the directional roles of the entities involved in the event. Marshall et al suggest that therapy may have "restored information about perspective and about mapping between thematic and syntactic roles for these particular kinds of events" (p 875).

In certain situations, reduced access to verb-specific thematic information can be compensated for by the application of general mapping procedures, for example that the role of Actor is assigned to the first noun phrase in English. One individual who showed some ability to use this strategy is IB, reported by Randrup-Jensen (2001). IB showed preserved ability to generate simple sentence structures in written sentence production in the context of severe verb retrieval problems. He was able to retrieve correctly the noun labels for the agent and theme and map these onto the appropriate 'slots' around an empty verb slot. However, other aspects of his performance suggested that his access to verb-specific thematic information was reduced. For example, he over-applied the Actor-first heuristic to produce sentences that violated the verb's thematic or argument structure, e.g. "You fall eraser". In addition, like PB above, IB had particular difficulties with transactional verbs, which are reliant on verb-specific thematic information for their interpretation. For example, on hearing a sentence like *"The girl bought the cat from the boy"*, assignment of the role of Actor to the *girl* would not provide sufficient information to tell us whether she is the source or goal of the transaction.

Other investigators have also reported problems with transactional verbs (sometimes referred to as 'reverse role' verbs) in individuals with aphasia. For example, JG and BRB, studied by Byng (1988), both made significantly more errors on 'reverse role' verbs (e.g. *buy/sell),* than on 'reverse direction' verbs (e.g. *lift/drop*) and 'reverse action' verbs (e.g. *hit/miss*) in a task that involved matching a verb label to a one of two simultaneously presented video scenes. The scenes showed the target verb and its related counterpart. Similar results were reported for two individuals in a study by Breedin and Martin (1996) using a similar verb-to-scene matching task. These two individuals also had more difficulty with producing single verbs to describe these kinds of events.

One possible reason for the particular difficulty with transactional or 'reverse role' verbs demonstrated by these individuals is the increased need for the integration of conceptual and linguistic information. This is because, unlike 'reverse action' or 'reverse direction' verb pairs, both the verbs in a 'reverse-role' pair can describe the same visual event. Selection of the correct scene to match the target verb therefore requires the ability to retrieve the verb-specific thematic role and perspective information from the lexical entry of the target verb and to map this onto the information derived from analysing the perspective of the visual scenes (Byng 1988). As discussed in section 3.1 above, analysis of visual perspective may itself be an additional source of deficit for some people with aphasia (Dipper 1999). Thus the combination of reduced access to thematic and perspective aspects of linguistic meaning and difficulties interpreting perspective in a visual transactional scene might interact to affect performance on this task, resulting in what Black & Chiat (2000) refer to as a "processing double-whammy".

Specific problems with other kinds of verbs that involve a choice of perspective have also been reported for individuals with aphasia in reversible sentence-to-picture matching tasks. For example, Jones 1984 and Haendiges et al 1996 both found that more errors occurred with directional motion verbs, such as *chase/flee, follow/lead* in such tasks. Black and Chiat (2000) suggest that, in these scenes, there are fewer cues to distinguish the participant who is the more agentive, or the “anchoring point” from whose perspective the scene should be understood. A *chase/flee* scenes involve two human participants in symmetrical roles: both are moving and both are doing something. Thus both participants in these scenes are roughly equivalent in conceptual or perceptual agentivity.

The above findings are relevant to the current study, not only because they relate directly to the kinds of events under investigation, i.e. caused change of possession events, but also because they highlight the link between access to verb-specific thematic and perspective information and processing of role and perspective information in visual events (see Chapter 2, sections 2.3.2 & 2.3.3). One possibility, considered by Black and Chiat (2000) and Dipper et al (2005) is that reduced access to the perspective and role options available in one’s language may fail to supply the necessary constraints on perspective-taking and foregrounding when one is processing an event with the aim of talking about it. The result may be an increased reliance on perceptual and conceptual factors in both event description and in comprehension tasks involving verb or sentence-to-picture matching.

Some limited evidence that this may be the case comes from WH, a man with “agrammatic” aphasia reported by Chaterjee and colleagues, whose primary source of linguistic deficit was hypothesised to be a problem with verb-specific thematic and mapping information (Maher, Chatterjee, Gonzalez-Rothi & Heilman 1995; Chatterjee, Maher, Gonzalez-Rothi, & Heilman1995). In both event description and sentence-to-picture matching tasks involving reversible events, WH was found to use a “temporal-spatial strategy” of mapping the entity on the left of the picture to the noun phrase in sentence-initial position, regardless of the role of this entity in the event. This resulted in incorrect responses when the agent of the event appeared on the right of the picture. For example a picture of a circle kicking a square with the circle appearing on the right would be incorrectly matched to the sentence *"The square kicks the circle".*

The suggestion that the language impairment itself might affect the conceptual preparation stage of production is relevant to the current investigation, since, as discussed in Chapter 2, some aspects of conceptual preparation are assumed to be shared by linguistic and non-linguistic output modalities. Processing of role and perspective information in events are two such "modality-general" aspects. If a reciprocal relationship exists between the language impairment and event conceptualisation for the purpose of communication, this would predict a similar increased reliance on perceptual and conceptual factors in graphic event communication for individuals whose access to thematic and perspective-related aspects of verb meaning is reduced. The current investigation can shed some light on this issue, by comparing individuals' graphic event communication abilities with their language processing abilities. Comparisons between participants, in particular, should yield some relevant information.

Another source of verb-related deficit for some individuals with aphasia is a problem in accessing 'core' aspects of verb meaning. These specify the precise nature of the event occurring and, in some cases, restrict the nature of the participants involved. They also enable one event to be distinguished from other similar events that differ in terms of specific features such as the manner of the action, e.g. *throw/drop* or the direction of the movement, e.g. *drop/lift.* Thus a problem with 'core' aspects of verb meaning might predict difficulties in comprehension tasks involving semantically-related verbs and in semantic errors in verb retrieval.

These were precisely the kinds of problems shown by RG, a man with fluent aphasia reported by Marshall et al (1996), who showed a clear dissociation in his ability to process 'core' and thematic aspects of verb meaning. RG made semantically related errors in both production and comprehension tasks, for example he produced '*swing*' for *skip* and selected a picture of *skate* in response to the target *slide.* In contrast, his understanding of relational aspects of meaning was very strong. He could identify characters in pictured reversible events by their role with respect to the verb. For example, on hearing a sentence like *"Aberdeen is chasing Ealing",* he could reliably pick out the Aberdeen or Ealing characters by using the information that they were either chasing or being chased. He was also able to pick out characters in pictured transactions in response to questions like *"Which one is taking?".*

Marshall et al suggest that a possible source of RG's problems with specific aspects of verb meaning is a difficulty in accessing concrete, perceptually-based aspects of meaning. This was supported by other aspects of his performance, such as an overall advantage for verbs over nouns, and a reverse concreteness effect for nouns. Thus the more visual properties of verb meaning, such as the manner of the action, were hypothesised to be impaired, whereas more abstract features, such as functional and relational aspects, remained intact (see also Bird, Howard & Franklin 2000, 2002). This analysis of RG's performance is relevant to the current thesis, since it suggests a link between the conceptualisation of specific aspects of visual events or scenes and access to 'core' aspects of verb meaning. In RG's case, the conceptual problem is hypothesised to underlie his difficulties with understanding and producing specific verb labels.

The consequences for the graphic communication of events of a problem restricted to 'core' aspects of verb meaning and/or a problem with processing specific features of a visual event are not altogether clear. As discussed in Chapter 2, these aspects of events may not be so relevant to the graphic output modality, due to the absence of a graphic equivalent to a verb label. The event drawing task will be able to shed further light on this issue.

3.3 Summary

The evidence from the aphasia literature reviewed in this chapter is highly relevant to the concerns of the current thesis, since it highlights some possible links between event conceptualisation and verb and sentence processing impairments in aphasia.

Section 3.1 presented evidence demonstrating that problems with processing certain communicatively-relevant aspects of events can occur even on tasks where no language is involved. These problems at the conceptual preparation level affect the schematisation of events resulting in conceptualisations not optimally structured for communication, either in language or in non-linguistic modalities. The specific patterns of performance shown by the individuals discussed in Section 3.1 indicated that event conceptualisation for communication is internally complex, involving a number of separable aspects of event processing that may be differentially or multiply impaired in aphasia. The interaction between these different aspects of event processing is one of the key concerns of this thesis. This is reflected in the design of the current study, in particular the experimental event drawing task, which allows for concurrent analysis of a number of different communicatively-relevant aspects of event conceptualisation, including those identified as problematic for the individuals discussed here. Comparison between participants is also a feature of the design, which should reveal any patterns and dissociations that will add to the current limited evidence base on event conceptualisation problems in aphasia and their effects on the ability to communicate about events.

The evidence presented in Section 3.2 showed that some individuals with aphasia have particular difficulties with aspects of linguistic meaning that are directly related to particular aspects of events identified as important for their communication. Problems with thematic and perspective-related aspects of verb meaning, in particular, are related to the interpretation of the structure of events and the roles of participants in those events. Problems with 'core' aspects of meaning are related to processing specific features of visual events. Reduced access to one or more of these aspects of verb meaning will have a number of consequences for event conceptualisation and communication. In terms of comprehension, it would undoubtedly result in difficulties forming a conceptualisation of an event from linguistic input. In terms of production, reduced access to the full lexico-semantic representation of a verb would result in problems in producing linguistic descriptions of events. This may be characterised by a failure to retrieve an appropriate verb label, and problems in constructing a semantic structure for a sentence. These linguistic impairments might also interact with event conceptualisation, due to the reduced influence of linguistically-mediated constraints on this process. This may in turn result in problems structuring conceptualisation in a way optimally organised for communication (Black & Chiat 2000; Dipper et al 2005).

By extending the investigation to non-linguistic communication, the current study should provide further information about the interaction between event processing and impaired language in aphasia. If language impairment itself affects the process of event conceptualisation, then greater difficulties might be expected when language is least available as a source of constraint. Comparisons between participants and across the visual and linguistic modalities in the current study should highlight any correlations between the extent and nature of the language impairment and problems with particular aspects of event conceptualisation. The following chapter provides details of the design and methodology of the current investigation.

Chapter 4

METHODOLOGY

The study comprises a series of single case studies of seven participants with severe aphasia. The single case study methodology was felt to be most appropriate for this study for a number of reasons. Firstly, the difficulty in finding a homogenous group of people with aphasia is well-documented (Howard & Hatfield 1987; Schwartz 1987; Byng 1988; Berndt et al 1996). Secondly, as discussed in Chapters 2 and 3, both language processing and event conceptualisation involve a number of separable abilities, which may be differentially affected in aphasia. Thus individual strengths and deficits need to be identified on a case-by-case basis, in order to reveal information about different possible sources of underlying deficit for similar surface symptoms, and about the consequences of these deficits for different individuals (Berndt 1987; Byng et al 1994; Fox & Fried-Oken 1996; Berndt et al 1997b).

This chapter will cover the following:

- Procedure for the selection of participants with aphasia and preliminary language assessments (Section 4.1)
- Background information about individual participants, including a profile of their language and communication abilities (Section 4.2)
- Details of further language and event-processing assessments used in the experimental stage of the study (Section 4.3)
- Details of the experimental event drawing task designed for the study (Section 4.4).

4.1 Selection of participants with aphasia

Participants were referred to the study by their local Speech & Language Therapist. The main criteria for inclusion were:

- Chronic aphasia resulting from a single neurological event
- No evidence of degenerative conditions or clinical depression
- No significant visual deficits, e.g. hemianopia or visual agnosia
- Severely restricted spoken and written output
- Ability to draw objects to command and from memory

No particular type of aphasia was specified, neither were there any restrictions in terms of level of auditory comprehension. The rationale for leaving the referral criteria relatively open and basing selection largely on output abilities was to recruit participants with a range of underlying language and event-processing abilities. Comparisons between participants should then allow for a more detailed characterisation of the relationship between specific aspects of event conceptualisation, language processing and event communication.

Prospective participants were visited in their homes and given more detailed information about the project, both verbally and in writing via an aphasia-friendly information leaflet (see Appendix A). Informed written consent was gained through the completion of a consent form in line with Ethics committee procedures of University College London (see Appendix B). Where possible a relative or friend of the person with aphasia was invited to take part in this initial meeting. A short screening assessment (see Section 4.1.1) was carried out to ensure that the criteria for inclusion were met. Of twelve people screened, seven matched the criteria. These participants were subsequently assessed on a number of preliminary language assessments, described in Section 4.1.2. The results of the screening assessment, preliminary language assessments and other observations are discussed in Section 4.2 in the context of individual language and communication profiles.

4.1.1 Screening assessment

The initial screening assessment was designed to assess picture comprehension and single item drawing ability. An 80% success rate on all sub-tests of the screening assessment was required for eligibility for the study. A full list of all the stimuli used in the screening assessment is provided in Appendix E. The screening assessment focused on three areas:

a) assessment of picture comprehension
b) assessment of drawing ability
c) informal assessment of spoken and written output.

A. Assessment of picture comprehension

This was assessed to ensure that participants had no difficulty in picture or object recognition and to rule out any broad problem with picture semantics. Two tasks were used:

1. Matching real objects to a corresponding line drawing (10 items).
   Participants were shown a real everyday object and had to select the corresponding line drawing from a choice of 3 related items.
   Example: real object FORK; choice of drawings: *fork, spoon, knife.*

2. Odd-one-out (10 items).
   This assesses the comprehension of semantic relations between pictured items. Participants were shown line drawings of three items from the same general semantic field, two of which were more related than the third. The task was to select the odd-one-out, or least related item.
   Example: Stimulus pictures: *pen, pencil, scissors*; Target: *scissors.*

B Assessment of drawing ability

The ability to draw objects was assessed to ensure that participants were able to access the visual forms of objects from memory and to represent them graphically. This involved three tasks:

1. Drawing everyday objects to verbal command (name prompt) (10 items).

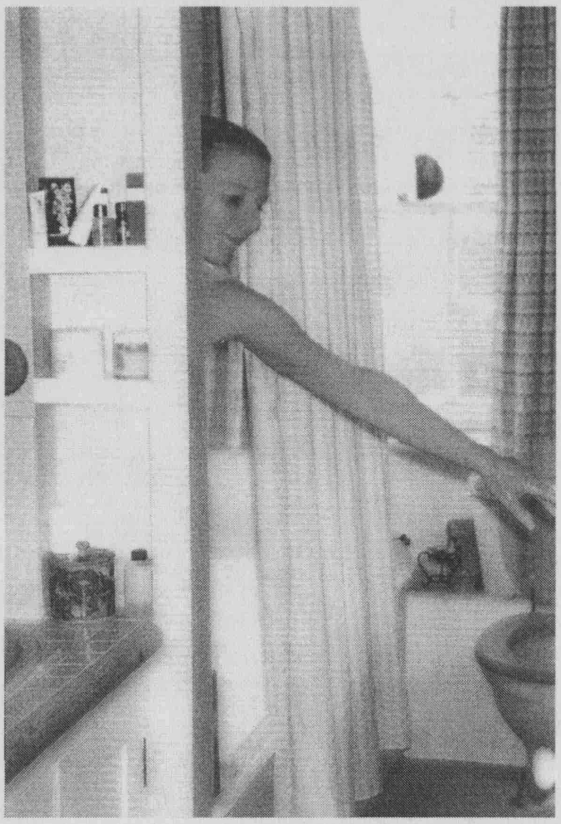
2. Complete the category (10 items).
   The investigator drew two items from within a semantic category and the participant had to draw a third item from the same category from memory.
   Example: Investigator draws *hat* and *scarf,* credit given if another article of clothing is drawn e.g. *glove, sock.*

3. Generative drawing assessment (Photographs) (30 items)
   This unpublished assessment was designed for a previous study investigating communicative drawing (Sacchett et al 1999). It assesses the ability to generate a sufficiently well-defined concept of an absent item within a given pictorial context to drive drawing of that item from memory.

Participants were shown a colour photograph of a person carrying out an everyday activity, in which a required object is missing or out of view and has to be inferred from the context. The task was to draw the missing object in response to the cue *"What does she/he need/want?"* For example, one photograph shows a woman stepping out of the shower and reaching out towards something which is out of view (see Figure 4.1). The expected response in this case is a towel. However, credit would also be given for other contextually plausible objects, e.g. a bar of soap or bottle of shampoo. Participants were told that the quality of the drawing was not important. Cues were permitted if participants had difficulty identifying the activity in the photograph. These consisted of pointing out and naming objects present in the photograph, specifying the location, and if necessary identifying the activity. The missing object was never directly named.

Figure 4.1

Example of photograph from Generative drawing test. Target item: towel



There are no published norms for this assessment, but it was piloted with 20 non-aphasic control participants prior to its use in the original study. The 30 items selected for use in this screening assessment were those for which there had been a high level of consistency of response in the pilot, i.e. where at least 18 of the 20 control participants had drawn the same object in their response. A full list of the stimuli is given in Appendix E.

C. Informal assessment of spoken and written output

Any spoken and/or written output language produced during conversation and in an informal action picture description task in the screening interview was recorded. To meet the inclusion criteria, participants should have only limited spoken or written output.

4.1.2 Preliminary Language Assessments

Prior to the experimental stage of the study, participants completed a number of published language assessments, in order to provide an overview of their language functioning in a range of production and comprehension tasks. A brief description of the assessments and their purpose follows.

A. *Western Aphasia Battery* (WAB; Kertesz 1982)

This was carried out to determine the severity of aphasia for each participant, to gain an overview of their language functioning and to a broad clinical classification. The test involves sampling of a small number of items in a range of expressive and receptive language tasks. Any spoken production was tape-recorded and transcribed.

B. *Object and Action Naming Battery* (Set A, numbers 1 – 50, Druks & Masterson 2000)
This was carried out to assess participants' naming of nouns and verbs in response to picture stimuli. The nouns and verbs are matched for frequency, imageability, age of acquisition and familiarity. Participants were given the choice of spoken or written naming. Spoken responses were tape-recorded and transcribed.

C. *Test for Reception of Grammar, Auditory version* (TROG Bishop 1982)

This was carried out to broadly assess participants' comprehension of a variety of sentence constructions. The test involves selection of a picture from a choice of four that matches a spoken word, phrase or sentence. Distractors may be lexical or syntactic or both. There are 80 items in total, ranging from single words, through simple sentences, to complex syntactic structures such as embedded sentences.

D. *Psycholinguistic Assessment of Language Performance in Aphasia: Sub-test 47* (Kay, Lesser & Coltheart 1992).

This was carried out to assess single word and picture semantics for objects. The test involves selection of a line-drawing of a single object from a choice of 5 on an A4 size page, in response to its spoken word equivalent. Distractors are semantically and/or visually related to the target.

4.2 Participants with aphasia

The seven participants recruited to the study were 5 male and 2 female monolingual English-speakers. They all have aphasia resulting from a single neurological episode, which occurred at least one year before the start of the study. All participants were pre-morbidly right-handed, but now use their left, non-preferred hand for writing and drawing due to right hemiplegia or hemiparesis. The mean age for the participants with aphasia at the start of the study was 63 with a range of 54 to 74. Demographic information on the participants with aphasia is presented in Table 4.1 overleaf. Table 4.2 shows the individual participants' results on the screening assessments described above.

TABLE 4.1 Demographic information on the participants with aphasia

Name	Age	Sex	Current hand use	(Former) Occupation	Age left F/T education	Time post-onset	Aetiology
JOK	74	M	Left	Research scientist	21	2y 3m	L hemisphere infarct
PZ	57	F	Left	Secretary	18	2y 2m	L CVA
JT	74	F	Left	Farmer's wife	15	2y +	L CVA
BP	54	M	Left	Company director	21	5y +	L CVA
DN	66	M	Left	Bank manager	18	1year	L CVA
DA	55	M	Left	Council worker (manual)	16	4y 5m	L cerebral haemorrhage
JIK	58	M	Left	Bus driver	15	7y 7m	L MCA infarct

TABLE 4.2 Individual participants' results on Screening Assessments (expressed as %)

	Match objects to pictures	Odd-one-out	Draw objects to command	Complete the category	Generative drawing assessment
JOK	100	80	100	100	93.3
PZ	100	80	100	100	93.3
JT	100	80	100	100	83.3
BP	100	90	100	100	100
DN	100	80	100	100	93.3
DA	100	80	80	100	86.6
JIK	100	90	100	100	83.3

A brief summary of the backgrounds and individual language and communication profiles of each of the participants is given in the following sections, based on the results of the screening and preliminary language assessments, informal observations and discussion with participants and their families. A more detailed breakdown of individuals' performance on the preliminary language assessments is provided in Appendix F. Examples of spoken or written picture description are provided where available, taken from the informal picture description task in the screening assessment and the WAB picture description task, which requires participants to describe a composite scene, using sentences if possible. The scene shows a man and a woman having a picnic near a lake. The woman is pouring a drink and the man is reading a book. A car is parked nearby. In the foreground another man is walking his dog. In the background a boy is flying a kite. Also in the background are a sailing boat on the lake, some trees and a boathouse.

4.2.1 JOK

JOK, a retired government scientist, sustained a left fronto-parietal stroke in 2000 at the age of 72. This resulted in right hemiparesis, dysphasia and oral/articulatory dyspraxia. He made a good physical recovery from his stroke, and is independently mobile, walking with a stick and driving an adapted car. He has not regained function in his right arm and hand. JOK is a widower, who lives alone, with a son, daughter and grandchildren living nearby. He maintains an active lifestyle despite his persisting difficulties in communication, and has many friends and social contacts. JOK had regular speech and language therapy for about one year after his stroke, targeting speech production, auditory memory and sentence comprehension. Drawing was not specifically targeted in therapy. JOK now attends a local dysphasia support group twice weekly, but receives no other therapy.

JOK was previously right-handed, but switched to left-hand use with ease following his stroke. He uses both writing and drawing spontaneously in conversation. His spontaneous drawing consists mainly of single objects, for example, he drew a canal boat when asked about his hobbies. JOK had little difficulty performing the screening assessments. He was able to generate recognisable drawings of objects with ease, requiring very little cueing in the Generative Drawing Test, suggesting good recognition of the pictured situations.

Language profile

TEST	SCORE
WAB	AQ: 17.8 Classification: Broca's
TROG	62/80
Object & Action Naming Battery	Objects: 44/50 Actions: 18/50
PALPA 47	38/40

The WAB gave JOK an AQ of 17.8 and classified him as non-fluent. The AQ calculation only takes account of spoken output and not written, and perhaps gives an overly negative indication of the severity of the language deficit in JOK's case. His spoken output is limited to a few words such as *"Yes"*, *"Bye Bye"*, *"but"*, *"because"*, whereas his access to written word forms is considerably better: he can write the names of people, places and objects, times and dates. However, his spontaneous written output consists mainly of single nouns or an unordered string of nouns, with no verbs or sentence structure (see Box below). Interestingly, JOK indicated that he was aware that his picture descriptions were incomplete by writing *'VERBS – NO'*, which suggests a degree of insight into his problems.

JOK Written picture description

A. Action pictures

Target	**Response**
Man ironing shirt	*Shirt, iron, boy, iron table**
Boy putting money into piggy bank	*boy, money, elephant*
Boy taking off his pyjamas	*shirt, boy, trousers, arms*
Girl laying table	*girl, table, china, knife, spoon, fork,*

B. WAB

Path River House Garage Cup, drink Kite Boat Book Tree

* intended target = ironing board

JOK's relative difficulty accessing verbs was confirmed by his performance on the Object and Action Naming Battery, carried out in the written modality. The difference between his object score and his action score was highly significant ($\chi^2 = 26.53$, df 1, $p < 0.0001$). However, in contrast to his spontaneous output, he *was* able to access the written form of a number of verbs. The majority of these were produced as infinitives, but he produced five *'-ing'* forms. Most of his errors in action naming were noun errors in which he produced the name of an object pictured in the stimulus e.g. "wall" for *leaning*, "toy" for *playing*. However, there were several ambiguous responses, which could have been a stem noun or a verb infinitive e.g. *drink* or *slide*. A full transcript of JOK's responses in the Object and Action Naming Battery is provided in Appendix G.

JOK has good comprehension for informal conversation. He responds appropriately to questions and copes well with changes of topic. His performance on the TROG revealed good comprehension at single word and simple sentence level, but problems with longer, more complex sentences, in particular reversible and embedded sentences. JOK's comprehension of single nouns is intact with no evidence of semantic problems (PALPA 47).

4.2.2 PZ

PZ worked as a secretary in a nursing home prior to sustaining a left fronto-parietal stroke in 1999 at the age of 55. This resulted in right hemiparesis, aphasia and 'verbal apraxia'. PZ has made a good physical recovery from her stroke and is independently mobile, though remains unable to use her right arm. She lives with her husband and one adult son and has two other sons living elsewhere. PZ received twice weekly Speech & Language Therapy at her local hospital for 2 years after her stroke. Therapy was aimed at improving spoken and written production of single words and did not target drawing. She now attends a local stroke support group once weekly, and receives no other therapy. PZ uses her left, non-preferred hand for writing and drawing. She does not draw spontaneously in conversation, but will do so when prompted. PZ performed the screening assessments with ease. She had little difficulty with generating drawings of objects, and required little cueing in the Generative Drawing Test, suggesting that she could interpret the scenes easily.

Language profile

TEST	SCORE
WAB	AQ: 14.8 Classification: Broca's
TROG	49/80
Object & Action Naming Battery	Objects: 36/50 Actions: 1/10
PALPA 47	37/40

The WAB gave PZ an aphasia quotient of 14.8 and classified her as nonfluent. As with JOK above, the AQ calculation may give an overly negative indication of the severity of PZ's language deficit, since it only takes account of spoken and not written output. PZ's spoken output is limited to "Yes". Her spontaneous written output consists of single nouns and numbers. In constrained tasks such as picture description, she produces mainly strings of nouns, though she makes some attempt at sentence structure when specifically requested to do so (see Box overleaf). In her WAB description for example, words other than nouns are included, although these are not always structurally appropriate. There is one acceptable sentence and one attempt at producing a predicate structure, although the only verb that is used is *be*. Spelling errors are also in evidence, e.g. "spectules" for *spectacles.*

PZ: Written picture description

A. Action pictures

Target	**Response**
1. Boy putting money into piggy bank	*money - pigtail*
2. Boy getting undressed	*T-shirt with*

B. WAB

The dog is . . . Pasons Jack Russell Terrier.

The lady is . . . .who . . . .(points to drink in lady's hand) .... *grass* of* (points to drink).

*The gentlmens who spectules**, book* (crosses out book), *kite, yacks* (crosses out yacks) *yauks*** . ... trees, car, banglow*****

Intended targets: *glass, ** spectacles, ***yacht, **** bungalow

In the Object and Action Naming Battery (written modality), PZ's object naming was significantly better than her action naming ($\chi^2 = 11.06$, df 1, $p < 0.001$). She was able to access 36/50 nouns. Her errors were mainly semantic errors, e.g. "moon" for *circle*, "shirt" for *collar*. In contrast, she had great difficulty with the action naming section, producing only one correct verb and requesting that the test be discontinued after ten items. On these ten items, she usually named an object in the picture, e.g. "lion" for *roaring*, "mug" for *drinking*. PZ's performance would imply that she has problems with both noun and verb retrieval, but has a specific verb retrieval deficit. A full transcript of PZ's responses in the Object and Action Naming Battery is provided in Appendix G.

PZ's auditory comprehension is relatively good in informal conversation. She understands questions and instructions and can follow changes in topic. Her performance on the TROG revealed good comprehension at single word and simple sentence level, but some difficulties with more complex language, in particular reversible and embedded sentences. Her comprehension of single concrete nouns is intact with no semantic deficit (PALPA 47).

4.2.3 JT

JT, a farmer's widow, had a left temporo-parietal stroke in 1999 at the age of 72, resulting in right hemiparesis and a diagnosis of *"moderate receptive and severe expressive dysphasia"*. She has made a good physical recovery from her stroke and is independently mobile, though retains some loss of function in her right arm. She lives with her daughter, son-in-law and 2 teenage grandchildren. She attends a stroke support group twice weekly, and receives speech and language therapy at a community clinic once weekly. Drawing is not specifically targeted in therapy, but may be used as part of a total communication approach to improve functional communication.

JT does not use drawing or writing spontaneously in conversation, her preferred modality being speech. She uses her left, non-preferred hand for writing and drawing. She performed the screening assessments with ease and had no difficulty with generating recognisable drawings of objects. Little cueing was needed in the Generative Drawing Test, suggesting that she was able to recognise the pictured scenes.

Language profile

TEST	SCORE
WAB	AQ: 47.6 Classification: Conduction
TROG	62/80
Object & Action Naming Battery	Objects: 15/50 Actions: 8/50
PALPA 47	37/40

The WAB gave JT Aphasia Quotient of 47.6, which is the highest score amongst the participants with aphasia, due largely to the fact that she was able to produce some spoken output. Her classification of fluent-type aphasia also differentiates her from the other participants. Despite these differences, she was considered to fulfil the criteria for inclusion which stipulated severely limited spoken or written output. Her fluency rating was only 5/10 on the WAB.

JT's conversational speech consists mainly of unintelligible words and phrases, interspersed with long pauses and set phrases such as "*You know*", "*Oh well.*" Occasional intelligible words are produced although these are not always appropriate to the context, and there is some evidence of perseveration. Her spoken output is similar in constrained tasks like picture description (see Box overleaf). She produced only two appropriate nouns: "*Man"* and "*dog".* There were some unrelated words, e.g. "*bush", "baby*" and some neologisms. Some sentence structure was attempted, but she produced only two recognisable verbs: "*be*" (possibly intended as part of the progressive) and "*go*" in the perseverative phrase "*go to school".* JT does not use writing spontaneously in conversation, but in a constrained task, her performance is similar to her spoken output (see Box overleaf).

JT: Picture description

<u>*A. Action pictures, spoken*</u>

Target	**Response**
1. Man ironing shirt	*/waɪən wɪndi:/ /s sku:l/ and the man .... Man... /sku:l/* (points to shirt)
2. Boy taking off pyjamas	*oh well he's .... Oh he's /lɛrɪn ku:l/ bush you know, bush*

<u>*B. WAB Spoken*</u>

Well..... /baik/ (points to kite) ...... (unintelligible) ...... */gɒg/* (dog) *and a /kənəkəz/ baby .... and a go to school* (points to tree) *and a school* (points to man) */ləli:z/*

<u>*C. WAB Written*</u>

Then Boy went TO give the fyl

Then the tea that your partel

Dog love gond good give live (illegible)

Pint on any

JT's Object and Action Naming Battery performance revealed difficulty in naming both nouns and verbs. Her most frequent errors in both object and action naming were neologisms. In action naming she had difficulty restricting her responses to one word and tended to produce neologistic jargon. Noun errors were present but were produced within a string of unrecognisable jargon, for example for *blowing,* she produced "*/kri:m/ and a <u>leaf</u> and a leaf /skri:m/*" (the target picture shows leaves blowing in the wind). A full transcript of JT's responses in the Object and Action Naming Battery is provided in Appendix G.

JT's auditory comprehension is relatively good in conversation. She has little difficulty following questions, instructions and changes in topic. Some difficulties are apparent with more complex language, as shown by her TROG performance, where she had difficulty with passives and sentences involving embedded clauses. Semantics for single concrete nouns is largely intact (PALPA 47).

4.2.4 BP

BP had a left hemisphere stroke in 1994 at the age of 46, resulting in a right hemiparesis and severe aphasia. Details of lesion site are unavailable. He made a good physical recovery from his stroke and is independently mobile, though has no functional use of his right arm. BP was managing director of an importing company at the time of his stroke, but has not returned to work. He lives with his wife. He had regular NHS-based speech and language therapy for 2 years following his stroke, and subsequently attended a university-based aphasia centre for 2 years. Details of his previous speech and language therapy were unavailable, but he reports that drawing was not targeted. He currently attends a dysphasia support group twice weekly.

BP uses his left, non-preferred hand for writing and drawing. He uses drawing spontaneously in conversation, for example he drew a map of Europe when discussing his work, and he drew the pedals of a car when discussing difficulties with driving. Attempts to write single words in conversation are frequently misspelt, e.g. *broke* for *brake*, or incomplete, e.g. *Jap* for *Japan.* BP performed all the screening assessments with relative ease. He was able to generate drawings of objects from memory, but required some cueing in the Generative Drawing Test to help him identify the event in the photograph.

Language profile

TEST	**SCORE**
WAB	AQ: 40 Classification: Broca's
TROG	45/80
Object & Action Naming Battery	Objects: 23/50 Actions: 11/50
PALPA 47	36/40

The WAB gave BP an AQ of 40 and classified him as non-fluent. His spontaneous spoken output consists mainly of single content words and some set social phrases such as "*all right*", "*Good lord!*". He often repeated back words produced by the interlocutor. In constrained tasks like picture description, he produces very limited sentence structure (see Box below). Only one verb was produced, in the context of the phrase: "*leave it!*" indicating he could not get the word he had been searching for. He also produced semantic errors, e.g. *flag* for kite, phonemic errors and neologisms .

BP Spoken picture description

A. Action pictures

Target	Response
1. Man ironing	(gestures) */kə/ no .... Em .... Good lord .../s/*
2. Girl laying table	*fork...fork...no...cup, no no no ...em em plate, plates*
3. Boy putting money in piggy bank	*ten ... piggy back ...eh /kə kə/ one*
4. Boy getting undressed	*No ... eh* (points to clothes)...... *leave it!*

B. WAB

Wine ... book .... Em...em .....(6 secs)...*em eh* (gestures holding kite) .... *Eh /bənd/ dog ....em ...a /k/ ...em tree... car...fern .../b/ /w/ /k/ em em em em house, well..... /pf/. . . /baŋgləʊ/ .... Eh /s/ ..../f/ em, no ....damn, damn, damn /pɒnt/ /pɒntin/ no /flæd/ flag* (gestures holding kite) ..... */k/ flag, no ... oh dear, damn. No,,no.*

On the Object and Action Naming Battery (spoken), BP produced a number of nouns and some verbs, although his scores on both sections were below 50%. Object naming was significantly better than action naming (χ^2 = 5.39, df 1, $p <$ 0.05). Error analysis revealed semantic errors in both object and action naming. However, BP often seemed aware that he had accessed the wrong name and rejected his related errors. In object naming his semantic errors were usually a related noun, e.g. *"orchestra"* for *conductor*, *"furrow"* for *tractor*, but he occasionally produced a related verb or adjectival phrase, e.g. "*Hang in ... screen*" for curtain, "*winding...path, no*" for road. In action naming he occasionally produced a related verb, e.g. *"carrying"* for *riding, "burning"* for *lighting.* However, most of his action naming errors were noun errors, (N = 22) where he named an object that was present in the picture, e.g. *"ball"* for *kicking*, *"shoe"* for *tying.* Sometimes these would act as a cue for the production of the verb e.g. *"cup ... tea ... drinking, hooray!".* A full transcript of BP's responses in the Object and Action Naming Battery is provided in Appendix G.

BP's poor performance on the TROG indicates significant problems with auditory comprehension. Difficulties were revealed at all levels of this test, including single word and simple sentences, as well as complex sentences. BP's score on the PALPA word to picture matching test was slightly lower than the norm of 38 and above, but this difference was not significant. All of his errors were close semantic distractors which might be indicative of a mild semantic deficit at single word level.

4.2.5 DN

DN is a retired bank manager who had a left frontal stroke with parieto-temporal involvement in 2001 at the age of 65. This resulted in right hemiparesis and "severe receptive and expressive dysphasia". He is able to walk unaided for short distances, but has no use of his right arm. DN lives with his wife and has two adult sons living nearby. He attends a dysphasia support group twice weekly, and receives speech and language therapy at his local hospital once weekly. Therapy is mainly targeting auditory comprehension. Drawing is not specifically targeted, but is encouraged as part of a total communication approach to improve functional communication. DN uses some drawing in conversation when prompted, usually single objects. He uses his left, non-preferred hand for writing and drawing. DN performed the screening assessments with ease and had no difficulty generating drawings of objects. He required very little cueing in the Generative Drawing Test, suggesting that he was able to understand these visually presented scenes.

Language profile

TEST	**SCORE**
WAB	AQ: 16.1 Classification: Broca's
TROG	52/80
Object & Action Naming Battery	Objects: 0/50 Actions: 0/50
PALPA 47	31/40

The WAB gave DN Aphasia Quotient of 16.1 and classified him as non-fluent. DN has no spoken output other than *'Yes'* and *'no'*. He attempts to write words when prompted, but produces unrelated strings of letters. DN was unable to complete the Object and Action Naming Battery, since he cannot produce any names of nouns or verbs in either the spoken or written modality.

DN's auditory comprehension appears good in simple conversation. He understood questions and followed instructions and changes in topic with little apparent difficulty. However, assessment on the TROG revealed some difficulty understanding more complex sentences, in particular sentences involving embedded clauses. He also made several lexical errors in the early part of the test, which may have been attributable to inattention, since he tended to rush into a response before looking at all the pictures on the page. This may also have affected his performance on the PALPA 47, where his score differed significantly from the normal score of 38 (Chi Square = 3.79, p = 0.05). He made mainly close semantic errors, which might suggest a semantic deficit at the single word level.

4.2.6 DA

DA was working as a council employee when he had a left MCA stroke in 1995 at the age of 48, resulting in right hemiparesis and severe aphasia. He has not returned to work. He is able to mobilise independently around the home, but uses a wheelchair outside. He has no use of his right arm. DA lives with his wife and 3 teenage children. He received regular speech and language therapy for 18 months after his stroke. Details of previous therapy were unavailable, and DA and his wife recall only that writing was targeted. He attends a stroke group twice weekly and receives once weekly visits from a Dysphasia Support Service volunteer[11]. DA uses his left, non-preferred hand for writing and drawing. He uses some drawing spontaneously in conversation, for example drawing a road with lines when asked to talk about his work. DA performed well on the screening assessments. He was able to generate recognisable drawings of objects, but required some cueing on the Generative Drawing test,

[11] The Dysphasia Support Service is run by The Stroke Association. Trained volunteers support individuals with aphasia by visiting them in their homes and encouraging them to participate in communication-related activities.

suggesting that he may have difficulty comprehending the visual scenes in the photographs.

Language Profile

TEST	SCORE
WAB	AQ: 11.9 Classification: Broca's
TROG	46/80
Object & Action Naming Battery	Objects: 0/50 Actions: 0/50
PALPA 47	30/40

The WAB gave DA an AQ of 15.9 and classified him as non-fluent. DA has no spontaneous spoken output other than "*yes*" "*no*" "*Why?"* and *"Oh God!"* Written output is limited to his own name, the initial letters of highly familiar words, and some numbers. DA was not able to produce any names of nouns or verbs in the Object and Action Naming Battery either in the spoken or in the written modality.

DA was able to understand biographical questions and could follow simple instructions. However he had difficulty understanding more complex language, as shown by his performance on the TROG. He began to have difficulties at simple sentence level and had problems with negatives, comparatives, pronouns and embedded sentences. He made a variety of errors, including syntactic and lexical errors. Some of DA's comprehension difficulties may be attributable to a semantic deficit at the single word level. On the PALPA 47 his score differed significantly from the normal expected score of 38 (Chi square = 4.80, $p < 0.05$) and most of his errors were close semantic distractors.

4.2.7 JIK

JIK had worked as an HGV and bus driver prior to his left hemisphere stroke in 1994 at the age of 51. No details of lesion site are available. He was left with severe receptive and expressive aphasia, severe verbal apraxia and right-sided hemiparesis. He is able to walk short distances unaided, but has no use of his

right arm. JIK lives alone and has few social contacts. His ex-wife and four daughters live in Scotland. He had regular speech and language therapy for 18 months after his stroke, but details were unavailable. He now attends a dysphasia support group once weekly. JIK
uses his left, non-preferred hand for writing and drawing. He uses some drawing spontaneously in conversation, for example when asked about his work, he drew a bus. JIK performed well on all the screening assessments. He was able to generate drawings of objects, though he required some cueing in the Generative Drawing Test, which suggests that he may have had difficulty identifying the scene or situation in the photographs.

Language profile

TEST	SCORE
WAB	AQ: 14.2 Classification: Broca's
TROG	35/64
Object & Action Naming Battery	Objects: 0/50 Actions: 0/50
PALPA 47	37/40

The WAB gave JIK an aphasia quotient of 14.2 and classified him as nonfluent. JIK has no spoken output other than *"Yes"* and one repetitive meaningless phrase: /bʌʔəŋ biə/. His written output is limited to his name, some numbers used appropriately (e.g. his age, the time) and the initial letters of personally significant words (e.g. his daughters' names). JIK was not able to perform the Object and Action Naming Battery since he cannot produce any nouns or verbs in either the spoken or written modality.

JIK could understand simple questions about his life and family, but may well have been relying on key words. Comprehension breaks down when more complex structures are used, as shown by his performance on the TROG. JIK was unable to complete this test and asked for it to be discontinued after 64 items. He scored a total of 35/64. He had no difficulty at the single word level, but performance began to break down at simple sentence level, confirming a severe auditory comprehension deficit. His error pattern suggests difficulties with several aspects of sentence comprehension, both syntactic and lexico-semantic. JIK's comprehension of single nouns is largely intact, with no evidence of a semantic deficit at the single word level (PALPA 47).

4.3 Further Event-processing and Language Assessments

A range of non-linguistic and linguistic tasks was used to gain a more in-depth understanding of participants' language and event processing. The selection and design of specific assessments was theoretically motivated, on the basis of their relevance to "thinking for communication", as discussed in Chapters 2 and 3. Analysis of performance on these assessments provides a point of comparison for performance on the experimental event drawing task (Section 4.4) and contributes to interpretation of an individual's profile of strengths and impairments. Individual results are discussed in Chapter 6.

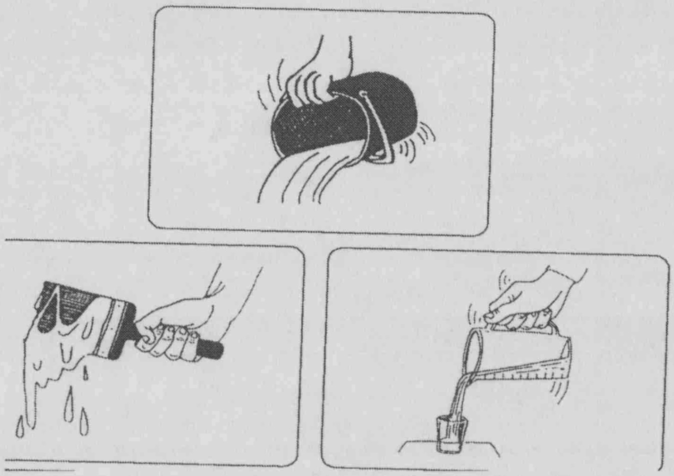
Several of the tasks used here were devised by previous researchers and are reported in the aphasia literature. Some were adapted for this study through the development of computerised versions of the tests. This was done for ease of administration and analysis. Computerised versions of video-based tasks obviated the problem of access to a VCR and television in participants' own homes. Recording and analysis of data was also simplified and included information about aspects of performance such as response times or number of repetitions, which might have a bearing on interpretation.

4.3.1 Assessments of event-processing with no language encoding

A. Event Perception Test (Marshall, Chiat & Pring 1999)

This test is designed to assess participants' ability to derive linguistically-relevant semantic information from pictures of events. It requires non-identical events to be matched on the basis of common features, such as direction of movement or manner of contact. Participants were presented with three pictures of different events on an A4 page. The top picture represents the stimulus. Underneath are two further pictures, one of which depicts a similar event (the target) and the other a distractor. Participants were instructed to indicate which of these two pictures showed a similar event to the stimulus. For example, in Figure 4.2, the target is on the right, since it shows a similar *pouring* event to the stimulus, while the distractor is on the left, showing a *dripping* event. There are three practice items, in which any errors can be explained and the correct response demonstrated.

Figure 4.2.
Example of one stimulus from Event Perception Test (reproduced from Marshall et al 1999)



The test has 60 items. In 40 items, the distractor is semantically related to the target event, e.g. in terms of manner or direction. In some items, the distractor differs from the target only in terms of direction (push/pull) and this represents a close semantic distractor. In others, the distractor differs from the target in terms of manner but shares the same direction (push/throw) and this represents a distant semantic distractor. In the remaining 20 items the distractor is not related to the target event. A full list of the stimuli in the Event Perception Test is found in Appendix H.

The original test was piloted with 10 non-aphasic people, who all made three errors or fewer, most of which were close semantic. According to the test authors, to succeed on this test, participants must be able to a) recognise pictures, b) retrieve the semantic properties of the pictured events and c) pair the target with the stimulus picture on the basis of shared semantic information.

Success on this task therefore reveals abilities in linguistically-relevant event analysis relating to verb selection. Chance performance or a random pattern of errors would suggest problems either with understanding the task or with recognition or interpretation of pictures of events. Predominantly semantic errors would suggest difficulty either with retrieving full semantic information from pictures of events and/or with analysing this information. The authors propose that problems with this test would also predict difficulties in conveying event information in non-verbal modalities such as gesture or drawing (Marshall et al 1999), and this is therefore highly relevant to this study.

B. Role Video (Marshall, Pring & Chiat 1993)

This test is designed to assess participants' ability to identify and process the roles of entities participating in enacted visual events. This assessment is relevant to this study for two reasons:

1) it compares performance on non-reversible and reversible visual events, which is also one of the manipulations of the experimental event drawing task.
2) it includes some change of position and change of possession events, which are the types of events used in the experimental event drawing task.

The Role Video consists of 32 scenes. 16 are non-reversible events showing people acting on objects (e.g. a woman closing a suitcase), and 16 are reversible events. The reversible events are further subdivided into 8 scenes showing one person acting on another and 8 scenes showing a change of possession. Participants view the scene then have to select from three photographs the one that represents the outcome of the event. The photographs consist of a) the target response, b) an event distractor, in which the target object or person has undergone a different outcome, and c) a role distractor, in which another object or person from the clip has undergone that outcome. In non-reversible events, the role distractor is an object present in the video scene but not directly involved in the event. In reversible events the role distractor transposes the two human participants. Examples of different event types and distractors are provided below. A full list of the stimuli in the Role Video is found in Appendix J

Examples of stimuli for the Role Video

1. Non-reversible event	Photographs	
Woman closing suitcase	Target	*Closed suitcase*
	Event distractor	*Open suitcase*
	Role distractor	*Closed box*
2. Reversible event: person acting on person		
Woman punching man	Target	*Man with eye-patch*
	Event distractor	*Man with wet hair*
	Role distractor	*Woman with eye-patch*
3. Reversible event: change of possession		
Man gives flowers to woman	Target	*Woman holding flowers*
	Event distractor	*Woman holding camera*
	Role distractor	*Man holding flowers*

According to the test authors, to succeed on reversible scenes it is necessary to process and retain the specific roles performed by participants in the event. People with difficulties conceptualising role information would be expected to make predominantly role errors on reversible events, where the role distractor transposes two of the roles, but not on the non-reversible events where no such transposition occurs. However, there may be additional difficulties with processing other aspects of visual events, which might result in a different error pattern. For example, problems with identifying the particular event that occurred might result in event errors on both non-reversible and reversible events. Likewise, role errors on non-reversible events might occur as a result of a problem identifying relevant participants and relations in a scene (Dipper 1999).

A computerised version of the Role Video test was developed for this study, which was piloted with 8 non-aphasic English-speaking adults. The mean score for the control participants was 29.65 with a range of 26 – 32. The control participants made more errors on reversible events and there were slightly more role errors than event errors, but neither of these differences was significant. A consistency analysis of errors and response times across stimuli showed that four items seemed to cause particular difficulty in this version of the test. The main difficulty with these items appeared to lie in the quality of the photographs. It was decided to retain them in the test, but to alert the participants with aphasia to aspects of these particular photographs that were difficult to see.

The video clips were presented on a 14" colour Dell Latitude laptop screen. Each scene was presented twice, followed by the photographs displayed on the left, centre and right of the screen. Participants responded by pressing an identified key corresponding to the position of the target photograph on the screen (Z key: left; B key: centre; M key: right). The remainder of the keyboard was obscured to avoid confusion, and the labels L, C and R were stuck over the keyboard letters. Participants were also given the option of pointing to the appropriate photograph directly on the screen, and the investigator then pressed the relevant key to record the response.

4.3.2 Assessments of language processing

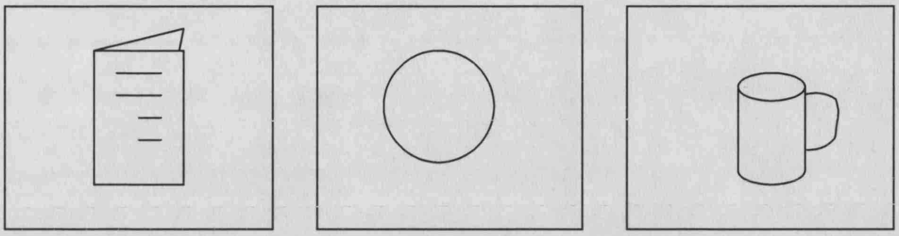
A. Noun pointing task

This task was devised for this study to assess participants' auditory short-term memory and to establish whether they could maintain a record of the phonological form of a sentence. More specifically, it assesses their ability to process and correctly maintain the linear order of noun phrases in a sentence. The task developed for this study is similar to that described in Byng et al (1994). Participants were shown an array of three or four line drawings of objects or stick people with proper names written below them. They had to (1) select the pictures from the array that corresponded to a verbally presented list of two or three nouns, or a sentence including two or three of the nouns and (2) place them onto a linear grid in the order in which they were mentioned. The positions of the pictures in the array were varied to ensure that they did not match the sentence order. One of the pictures in the array served as a distractor. An example is shown in Figure 4.3 overleaf.

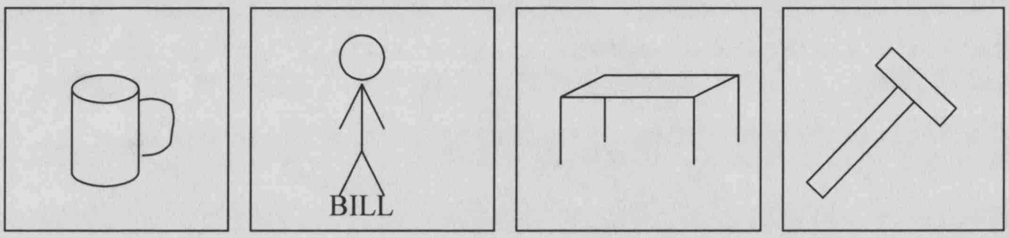
Figure 4.3

Stylised examples of picture arrays used in noun pointing task.

<u>Two noun list:</u> *"ball, book"*



<u>Three noun sentence:</u> "*Bill hit the table with the hammer*"



Placement on a linear grid was favoured over a pointing task for the participants in this study, as it provides some visual feedback about their response, allowing self-monitoring and, if necessary, self-correction. Responses were scored on the basis of the final placement of pictures on the grid, rather than the order in which they were selected. The objects used in this task were all highly familiar and included some of those that occur in the experimental event drawing task (see Section 4.4). Earlier assessments had confirmed that none of the participants had problems with object recognition. Single item semantics was also adequate to preclude failure due to non-comprehension of the noun labels. The sentence structures used in this task included both two- and three-argument sentences, the latter of which mirror the sentence forms to be used in the experimental event drawing task (see Section 4.4).

There were five levels of auditory stimulus with 10 items in each level. Examples of each level are provided in the box below, with the distractor underlined[12]. In levels 4 and 5, the distractor was either a plausible Instrument

[12] For convenience in tables and graphs, the labels 'name' and 'noun' are used to distinguish between proper names and general nouns, although it is acknowledged that proper names are also nouns.

(example a) or a plausible Theme (example b). In level 5 the position of the second proper name was varied, in order to reduce predictability. In half the sentences, the second proper name occurred as the second noun phrase, with the role of Theme, and the final noun phrase had the role of Instrument (example 5a). In half the sentences, the second proper name occurred as the final noun phrase, with the role of Goal, and the second noun phrase had the role of Theme (example 5b). A full list of the stimuli is provided in Appendix K.

Examples of stimuli for each level of the Noun Pointing Task

Level	*Stimulus*	*Pictures*
A. Noun lists		
1. Two nouns	*Mug, ball*	ball, mug, table
2. Three nouns	*Mug, ball, apple*	apple, table, mug, ball
B. Sentences		
3. Two names	*Anne saw John*	Anne, John, Mary
4. 1 name & 2 nouns	*John hit the ball with the bat*	a) ball, bat, John, hammer
		b) table, bat, John, ball
5. 2 names & 1 noun	*a) John hit Anne with the bat*	Anne, bat, hammer, John
	b) John brought a chair for Anne	Anne, cup, John, chair.

The task was piloted with 12 non-aphasic control participants, who all performed the task with little difficulty, making 2 errors or less. A number of possible error patterns may occur in this task. If more errors occur on three-item than on two-item stimuli in both noun lists and sentences, this would imply a deficit in auditory short-term memory. Equal numbers of errors on sentences and noun-lists, or worse performance on sentences, would suggest that sentence structure and meaning does not help with remembering the linear order of noun phrases around a verb. Better performance on sentences than noun-lists would suggest that sentence structure and/or meaning assists in the process of maintaining the form of the sentence.

Analysis of performance on this task includes analysis of the types of errors produced. The errors were classed as either lexical errors, in which an incorrect lexical item (i.e. the distractor) was selected, but correct order maintained, or sequencing errors, in which the correct lexical items were selected but placed in the wrong order on the grid. Responses which involved both selection of an incorrect lexical item and violation of order were counted twice, as both lexical and sequencing errors.

B. Reversible Sentences Comprehension Test (modified version: Auditory Singles) (Byng & Black 1999).

This test was carried out to assess participants' ability to comprehend different types of simple active reversible sentences. This assessment is relevant to this study, since both reversible and non-reversible sentences are used in the experimental event drawing task. In the 'Singles' version of the RSCT used in this study, participants have to decide whether a spoken sentence describing a reversible situation matches a single line-drawing of a situation. This version was chosen over the published 'Triples' version (Byng & Black 1999), so as to reduce the non-linguistic cognitive demands of the task, due to increased processing required to compare three separate pictures (Cupples & Inglis 1993).

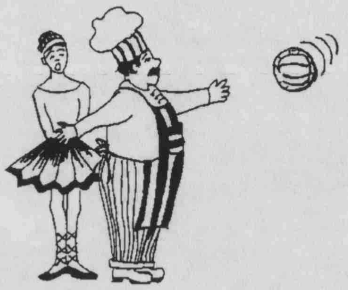
The Singles version comprises 80 items, 20 each of 4 different types of active reversible sentence:

a) Action verbs, e.g. *The cook protects the dancer*
b) Non-action verbs, e.g. *The dancer surprises the cook*
c) Be + adjective, e.g. *The dancer is sorry for the cook*
d) Locative, e.g. *The chair is on the box*

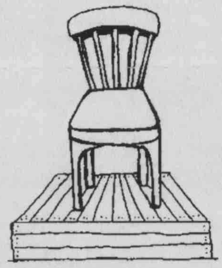
Each sentence occurs twice in the whole test, once with the correct picture (congruous) and once with a picture showing the reverse relationship (incongruous). For example, for the sentence *"The dancer surprises the cook"*, the incongruous picture would show the cook surprising the dancer. Examples of congruous and incongruous items are provided below (Figure 4.4 overleaf). To avoid the effects of learning, the test is divided into two sets of 40 items, which were carried out on separate occasions with at least a week between them. A full list of the stimuli is provided in Appendix L.

Figure 4.4:
Examples of congruous and incongruous stimuli in the Singles version of the RSCT (reproduced from Byng & Black 1999)

A) Congruous

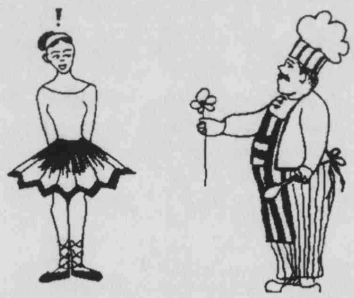


The cook protects the dancer



The chair is on the box

B) Incongruous



The dancer surprises the cook

The dancer is sorry for the cook

A previously piloted computerised version of this assessment was used in this study. Participants heard a recording of the sentence, followed by a line drawing of the scene, displayed in the centre of a 14" laptop screen. The sentence can be repeated as often as necessary. At the same time as the picture, the words YES and NO appeared on the left and right of the screen respectively. Participants were instructed to press a key on left side of the computer keyboard marked with a Y, if the sentence matched the picture or a key on the right marked with an N, if the sentence and the picture did not match. The remainder of the keyboard was obscured and only these two keys left in view. As an alternative to the keyboard, participants were given the option of pointing to the words YES and NO written on the left and right sides of a piece of A4 paper. The investigator then pressed the appropriate key on to record the response. If participants responded verbally with "Yes" or "No", but failed to point to a written label or press a relevant key, the response was checked by the investigator so as to avoid errors due to Yes/No confusion, which is a common feature of severe aphasia. To ensure that participants understood the task, three non-computerised practice items using different stimuli were used. Any errors on the practice items were corrected and explained.

Some unpublished normative data are available for the computerised Singles version of the RSCT. In two separate trials, each with 18 non-aphasic adults, the mean number of errors over all verb sets was low: 5.95 and 3.65, with fewer errors occurring on action verbs and locatives than on non-action verbs and adjectives. Additionally, in all sentence sets, control participants made more errors on incongruous items than on congruous items.

Interpretation of performance on this test is complex, since the test taps a number of different linguistic and non-linguistic processes. Failure on this test could therefore reflect breakdown or impairment of many different types of process. An error could be a result of incorrect interpretation of the sentence, or a problem in the translation between pictures and language, or a problem in picture recognition itself (Byng & Black 1999). Performance on this test therefore needs to be viewed in the context of other assessments of language and event-processing.

C. Perspective Video (Dipper 1999, unpublished)

The aim of this test was to assess participants' ability to: a) conceptualise a visually presented event and encode the perspective to be taken on it; and b) use this information to access the appropriate lexical (verb) label. Although only the verb, and not the whole event, is encoded linguistically in this assessment, it was included under the heading of "linguistically encoded events", since it involves selection of a relational linguistic term. This assessment is relevant to this study, since the event drawing task includes events which differ only in terms of perspective on the same event, e.g. *give/take.*

Participants were shown a silent video clip of an event, which could be described by two different verbs depending on the perspective taken. They then had to select from three written verb labels the one that most closely describes the event. The Perspective Video test aims to constrain selection of the verb by using visual means to focus on one participant in the event, thus biasing perspective choice. The task was designed so that conceptualisation of the event would take place before the presentation of the verb labels, so that the labels would not constrain or aid conceptualisation.

The test consists of 18 short silent video scenes. 12 of the scenes depict events that involve the movement of a Theme from one place or person (Source) to another (Goal) e.g. *pour/fill, buy/sell,* and 6 scenes depict events in which an Actor acts on a Theme e.g. *push/pull, ride/carry.* The full list of stimuli is provided in Appendix M. Three different scenes of the same event are used:

a) unbiased
b) biased to Source or Actor
c) biased to Goal or Theme

The 'biased' scenes are visually manipulated to predict the perspective choice by zooming in on one of the participants. The three verb labels consist of the target verb (i.e. the verb that describes the scene from the perspective of the focused participant); the 'perspective error' (i.e. the verb that describes the event from the perspective of the non-focused participant); and a distractor verb that describes an event similar to the target in terms of participant entities, thematic role assignment and event type. The biased scenes would predict selection of one verb over the other. For example, in a *ride/carry* event, the choice of verb would be biased to *ride* by zooming in on the rider shortly after the start of the scene. In the unbiased condition, both participants are given equal prominence and remain in view throughout the whole scene. This allows a free choice of perspective and either of the two verbs would be an acceptable response. Thus there is no 'perspective error' option in the unbiased scenes.

This test was piloted with 12 non-aphasic controls who all scored at ceiling (Dipper 1999). Because this test involves both conceptual processing of a visual event and selection of a lexical label, interpretation of errors is complex. The presence of predominantly perspective errors could indicate either a problem with the identification of the perspective of the visual event, or impaired/ underspecified representation of the meaning of verb, or both. A third possibility is that the lexical labels corresponding to the two alternative perspectives on the event are both equally activated, but no selection is made between them (Dipper 1999). The presence of both perspective and distractor errors could indicate a more general difficulty with conceptualising visual events and/or understanding verb meanings.

A computerised version of this assessment was developed for this study, using digitalised versions of the original video clips. The clips were presented in the centre of a 14" Dell Latitude lap-top computer screen. Both the order of the scenes and the position of the target verb label on the screen were randomised for presentation. 6 training scenes were presented before the test proper to explain the test requirements. Each scene was shown twice. The three written verb labels were then presented on the left, centre and right of the screen. Selection was made by pressing a corresponding key from a choice of three marked keys on the computer keyboard. The position of these keys corresponded to the position of the verb labels on the screen: Z key for the label on the left of the screen, B key for the middle label, and M key for the label on the right. To avoid confusion, the remainder of the keyboard was obscured, so that only these three keys were in view, and labels with the letters L, C and R were stuck over the keyboard letters. Participants were also given the option of pointing to the verb label directly on the screen, and the investigator then pressed the appropriate key to record the response.

4.4 Experimental event drawing task

This task was designed for this study to investigate and compare participants' ability to form conceptualisations of events from visual input (visual condition) and from linguistic input (verbal condition), and to use these conceptualisations to drive graphic communication of these events. The aim of the task is to identify specific aspects of event conceptualisation or sentence processing that may cause difficulties for individual participants with aphasia. Since the visual condition requires no overt linguistic encoding, performance can more certainly be attributed to conceptual processing, without the confounding effects of any linguistic problems at the phonological or syntactic level. Comparison of individuals' performance across the visual and verbal conditions, which differ in terms of input modality but share a common non-linguistic output modality, should provide further insights into the relationship between event conceptualisation and language impairment. Similarities in performance across the two conditions would argue for a more generalised deficit with event structure processing, while problems that occur only in one condition would be indicative of specific difficulties with processing events from that particular input modality. The event drawing task allows for analysis of multiple aspects of processing, and can therefore provide information both about intact and impaired abilities. This is achieved by means of a number of theoretically motivated qualitative analyses of the process and product of the drawings produced by participants. These are described in Section 4.4.4 below.

4.4.1 Event types and manipulations

Participants were required to communicate, using only drawing, single caused change of location events presented on short video clips and similar events described by a simple sentence. The rationale and theoretical motivation for choosing these particular kinds of events was discussed fully in Chapter 2.

<u>Variable 1: Event type</u>
Two different types of caused change of location events were used in the event drawing task:

1) caused change of possession events, e.g.

 a) "*Mary gives the book to Bill*"

 b) "Mary takes the book from Bill",

2) caused change of position events, e.g.

 a) "*Mary puts the book on the table*"

 b) "Mary takes the book off the table".

These event types share the same structure, in that they involve a Cause (Mary) acting on a Theme (the book) resulting in its movement to or from a Goal or Source (Bill/the table). However, they differ in the number of animate entities involved, and this may affect the ease with which they are processed in both the visual and verbal conditions. Perceptually, change of possession events offer a choice of perspective options: the same scene can be interpreted as a *giving* event or a *taking* event, depending on whose perspective the event is viewed from. In change of position events, we are more likely to take the perspective of the single animate entity (see Chapter 2, Sections 2.3.3 and 2.4.1).

Linguistically, the sentences used to describe change of possession events are reversible, while those describing position change events are non-reversible. Reversible sentences rely more on the integration of linguistic sources of information, since there are no semantic/pragmatic clues to thematic role information (see Chapter 2, Section 2.2). This manipulation will henceforth be referred to as the variable 'Event type'.

<u>Variable 2: Cause-role</u>

A further manipulation in the task design was variation in the direction of the Theme's movement in relation to the initiator, or Cause, of the event. In half the events, the Cause entity was co-referential with the Source of the Theme's movement, as in examples 1a) and 2a) above. These will henceforward be referred to as *give/put*-type events, but may be abbreviated to CS (Cause = Source) in graphs and tables. In half the events the Cause entity was co-referential with the Goal, as in examples 1b) and 2b) above. These will henceforward be referred to as *take/pick*-type events, but may be abbreviated to CG (Cause = Goal).

For the purpose of clarity, in the subsequent discussion the label 'Cause' will be applied to the initiator of the event, regardless of his or her role as either the Source or Goal. The labels 'Source' and 'Goal' will be reserved for describing entities that are not co-referential with the Cause entity. The label 'Cause-role' was selected for this variable, since the co-referential role of the Cause might influence performance in both the visual and verbal conditions of the event drawing task. Perceptually, causality may be perceived more easily in scenes where the Theme starts off with the Cause and moves away from it, i.e. in *give/put*-type events, than in scenes where the initiating movement of the Cause does not immediately effect a corresponding movement in the Theme, i.e. in *take/pick*-type events (see Chapter 2, Section 2.4.2). Linguistically, access to directional information encoded in verb meanings is required and this may be a problem for some of the participants.

4.4.2 Stimuli

A. Visual condition

The stimuli in the visual condition were 32 short digitised video clips (edited to 1 – 3 seconds duration) of a single caused change of location event. Each clip is animated and totally silent.

16 clips showed caused change of possession events, and 16 showed caused change of position events. These were further subdivided into *give/put*-type events and *take/pick*-type events. Thus each stimulus was assigned to one of four stimulus groups, with a total of 8 items in each group. Examples are provided below. A full list of the visual stimuli is provided in Appendix N.

	Give/put-type	*Take/pick*-type
Change of possession	Girl gives flower to boy	Boy takes apple from girl
Change of position	Boy puts book on table	Girl lifts box off table

The inanimate entities in the clips were selected on the basis of familiarity and ease of drawing. Many of the items have simple basic shapes (e.g. ball, book, box) with few necessary distinctive features. The same human entities appeared in all the visual stimuli: a boy and a girl, easily distinguishable by clothing and hairstyle.

A number of perceptual factors were controlled for in the visual stimuli, based on evidence from event perception (see Chapter 2, Section 2.4), as follows:

- The clips included only the entities actually participating in the event. They were filmed against a neutral background, with no extraneous items in view. One exception to this was the scenes showing *buy* and *sell* events. Here some background was provided to "set the scene", for example a table with a number of items "for sale".

- The clips showed clearly defined single events with a perceived beginning and end, and were neutral in focus. All three entities were present throughout the clip, and the camera angle was stable. At the start of the clip, all three entities were static. The visual stimuli were carefully constructed to make the Cause entity as easily identifiable as possible. The beginning of the event was signalled by an initiating movement by the Cause entity involving only his/her hands, arms or upper body. The entity playing the role of Source or Goal remains static or passive throughout the event. The end of the event was signalled by the Cause returning to stasis.

- The position of the Cause entity on the screen was balanced across the variables of Event-type and Cause-role, i.e. the Cause entity appeared on the left of the screen in half the clips and on the right in the other half.

- The gender of the Cause entity was balanced across the variables of Event-type and Cause-role, i.e. in half the clips, the Cause entity was represented by a boy and in the other half, by a girl.

To ensure that the video clips were an unambiguous representation of the intended event, they were shown to a group of 8 non-aphasic English speakers who were asked to write a short sentence describing "*the main thing that happens*". Video clips were only used if all 8 judges correctly interpreted and described the event by producing an acceptable verb and all its arguments. Some variation in the choice of verb was allowed (e.g. *"snatch"* or *"grab"*) as long as the event type, perspective and focus of the event was maintained.

B. Verbal condition

The stimuli in the verbal condition were 32 digitally recorded sentences describing caused change of location events. 16 sentences described caused change of possession events and 16 described caused change of position events. These were further subdivided into *give/put*-type events and *take/pick*-type events. Thus each stimulus was assigned to one of four stimulus groups, with a total of 8 items in each group. Examples are provided below. A full list of the verbal stimuli can be found in Appendix N.

	Give/put-type	*Take/pick*-type
Change of possession	Mary gives the flower to Bill	Bill takes the flower from Mary
Change of position	Bill puts the book on the table	Mary picks the book off the table

The same inanimate entities were used as in the visual condition. Animate entities were identified by the proper names "Mary" and "Bill". A number of linguistic factors were controlled for in the verbal stimuli, as follows:

- A range of verbs expressing change of possession and change of position was selected to sample a variety of verbs of transaction or transfer. Each verb was used at least twice.

- Simple active declarative sentences were used throughout, with verbs in the present tense and the definite article used with inanimate nouns. The rationale for using the present tense was so that the stimuli would remain neutral regarding the focus of the event. Although use of the present tense with progressive aspect is more common when talking about events, it was felt that this might focus people onto the initiating act and process of transfer, whilst backgrounding the end point of the event. Similarly use of the past tense might bias people to focus on the completed event i.e. the end point.

- The syntactic structure of the sentences remained constant throughout. The structure used was NP $_{VP}$[V NP PP]. This structure was selected to incorporate the whole of the causal event, including the resulting State. Maintaining a constant structure also controlled for specific verb-related differences, such as number of obligatory arguments (e.g. *put, give*: 3 obligatory arguments vs. *throw, grab, sell*: third argument optional), or optional argument structures (e.g. *give, throw*: can occur in V NP NP or V NP PP frame vs. *grab, put*: cannot occur in NP NP frame).

4.4.3 Procedure

Participants were required to produce a total of 64 drawings of events over a minimum of two sessions, 32 in response to a video clip (visual condition) and 32 following a spoken sentence (verbal condition). The participants with aphasia all completed the visual condition first, which was hypothesised to be the easier task for them, to ensure they had understood the task requirements. In order to minimise the possibility that learning across tasks would affect the overall results, there was an interval of at least one week between the two sessions.

The order of presentation of the stimuli within both conditions was randomised. Each stimulus was presented twice on a 14" colour-screen portable computer (Dell Latitude C610) prior to the commencement of the drawing. Further repetitions were permitted at the participant's request with no limit on the number. Each drawing was produced on a separate sheet of A4 paper using a black fibre-tip pen. No time limit was set for the task.

Participants with aphasia were provided with a verbal explanation of the task requirements, supported by gestures, modelling and a written/pictorial instruction sheet (see Appendix P). They were instructed that their task was to draw *"the main thing that happens"* as if they were trying to *"get it across to somebody else"*.

Participants were given no specific training in drawing and it was stressed that the quality of their drawings was not important. Prior to commencing the task they were shown still photographs of the objects and people involved in the events and could practise drawing these if required. They were instructed to draw stick figures to represent people, and to differentiate between genders by drawing females wearing a skirt. They were also told that the use of symbols such as arrows or £ sign was permitted, but that no written words were allowed. Examples of this were provided by the investigator, but were removed from view prior to the start of the task. Participants were advised only to include details that were directly relevant to the main event. In addition they were advised to draw the event in a single drawing if possible.

Prior to its use with the participants with aphasia, the event drawing task was piloted with 12 right-handed, non-aphasic control participants, matched to the participants with aphasia on gender, age, education and occupation. Half the control participants completed the visual condition first, and half completed the verbal condition first. Control participants were given the same verbal instructions as the participants with aphasia, supported by a written instruction sheet (see Appendix Q). The main purpose of the control study was to provide a point of comparison for the performance of the participants with aphasia, since little is known about how people with no language impairment would approach this task. Control participants' drawings were subjected to the same analyses as those of the participants with aphasia (Section 4.4.4 below), with the aim of identifying any regularities in performance. The results of the control study provided information about:

a) strategies typically used by control participants to indicate specific aspects of the events;
b) the interaction of input and output modality constraints and the resultant effects on graphic communication of these kinds of events.

The results of the control study are presented and discussed in the following chapter. The results for the individual participants with aphasia are discussed in Chapter 6.

4.4.4 Analysis of data

A number of analyses were carried out on both the product and the process of participants' drawings in the event drawing task. These analyses are theoretically driven and relate to different aspects of event structure processing identified in the literature review in Chapter 2. The aim and motivation for each analysis is described below, together with some predictions for the performance of the control participants. Predictions for the performance of the participants with aphasia will be discussed in the following chapter, in the light of the results of the control study.

Analysis 1. Number of repetitions required

The number of repetitions required should provide some indication of the ease with which each stimulus was processed and/or remembered. Differences in the number of repetitions required between the visual and verbal conditions of the task would indicate that one or other input modality is more difficult to process. Within condition differences might indicate specific effects related to the variables of Event-type and Cause-role. The number of repetitions required for each stimulus was automatically recorded by the computer programme.

Analysis 2. Number and type of entities included in drawings

The purpose of this analysis was to determine whether participants selected and included all and only the relevant entities in their drawings. The relevant entities are the Cause, the Theme and the Source/Goal. This analysis was motivated by evidence that some people with aphasia have difficulty identifying the relevant participants in an event (Byng et al 1994; Dipper 1999). It was predicted that the control participants would only include entities that are involved in the target event, and would not omit entities that play an integral role in the event. The number and type of entities included was recorded post-hoc from participants' completed drawings. The addition, omission or substitution of entities and their role in the event were recorded.

Analysis 3: Use of arrows

Two analyses of arrow use were carried out post-hoc on the completed drawings: a) a quantitative analysis of overall occurrence of arrows and b) a qualitative analysis of the position and direction of the arrows relative to other entities in the drawings.

The basis for these analyses is evidence indicating that arrows may be used to signal action, and spatial and temporal direction in graphic representations of events (Tversky 1997; see Chapter 2, Section 2.4.3). The inclusion of arrows in participants' drawings might be one way of indicating the temporal structure of the events, i.e. that they involve change over time. The position and direction of the arrows would also indicate appreciation, or otherwise, of specific action-related and directional aspects of the events.

Analysis 4: Entity drawn on left of page

This analysis aimed to identify whether there was consistency in terms of which entity was drawn on the left of the page. Differences across the visual and verbal conditions were predicted, due to the interaction between input modality factors and the graphic output modality constraint of "start drawing on the left of the page" (see Chapter 2, Section 2.4.1). In the visual condition, it was predicted that control participants would replicate screen position in their drawings i.e. the entity that appeared on the left in the video clip would be drawn on the left of the page. In the verbal condition, the first-mentioned entity in the stimulus sentence, i.e. the Cause, would be most likely to be drawn on the left of the page due to its position of prominence in the sentence (Chaterjee et al 1995).

The entity drawn on the left of the page for each stimulus in the visual and verbal conditions was recorded by the investigator at the time of production. In the visual condition, the entity that was drawn on the left was co-referenced with the position of the relevant entity on the screen.

Analysis 5: Spatial location of the Theme

The purpose of this analysis was to determine whether participants preferentially drew the Theme at or nearer to either its start position or its end position. The terms 'start position' and 'end position' are used in this analysis as inclusive labels for both the Cause entity and the Source/Goal entity. This analysis is based on the hypothesis that the location of the Theme in people's drawings would provide an indication of their choice of 'primary reference object' (Talmy 1983). This might affect temporal foregrounding choices in drawing, since the reference object is generally drawn before the Theme (van Sommers 1984).

Selection of a primary reference object may be influenced by perceptual/ conceptual factors, such as the relative stability of the entities involved (see Chapter 2, section 2.4.1). This might result in differences between the visual and verbal conditions, and/or differences across the variable of Event type. In position change events, the inanimate Source/Goal entity may be perceived as more stable, while in possession change events, neither of the two animate entities immediately fulfils the perceptual/conceptual criteria for primary reference object.

Consistent location of the Theme at either its start position or its end position might also indicate a particular focus on the beginning point or end point of the event. This might in turn suggest that directional information in the stimulus has been appreciated, provided that there is evidence from other aspects of performance that the causal and temporal structure of the events has been processed. The position of the Theme relative to other entities was recorded post-hoc from the completed drawings.

Analysis 6: Temporal order of drawing of three main entities

The purpose of this analysis was to identify any regularities in the temporal order in which the three main entities, Cause, Theme and Source/Goal, were drawn. This analysis is based on evidence reviewed in Chapter 2 suggesting that the temporal order of drawing of entities is one way of indicating foregrounding choices in graphic communication of events (see Chapter 2, sections 2.3.3. and 2.4.2). The assumption here is that the entity that is drawn first is given primary prominence, equivalent to the linguistic prominence afforded to sentence-Subject position in English. This then provides a "viewpoint" or perspective for potential interpreters from which the event has to be understood, directing observers to attend to that entity before others (Black & Chiat 2003a). The temporal order in which the entities are drawn may therefore provide some indication about participants' focus or perspective on the event. However, as discussed in Chapter 2, foregrounding choices in graphic communication are constrained by the interaction between output modality factors and factors related to the input stimulus, which give prominence to specific features of events. This may result in differences in foregrounding choices between the visual and verbal conditions, even amongst people with no language impairment.

In the visual condition, foregrounding choices are likely to vary across the variables of Event type and Cause role, depending on the interaction of a number of perceptual and conceptual factors which affect the relative salience of different entities (see Chapter 2, Sections 2.4.1 and 2.4.2). These factors were carefully controlled for in the development of the visual stimuli (see Sections 4.4.1 and 4.4.2.A above). They are:

a) Animacy: animate entities are generally more salient than inanimate. This factor would predict differences in foregrounding between position change events, where there is only one animate entity (i.e. only one candidate for the role of Cause) and possession change events, where there are two.
b) Agency/initiator of the event: the initiator of an event receives more attention than other entities, particularly if our intention is to communicate about what we see.
c) Start position of the Theme: perception of causality is easier in scenes where the Theme starts off with the Cause and moves away from it. This would predict differences in foregrounding between *give/put*-type and *take/pick*-type events.
d) Screen position: the entity on the left of the screen is more likely to be foregrounded when communicating about events.

It was predicted that the Cause entity would be more likely to receive primary foregrounding in situations where a number of these factors act in congruence to increase its prominence. In situations where the Cause is less prominent or where there is a choice of perspective, participants may rely more on perceptual factors to guide their foregrounding choices, even when there is no language impairment. However, as discussed in Chapter 2, language impairment might result in an increased reliance on perceptual factors across all scenes, which in turn would imply a failure to attend to or process the causal structure of the events.

Foregrounding choices in the verbal condition are more straightforward, since the strong linguistic foregrounding is likely to be reflected in participants' drawings. The prediction for the control participants is that the Cause entity, which appears in sentence-initial Subject position (i.e. the position of greatest linguistic prominence) is more likely to be drawn first throughout the verbal condition.

The data for this analysis were collected by the investigator during the production of the drawings, by recording the order of drawing of the three main entities directly onto a computer data file. These data were then transferred to Excel and SPSS files for analysis.

Chapter 5

CONTROL STUDY: RESULTS AND DISCUSSION

This chapter presents the results of the various analyses of the process and product of control participants' drawings. For each analysis, evidence from the visual and verbal conditions is discussed and comparisons between conditions are made where appropriate. The results are reported on a group basis, with individual performances referred to where required. The aim is to identify any regularities in performance across participants on each analysis, which would provide some indication of particular strategies employed by the control participants to communicate various aspects of the events via drawing. There follows a discussion of the implications of these findings for foregrounding choices in graphic communication of caused change of location (CCL) events (Section 5.3). This focuses on characterising how the interaction between input- and output- modality constraints influences this process. The final section of the chapter summarises the main findings of the control study and discusses their implications for the performance of the participants with aphasia.

5.1 Control participants

The participants in the control study were twelve monolingual English adults with no history of brain damage or disease, clinical depression or mental illness. There were eight men and four women, with a mean age of 58 years (range 44 - 72). All participants were right-handed and none had had any formal artistic training. Control participants were recruited from amongst the investigator's acquaintances. They were selected to match six of the participants with aphasia in terms of age (+/- 10 years), gender and educational level[13]. Prior to the study, they were given verbal and written information about the aims of the study and the extent of their involvement, and written informed consent was obtained in line with Ethics committee procedures of University College London (see Appendices C and D). Demographic information for the control participants is presented in Table 5.1.

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[13] The seventh participant with aphasia, DN, was recruited to the study after the control study had taken place and therefore has no matched control.

TABLE 5.1. Demographic information for Control Participants

Name	Age	Sex	Hand use	(Former) Occupation	Age left F/T edu.	Aphasic match
JH	56	F	Right	Secretary	18	PZ
HH	48	F	Right	Classroom assistant	18	PZ
RS	73	M	Right	Building engineer	21	JOK
JZ	69	M	Right	Company executive	21	JOK
TH	50	M	Right	Mechanic	16	JIK
DEB	58	M	Right	Builder/decorator	15	JIK
JA	48	M	Right	Airport baggage handler	16	DA
RW	54	M	Right	Groundsman for council	16	DA
MW	48	M	Right	Solicitor	23	BP
AS	46	M	Right	Computer analyst	21	BP
JR	72	F	Right	Housewife	15	JT
HS	72	F	Right	Office clerk	18	JT

5.2 Results of analyses

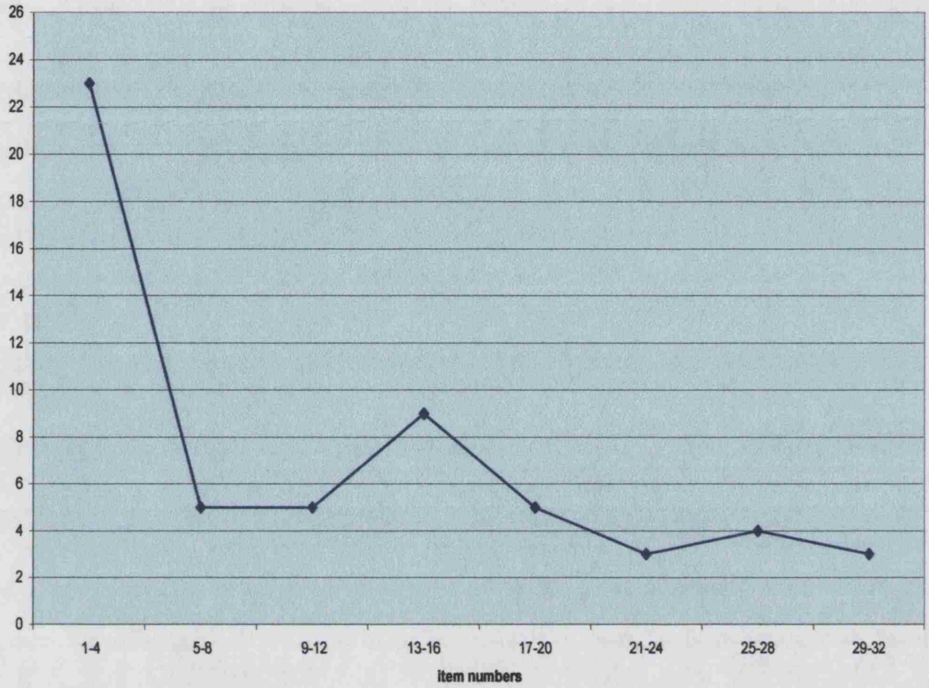
5.2.1 Analysis 1: Number of repetitions

Results

The number of repetitions required by each control participant for each stimulus was recorded. In the visual condition, the mean number of repetitions per participant was 4.92, with a range of 2 – 10, and the mean number of repetitions per item was 1.844. In the verbal condition, the mean number of repetitions per participant was 0.5, with a range of 0 – 3, and the mean number of repetitions per item was 0.016. Analysis revealed a significant between-condition difference in the total number of repetitions required (χ^2 = 43.22, df 1, $p < .0001$). Control participants required significantly more repetitions in the visual condition than in the verbal. There were no effects of either Event type or Cause role.

A learning effect was noted in the visual condition. The stimuli were grouped into sets of four according to their order of occurrence in the task. The majority of requests for repetition occurred on the first four items, with requests dropping sharply after that and remaining more or less stable (Figure 5.1). Item-by-item scrutiny showed a particularly high level of requests for repetition on items 1 and 4. Item 1 incurred 10 requests, which differed significantly from the mean (Binomial, two tailed $p < .05$). Item 4 incurred 7 requests, which neared significance in comparison to the mean (Binomial, two tailed $p = 0.07$).

Figure 5.1.
Number of repetitions requested by control participants in the visual condition as a function of order of stimulus items



Discussion

The presence of a learning effect in the visual condition suggests that the control participants were quickly able to develop strategies for completion of the visual condition. The majority of requests for repetition occurred on the first item, suggesting that at this point participants were still deciding how best to approach the task. The high number of repetition requests for item 4 can be explained by the fact that this was the first 'change of possession' stimulus in the visual condition, and participants may have had to "re-think" their initial strategy to accommodate the presence of a second human entity. After this, the requests for repetition remained stable.

However, removal of the first four items in the visual condition from the analysis would still yield a significant difference between the visual and the verbal conditions ($\chi^2 = 21.43$, df 1, $p < .0001$). This might suggest that the control participants found the visual condition slightly harder than the verbal. This may be related to differences in the task demands between the two conditions. To complete this task, participants must form a conceptual representation of the event from the input stimulus and maintain that representation in working memory whilst planning, constructing and completing a schematised drawing to convey that representation. For people with no language deficits, it is possible that constructing a conceptual representation of an event may be easier from a verbal description, where the input is already highly schematised. The video stimuli, on the other hand, require more constructive effort, or 'paring down', to arrive at a conceptual representation of the event that is sufficiently schematised for communication.

5.2.2 Analysis 2: Number and type of entities included in drawings

Results

All participants included the three main entities, Cause, Theme and Source/Goal in all of their drawings in both the verbal and the visual conditions. There were no omissions and no substitutions of the any of the three main entities.

In both the visual and verbal conditions, all participants included money in their drawings of *buy* and *sell* events, in both the verbal and the visual conditions. This usually took the form of either a **£** symbol or some coins. Examples are provided in Appendix R, Example 1.

In the visual position change events only, some participants included an additional entity, namely a table, which appeared in the video clip as a "physical support" for the Source/Goal entity, but was not a participant in the event depicted. For example in the video clip of G*irl puts flower in vase*, the vase was located on a table. Examples are provided in Appendix R, Example 2.

Discussion

The results of this analysis confirm that the relevant participant entities are easily identifiable from both the visual and verbal stimuli. Any difficulties that may be exhibited by the participants with aphasia in terms of selection and inclusion of relevant entities are therefore unlikely to be a function of the stimuli themselves, and can be more readily attributed to conceptual or linguistic processing problems.

The consistent inclusion of a symbol for money in *buy* and *sell* events indicates that control participants were aware of and communicated the special kind of transaction involved here, i.e. the exchange of money is what differentiates these events from the more straightforward *give* and *take* events.

The inclusion of a table in some drawings in the visual condition could be related to the constraints of the graphic output modality. A plausible interpretation is that it reflects our "regular visual commerce with the world" (van Sommers 1984), which tells us that smaller moveable items (e.g. a vase) are generally located with respect to a larger, more stable item (see Chapter 2, Section 2.4.1). An important implication of this finding is that constraints of the graphic output modality may affect which items are selected for inclusion in one's drawings of events. Items that would be unlikely to merit mention in verbal descriptions of events might nevertheless be included in drawings of the same events. Inclusion of these particular items does not, therefore, imply a problem with identifying relevant participants in the events: support items may become "relevant" in the context of graphic communication.

5.2.3 Analysis 3: Use of arrows

Two analyses of arrow use were carried out post-hoc on the completed drawings: a) a quantitative analysis of overall occurrence of arrows and b) a qualitative analysis of the position and orientation of the arrows in the drawings.

Results

a) Occurrence of arrow use

All control participants included at least one arrow in over 80% of their drawings in the verbal condition, and all but two participants included at least one arrow in over 80% of their drawings in the visual condition. Group analysis showed that arrows were used significantly more often in the verbal condition than in the visual (χ^2 = 14.86, df 1, $p < .0001$). However, this result is attributable to two participants, JZ and TH, who produced significantly fewer arrows in the visual than in the verbal condition (JZ, χ^2 = 20.51, df 1, $p < .0001$, TH, χ^2 = 7.03, df 1, $p < .01$). Both these participants made frequent use of an idiosyncratic 'strip-cartoon' strategy in the visual condition, whereby they drew two or more separate panels to depict the event, one panel showing the Theme at its start position, and the subsequent panel(s) showing the Theme at, or moving towards, its end position. Examples of the strip-cartoon strategy are provided in Appendix R, Example 5.

Some participants included more than one arrow in some of their drawings, referred to here as the double-arrow strategy. This occurred in only 16% of all drawings produced in the verbal condition and 18% of all drawings produced in the visual condition, and varied amongst participants. Analysis revealed an effect of Event type: the double-arrow strategy was used significantly more often in possession change events than in position change events, in both verbal and visual conditions (Fishers exact test, $p < 0.0001$ and $p < 0.01$). This can be attributed to the fact that most participants included double arrows in their drawings of *buy* and *sell* events (verbal condition: 10/12 participants; visual condition: 8/12 participants) (see Appendix R, Example 1 for examples).

Apart from in *buy* and *sell* events, the use of the double-arrow strategy was idiosyncratic amongst participants. Item-by-item analysis showed that some kinds of events were more likely to result in the use of this strategy, though the numbers are too small to be of statistical significance. For example, taking the visual and verbal conditions together, there were 14 instances of its use in *throw* events, and 10 instances in *grab* events. Examples are provided in Appendix R, Example 3.

<u>*b) Position and orientation of arrows.*</u>

In this analysis, the terms '*start position*' and '*end position*' will be used to refer to the spatial and temporal position of the Theme. These terms can refer both to the entity thus far labelled the Cause, and to the entity thus far labelled the Source/Goal. In *give/put*-type events, the Cause is the start position and the Goal the end position, while in *take/pick*-type events, the Source is the start position and the Cause the end position. Separate analyses were undertaken for drawings in which a single arrow was used and drawings in which the double-arrow strategy occurred.

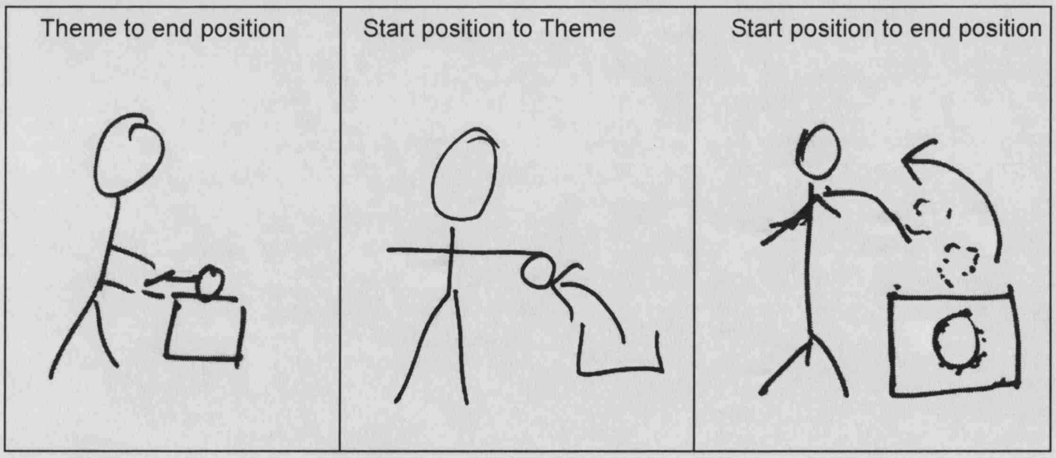
1) Single arrows

The position and orientation of single arrows was recorded post-hoc from the completed drawings. Three arrow positions/orientations prevailed:

1) from the Theme to its end position,
2) from the start position to the Theme
3) from the start position to the end position

Examples of these different single arrow positions/orientations are shown in Drawing 4A, with further examples provided in Appendix R, Example 4.

Drawing 4A:
Examples of different arrow positions in visual condition target event: Boy takes ball out of box



The totals across participants for each of these three arrow positions in the different stimulus groups are shown in Table 5.2. The results for the verbal and visual conditions are similar and the analysis is collapsed across the two conditions. The most common arrow position/orientation over all was 'Theme to end position'. This result was highly significant (One sample χ^2 = 325.31, df 2, p < .0001). Further analysis showed that this effect was significant for all the stimulus groups except for the *pick*-type position change events (CGPos) in both the visual and verbal conditions. In all other groups, 'Theme to end position' occurred significantly more often than the other two positions combined (Visual CSPos and Visual CSPoss, χ^2 = 66.77, df 1, p < .0001; Visual CGPoss, χ^2 = 6.82, df 1, p < .01; Verbal CSPos, χ^2 = 41.09, df 1, p < .0001; Verbal CSPoss, χ^2 = 57.47. df 1, p < .0001; Verbal CGPoss, χ^2 = 9.76, df 1, p < .005).

Table 5.2.
Total number of single arrows occurring in each recorded arrow position/orientation in each stimulus group

		Single arrows		
		Theme to end position	Start position to Theme	Start position to end position
Visual	CSPos	67	7	7
	CSPoss	67	10	7
	CGPos	35	28	7
	CGPoss	41	14	11
Verbal	CSPos	67	12	11
	CSPoss	69	11	7
	CGPos	36	27	19
	CGPoss	47	20	7

Key: CSPOS = put-type position change events; CSPOSS = give-type possession change events; CGPOS = pick-type position change events; CGPOSS = take-type possession change events.

2) Double-arrow strategy

The positions and orientations of both the arrows were recorded post-hoc from the completed drawings. Note that *buy* and *sell* events were excluded from this analysis, since the second arrow was used to signal the movement of the money and did not relate directly to the movement of the Theme.

Two positions/orientations prevailed:

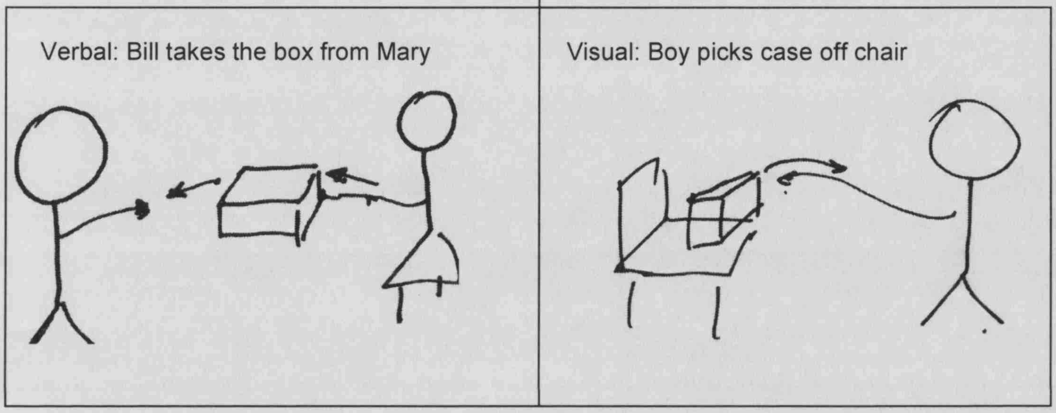
1) first arrow from start position to Theme, second arrow from Theme to end position
2) first arrow from end position to Theme, second arrow from Theme to end position.

Examples of these double arrow positions are provided in Drawing 4B.

Drawing 4B:

Examples of double-arrow positions produced by participant RS

Start position to Theme, Theme to end position	*End position to Theme, Theme to end position*



The number of times these two positions/orientations occurred in the different stimulus groups is shown in Table 5.3 overleaf. The analysis is collapsed across the visual and verbal conditions. Analysis revealed a highly significant effect of Cause role (χ^2= 22.36, df 1, $p < .0001$). In *give/put*-type events (CS), the first arrow was always drawn from the start position to the Theme and the second from the Theme to the Goal. In *take/pick*-type events (CG), the first arrow was usually drawn from the end position to Theme, and the second from the Theme to the end position.

Table 5.3.
Number of times double-arrows occurred in different positions/orientations in each stimulus group.

		Double arrows	
		1 start position to Theme 2 Theme to end position	1 end position to Theme 2 Theme to end position
visual	*CSPos*	6	
	CSPoss	7	
	CGPos	4	6
	CGPoss	1	9
Verbal	CSPos	5	
	CSPoss	2	
	CGPos	2	7
	CGPoss	1	2

Discussion

The consistent use of arrows by control participants supports research in related areas which suggests that arrows may provide a useful shorthand to depict action, movement or change in events, often replacing a verb symbol (see Chapter 2, Section 2.4.2). Overall, the findings of this analysis suggest that one of the primary functions of arrows in participants' drawings was to indicate temporal and spatial direction of change in these events (Tversky 1997).

The analysis of the position and orientation of arrows indicates that single arrows were generally used to represent the movement of the Theme from one position in time/space to another, i.e. the PROCESS subcomponent of these events. In the majority of drawings involving single arrows, the arrow signalled the Theme's movement towards its end position. Less frequently the arrow signalled the Theme's movement away from its start position or indicated the whole of the Theme's trajectory from its start position to its end position. This usually occurred on *take/pick*-type events. Thus the orientation of the arrow always corresponded to the directional information in the input stimulus. These findings confirm that the inclusion of arrows and their position and orientation in drawings of CCL events can reveal information about the ability to process and communicate temporal and directional information.

A minority of the control participants occasionally used double-arrows to also mark the ACT component of the event. In this case, the first arrow signalled the movement of the Cause entity towards the Theme, i.e. the initiating ACT component and the second arrow marked the movement of the Theme to its end position (PROCESS component). This can explain the effect of Cause role noted in this analysis. In *give/put*-type events the start position corresponds to the entity with the role of Cause, while in *take/pick*-type events the end position corresponds to the entity with the role of Cause. The less frequent and idiosyncratic use of arrows to signal the ACT component of these events, as compared to the PROCESS component, may be attributable to the fact that other strategies are available to direct attention to the ACT component, for example, by foregrounding the Cause entity by drawing it first (see Analysis 6 below).

The double-arrow strategy may have an additional function in the graphic communication of these events, namely to signal event-specific information, such as information about Manner or Path. Support for this comes from the consistent use of the double-arrow strategy in *buy* and *sell* events, indicating that arrows were used to signal the specific transaction in these events as compared to their *take* or *give* equivalents. Likewise the more frequent occurrence of the double-arrow strategy in events like *throw* and *grab* may be way of communicating the differences in Manner or Path between these events and their more neutral *give*, *put* or *take* equivalents. Some control participants used other graphic strategies to differentiate these events, for example participants HH and JA used an exclamation mark in *grab* events, possibly as a means of indicating the abrupt or unexpected nature of the action. However, the fact that not all control participants did signal manner differences between specific actions in this way provides support for the claim that these aspects of events are particularly difficult to communicate in the graphic output modality (Sutton et al 2002) (see Chapter 2, Section 2.4.2).

During the course of this analysis, two other strategies emerged that could also have been used to indicate temporal and spatial movement/direction.

The first is the 'strip-cartoon' strategy mentioned above, whereby the event was represented in two or more panels, rather than a single drawing (see Appendix R, Example 5). This approach was used almost exclusively by two participants, TH and JZ and was not subjected to a separate analysis. The second strategy is the 'double-Theme strategy' in which two Themes were included in a single drawing, the first being drawn at its start position, and the second at its end position. The two Themes were generally linked by an arrow, and these drawings were therefore included in the analysis of arrow use. This strategy occurred infrequently overall and was idiosyncratic to some participants. Examples are provided in Appendix R, Example 6. The use of these two strategies highlights the fact that the control participants were inventive in their attempts to indicate temporal and directional aspects of the events in their drawings. This confirms that these aspects of caused change of location events are critical for their communication in non-linguistic as well as linguistic output modalities.

5.2.4 Analysis 4: Entity drawn on left of page

Results

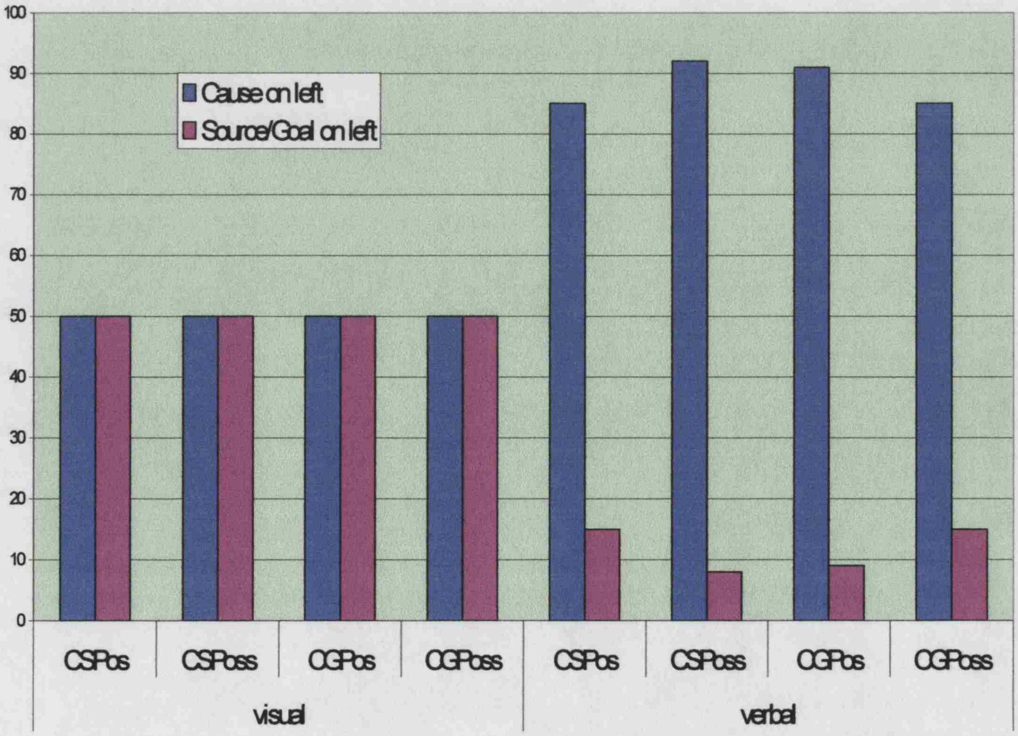
The entity that was drawn on the left of the page was recorded during production of the drawings. The Theme was never drawn on the left of the page. Table 5.4 (overleaf) shows the Mean number of times the Cause was drawn on the left (CL) and Source/Goal was drawn on the left (S/G L) in each stimulus group in the visual and verbal conditions, with standard deviations in parentheses. The proportion of CL and S/G L responses across all participants in each of the stimulus groups in the visual and verbal conditions is shown in Figure 5.2 (overleaf).

Table 5.4.
Means and Standard deviations of number of times the Cause and the Source/Goal were drawn on the left in the visual and verbal condition stimulus Groups

	Stimulus group	Cause-Left	Source/Goal-Left
Visual	CSPos	4.00 (0.00)	4.00 (0.00)
	CSPoss	4.00 (0.00)	4.00 (0.00)
	CGPos	4.00 (0.00)	4.00 (0.00)
	CGPoss	4.00 (0.00)	4.00 (0.00)
Verbal	CSPos	6.58 (2.31)	1.33 (2.36)
	CSPoss	7.08 (1.51)	0.92 (1.51)
	CGPos	6.67 (1.97)	1.33 (1.97)
	CGPoss	6.50 (1.93)	1.50 (1.93)

Key: CSPOS = *put*-type position change events; CSPOSS = *give*-type possession change events; CGPOS = *pick*-type position change events; CGPOSS = *take*-type possession change events.

FIGURE 5.2
Graph showing the proportion of times the Cause or the Source/Goal was drawn on the left of the page in each of the stimulus groups in the visual and verbal conditions



A Repeated Measures ANOVA (SPSS GLM procedure) was carried out, with participants-as-subjects. There were three within-subject factors: Stimulus Condition (Verbal, Visual), Cause-Role (*give/put*-type (CS), *take/pick*-type (CG)), and Event Type (Position change, Possession change) and the dependent variable was the number of times the Cause was drawn on the left. There was a significant main effect of Stimulus Condition ($F(1,11) = 30.493$, $p < 0.0001$). There were no other effects and no interactions. The Cause was drawn on the left significantly more often in verbal condition than in the visual in all stimulus groups. Post-hoc within-condition comparisons confirmed that:

1. In the visual condition, the Cause and the Source/Goal were drawn on the left an exactly equal number of times in all stimulus groups by all participants. Item by item analysis showed that the entity that appeared on the left of the screen in the video was always drawn on the left of the page by all participants.

2. In the verbal condition, the preference for drawing the Cause on the left was significant in all the stimulus groups (Binomial two-tailed, $p < .0001$). Individual analyses showed that this effect was highly significant for 10/12 control participants (Fishers Exact Test: $p < .0001$), 8 of whom drew the Cause on the left in over 90% of their drawings.

Discussion

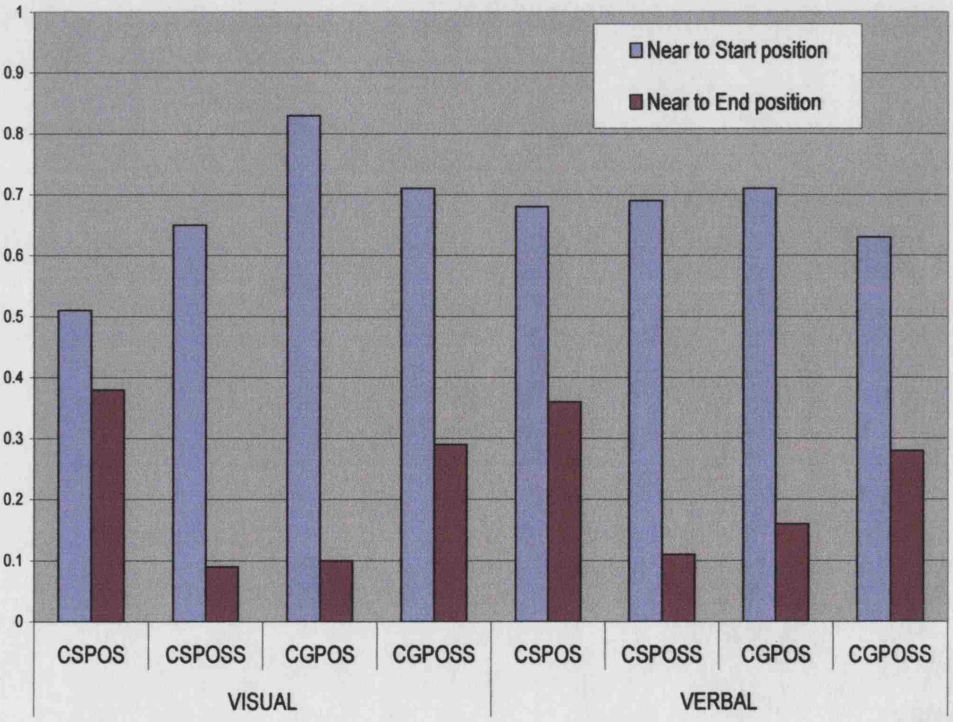
The results of this analysis provide support for the prediction that the spatial position of entities in drawings of events would be influenced by the interaction of input and output modality constraints. In the verbal condition, the strong tendency for the Cause to be drawn on the left is a result of the interaction between the input modality constraint of 'order of mention', which constrains us to draw the Cause first (see Analysis 6 below), and the graphic output modality constraint of 'start drawing on the left of the page'. This is similar to the findings of other research in this area discussed in Chapter 2 (van Sommers 1984; Chaterjee et al 1995, 1999). In the visual condition, the graphic output modality constrains us to replicate the spatial positions of entities in the stimulus when drawing. This interacts with the input modality factor of 'screen position' to determine which entity is drawn on the left. This might further interact with the output modality factor of 'start drawing on left' to influence temporal order of drawing in the visual condition: the item on the left of the screen might be more likely to be drawn first. This will be discussed further in the light of the findings of Analysis 6 below.

5.2.5 Analysis 5: Spatial location of Theme

Results

The number of times each control participant drew the Theme at or nearer to its start position and to its end position was recorded post hoc from their completed drawings. Drawings in which the Theme was drawn equidistantly from the other two entities or drawings in which a 'double-Theme' or 'strip-cartoon' strategy were used were excluded from this analysis. Figure 5.3 shows the proportion of times the Theme was drawn at or nearer to its start position and to its end position in the different stimulus groups in the visual and verbal conditions. Exclusions are not represented in the graph, hence the sum of the two columns is less than 1.0.

Figure 5.3
Graph showing proportion of times the Theme was drawn at/near to its start position versus its end position in all the stimulus groups.



Group analysis revealed that the Theme was significantly more likely to be drawn at or nearer to its start position than its end position in both the verbal condition (χ^2 = 129.20, df 1, $p < 0.0001$) and the visual condition (χ^2 = 129.65, df 1, $p < 0.0001$). Individual within-condition analyses confirmed that:

i) In the visual condition, this difference was significant for eight participants (Fisher's exact test: JA, $p < 0.05$; JH, $p < .005$; AS, JR, MW, RS, HS, HH, $p < 0.0001$). Two participants, RW and DEB, showed a non-significant trend in the same direction (Fisher's exact test: $p = 0.06$). Two participants, TH and JZ, were excluded from this analysis because they used the 'strip-cartoon' strategy in most of their drawings in the visual condition.

ii) In the verbal condition this difference was significant for eleven participants (Fisher's exact test: RW, $p < 0.05$; JA, $p < 0.005$; TH, $p < 0.001$; JR, JH, DEB, AS, HH, RS, HS, MW, $p < 0.0001$). The exception was JZ, who drew the Theme nearer to its Goal in all his drawings bar one in the verbal condition.

The effects of stimulus variables were analysed separately for the visual and verbal conditions using repeated measures ANOVAs (SPSS GLM procedure). There were two within-subjects factors: Cause-role (*give/put*-type, *take/pick*-type) and Event type (position change, possession), and the dependent variable was the number of times the Theme was drawn nearer to its start position. In the visual condition, there were no main effects of either Cause-role or Event type, but there was a significant interaction between Cause-role and Event type ($f = 6.570$, df 1,11, $p < .05$). Post-hoc comparisons revealed that the effect of Cause-role was limited to position change events. The Theme was significantly more likely to be drawn near its start position than its end position in *pick*-type position change events (CGPos) ($t = 3.027$, df 11, $p < .05$). However, in *put*-type position change events (CSPos) the Theme was equally likely to be drawn at its end position as at its start position.

In the verbal condition there were no main effects of either Cause-role or Event type and no interactions. The Theme was more likely to be drawn at its start position in all stimulus groups.

Discussion

This analysis was based on the hypothesis that the position of the Theme in people's drawings would provide an indication of their choice of 'reference object' (Talmy 1983). The main finding of this analysis showed that the majority of control participants selected the entity that corresponds to the Theme's start position as the primary reference object when drawing these caused change of location events.

Consistent location of the Theme at its start position might suggest that control participants are focusing on, or directing attention to, the beginning of the event in their initial drawings. One possible reason for this may be that they were following the temporal order in which the event unfolds and replicating this in their drawings. Drawing constrains us to represent the relationship between entities in an event in a static form and to use graphic artefacts like arrows and lines to depict movement or change (see Chapter 2, Section 2.4.3). We cannot therefore draw an event without first drawing what appears to be a locational state. The current findings suggest that participants may have 'elected' to represent the "pre-event" locational state in their initial drawing, turning it into an event by the subsequent use of graphic strategies such as the inclusion of arrows. Thus consistent location of the Theme at its start position in the events may be a further graphic strategy for indicating appreciation of temporal structure and temporal direction.

Consistent location of the Theme at its start position also indicates appreciation of directional information in the input stimuli, since it suggests that participants identified the beginning point and end point of the change, i.e. that they were aware of the directional roles of the entities in the event. In the visual condition this information is directly perceivable, but in the verbal condition, it is implicit in the interaction between the meaning of the verb and the prepositional phrase. For example in a sentence like *Mary puts the book on the table*, appreciation of Mary's role as the Source of the Theme's movement is dependent on the meaning of the verb *put*, since in this case prepositional meaning does not provide any information about the directional role of the first noun phrase (cf. *Mary sees the book on the table*). However, in a sentence like *Mary takes the book from Bill*, the prepositional phrase carries the greater clue to directional meaning (cf *Mary takes the book to Bill*).

The findings of this analysis also have implications for foregrounding choices in the graphic communication of events. Selection of the Theme's start position as its primary reference object might affect the temporal order in which entities are drawn, since the reference object is generally drawn before the Theme (van Sommers 1984). In the visual condition, in particular, the results suggest that the start position of the Theme might have a degree of attentional prominence when one's intention is to communicate about the event. However, this factor interacts with other perceptual/conceptual clues to influence choice of reference object, specifically the perceived stability of the entities. In visual *pick*-type position change events (e.g. example (a) below), the combined influence of 'start position' and 'more stable entity' resulted in a particularly strong tendency to treat the start position as reference object in (see Figure 5.5, Visual CGPos). In *put*-type position change events however (e.g. example (b) below), where the start position and the more stable entity do not coincide, the Theme was equally likely to be located at its end position as at its start position (see Figure 5.3 above, Visual CSPos).

a) boy picks case off chair
START POSITION
STABLE ENTITY
b) boy puts case on chair
START POSITION STABLE ENTITY

This finding supports previous research in this area that indicates that entities that are perceived of as more stable are more likely to be selected as reference object for a moving item (Talmy 1983; Geminiani et al 1995; Gershkoff-Stowe & Goldin-Meadow 2002).

5.2.6 Analysis 6: Temporal order of drawing of three main entities

The temporal order in which the three main entities were drawn was recorded by the investigator during production of the drawings. There were six possible temporal orderings, or response types, coded by the letters A, B, C, D, E, and F. These are shown in Table 5.5 below. The proportion of times each of the six response types occurred in each of the stimulus groups in the visual and verbal conditions across all participants is shown in Table 5.6 overleaf. There were very few instances overall of response types E and F indicating that control participants rarely drew the Theme first in either the visual or the verbal conditions. Response types E and F were therefore not included in further analyses.

Table 5.5.
Six possible response types in temporal order of drawing

Response type	**First drawn entity**	**Second drawn entity**	**Third drawn entity**
Type A	CAUSE	THEME	SOURCE/GOAL
Type B	CAUSE	SOURCE/GOAL	THEME
Type C	SOURCE/GOAL	THEME	CAUSE
Type D	SOURCE/GOAL	CAUSE	THEME
Type E	THEME	CAUSE	SOURCE/GOAL
Type F	THEME	SOURCE/GOAL	CAUSE

Table 5.6.
Proportion of each of the six temporal order response types produced in the verbal and visual stimulus groups across all control participants

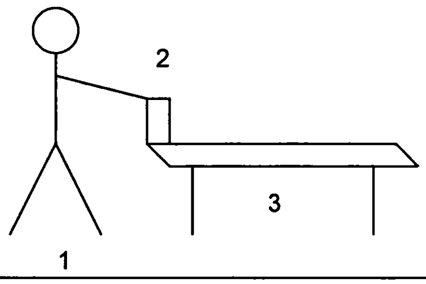
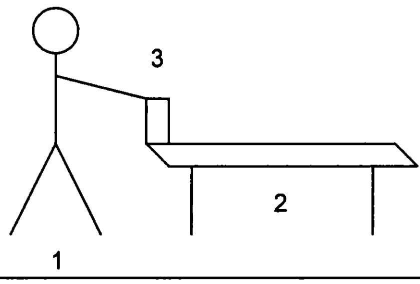
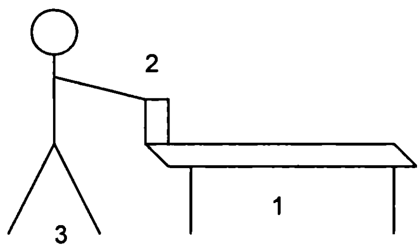
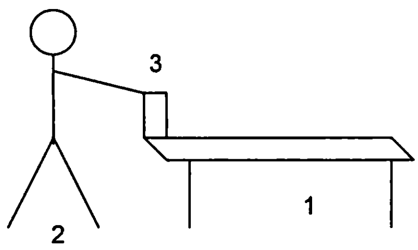
Input modality	Stimulus group	A	B	C	D	E	F	Total
Visual	CSPOS	.573	.198	.021	.198	.01	0	1
	CSPOSS	.635	.125	.052	.167	.021	0	1
	CGPOS	.229	.458	.24	.021	.042	.01	1
	CGPOSS	.167	.218	.416	.167	.021	.01	1
Verbal	CSPOS	.678	.135	.042	.135	0	.01	1
	CSPOSS	.833	.147	.01	.01	0	0	1
	CGPOS	.354	.437	.115	.073	0	.021	1
	CGPOSS	.396	.479	.073	.052	0	0	1

Key: CSPOS = put*-type position change events; CSPOSS =* give*-type possession change events; CGPOS =* pick*-type position change events; CGPOSS =* take*-type possession change events*

Graphic examples of response types A, B, C and D are provided in Figure 5.4 overleaf using stylised drawings of the event *The boy puts the book on the table*. The boy has the role of Cause, the book has the role of Theme and the table has the role of Goal. (In the corresponding *pick*-type event, *The boy picks the book off the table,* the table would have the role of Source, and this label has therefore been included in parentheses.) The numbers on the drawings indicate which of these entities was drawn first (1), second (2) and third (3) in each response type. Response types A and B both give primary foregrounding to the Cause (i.e. the Cause is drawn first), but differ in terms of secondary foregrounding. A Type A response gives secondary foregrounding to the Theme, while a Type B response gives secondary foregrounding to the Source/Goal. Similarly response types C and D both give primary foregrounding to the Source/Goal, but differ in terms of secondary foregrounding. In a Type C response the Theme is drawn second, whilst in a Type D response, the Cause is drawn second and the Theme last.

Figure 5.4:
Stylised examples of temporal order Response Types A, B, C, D for event:

The boy puts the book on the table.
CAUSE THEME GOAL (SOURCE)

Type A: Cause first, Theme second, Goal (Source) last  	***Type B:*** Cause first, Goal (Source) second, Theme last 
Type C: Goal (Source) first, Theme second, Cause last  	***Type D:*** Goal (Source) first, Cause second, Theme last 

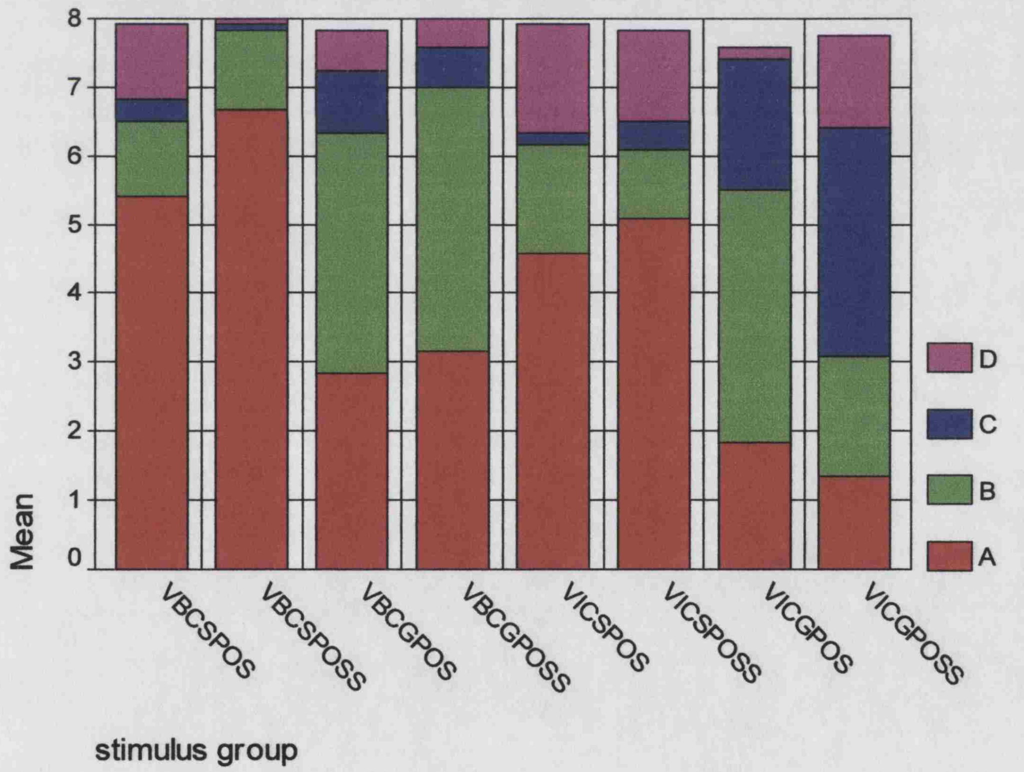
Results

Table 5.7 (overleaf)shows the mean number of times control participants used the remaining four response types A, B, C and D in each of the stimulus groups in the visual and verbal conditions with standard deviations in parentheses (maximum = 8). This is also shown graphically in Figure 5.5.

Table 5.7:
Mean number of times control participants used the temporal order response types A, B, C and D in each of the stimulus groups, with standard deviations in parentheses

Input modality	Stimulus group	A	B	C	D
Visual	CSPOS	4.58 (1.88)	1.58 (1.56)	0.17 (0.39)	1.58 (1.78)
	CSPOSS	5.08 (1.56)	1.00 (1.08)	0.33 (0.9)	1.33 (1.24)
	CGPOS	1.83 (2.55)	3.67 (2.43)	1.92 (1.83)	0.17 (0.58)
	CGPOSS	1.33 (1.07)	1.75 (1.29)	3.33 (1.72)	1.33 (1.07)
Verbal	CSPOS	5.42 (2.9)	1.08 (0.99)	0.33 (1.16)	1.08 (1.68)
	CSPOSS	6.67 (2.3)	1.17 (2.04)	0.08 (0.29)	0.08 (0.29)
	CGPOS	2.83 (3.24)	3.5 (3.0)	0.92 (1.73)	0.58 (1.44)
	CGPOSS	3.17 (2.33)	3.83 (1.95)	0.58 (1.08)	0.42 (0.67)

Figure 5.5.
Graph showing mean number of times control participants used temporal order response types A, B, C & D in the Verbal and Visual Stimulus Groups



Key: VB = Verbal condition; VI = Visual condition; CSPOS = put-*type position change events; CSPOSS =* give-*type possession change events; CGPOS =* pick-*type position change events; CGPOSS =* take-*type possession change events*

The data were subjected to the following analyses:

1. A between-conditions analysis to test the prediction that foregrounding choices in the two conditions will vary according to the constraints and cues provided by the two input modalities.

2. Two separate within-conditions analyses of individual performances in the visual and verbal conditions, to identify any regularities or differences in the temporal order of drawing across the variables of Event-type and Cause-role.

5.2.6.1. Results of between-conditions analysis

The data set for this analysis would not generally be subjected to parametric analyses, since the dependent variable of Response type is categorical. Levels of distribution across this variable are therefore dependent on one another to some extent, although these dependencies are not absolute. Following other researchers dealing with similar data sets (Gershkoff-Stowe & Goldin-Meadow 2002), a parametric method of analysis (analysis of variance, SPSS GLM procedure) was selected as this was felt to be most suitable for revealing any effects and interactions of the different variables in the task. This would not be possible using non-parametric analyses.

Each of the four response types (A, B, C and D) was subjected to an items-as-subjects univariate analysis of variance (SPSS, GLM procedure) with three between-subjects factors: Stimulus condition (Verbal, Visual); Cause-role (*give/put*-type (CS), *take/pick*-type (CG)), and Event type (Position change, Possession change).

For response type A (Cause drawn first, Theme second, Source/Goal last), there were highly significant main effects of Stimulus Condition, $F(1,56) = 16.98$, $p < .0001$, and Cause-role, $F(1,56) = 78.29$, $p < .0001$. There was no effect of Event type and no interactions. Type A responses occurred significantly more often in the verbal condition than in the visual, and significantly more often in *give/put*-type events than in *take/pick*-type events (Cause-role). Post-hoc comparisons revealed that the effect of Cause-role was robust across Event types and Stimulus conditions: verbal position change events: Tukey's HSD, $p = .01$; verbal possession change events: Tukey's HSD, $p < .0001$; visual position change events: Tukey's HSD, $p < .005$; visual possession change events: Tukey's HSD, $p < .005$.

For response type B (Cause drawn first, Source/Goal second, Theme last), there was a highly significant main effect of Cause-role, $F(1,56) = 52.71$, $p < .0001$, and a marginal effect of Event Type, $F(1,56) = 3.87$, $p = .054$. There was no effect of Stimulus condition, but there was an interaction between Stimulus condition and Event type, $F(1,56) = 3.26$, $p < .01$. Type B responses occurred significantly more often in *take/pick*-type events than in *give/put*-type events. Post hoc comparisons revealed that this effect was significant in verbal position change events (Tukey's HSD, $p < .005$), verbal possession change events (Tukey's HSD, $p < .05$), and visual position change events (Tukey's HSD, $p < .05$). The same trend was noted in visual possession change events, but failed to reach significance. The interaction between Stimulus condition and Event type can be explained by the fact that the marginal effect of Event type was restricted to the *visual* condition, where more Type B responses occurred in position change events than in possession change events (Tukey's HSD, $p < .05$).

For response type C (Source/Goal drawn first, Theme second, Cause last), there were significant main effects of Stimulus condition, $F(1,56) = 12.11$, $p = .001$, and Cause-role, $F(1,56) = 26.10$, $p < .0001$. There was no effect of Event type, but there were interactions between Stimulus condition and Cause-role, $F(1,56) = 9.22$, $p < .005$, and between Stimulus condition and Event type, $F(1,56) = 4.61$, $p < .05$. The main effect of Stimulus Condition shows that there were significantly more Type C responses in the visual condition than in the verbal. The interaction between Stimulus condition and Cause-role can be explained by the fact that the effect of Cause-role was significant only in the *visual* condition. More Type C responses occurred in *take/pick*-type events than in *give/put*-type events in the both visual position change events (Tukey's HSD, $p < .05$), and visual possession change events (Tukey's HSD, $p = .001$).

No such effect was found in the verbal condition. Likewise the interaction between Stimulus condition and Event Type can be explained by the fact that the there was a significant effect of Event type restricted to *take/pick*-type events in the Visual condition only (Tukey's HSD, $p < .005$). More Type C responses occurred in *take/pick*-type possession change events in the visual condition than in *take/pick*-type position change events.

For response type D (Source/Goal drawn first, Cause second, Theme last), there was a significant main effect of Stimulus condition, $F(1,56) = 7.58$, $p < .001$, and a marginal effect of Cause-role, $F(1,56) = 3.78$, $p = 0.057$. There was no effect of Event Type, but there was an interaction between Stimulus condition and Event Type, $F(1,56) = 6.712$, $p < .05$. Type D responses occurred significantly more often in the visual condition than in the verbal and more often in *give/put*-type events than *take/pick*-type events. Post hoc comparisons revealed that the effect of Event type was limited to *take/pick*-type events in the Visual condition only (Tukey's HSD, $p = .01$), which explains the interaction between Stimulus condition and Event Type. More Type D responses occurred in *take/pick*-type possession change events in the visual condition than in *take/pick*-type position change events.

With such a small number of participants in the control study, it is possible that any significant results may be a function of idiosyncratic performances by individual participants. To test for this eventuality, Repeated Measures ANOVAS (SPSS, GLM procedure) with participants-as-subjects and three within-subjects variables, Stimulus condition (verbal, visual), Cause-role (*give/put*-type, *take/pick*-type), and Event type (position change, possession change), were carried out on each of the four response types (A, B, C & D). In terms of main effects and interactions, the results of these analyses replicated those of the items-as-subjects analyses. For Type A responses, there were significant main effects of Stimulus condition, $F(1,11) = 7.83$, $p < .05$, and Cause-role, $F(1,11) = 34.67$, $p < .0001$. There was no effect of Event type and no interactions. For Type B responses, there was a significant main effect of Cause-role, $F(1,11) = 21.16$, $p = .001$ and a marginal interaction between Stimulus condition and Event type, $F(1,11) = 12.76$, $p = .069$. For Type C responses there were significant main effects of Stimulus condition, F (1,11) = 34.37, p < .0001, and Cause-role, F (1,11) = 13.54, p < .005 and significant interactions between Stimulus condition and Cause-role, F (1,11) = 14.02, p < .005, and between Stimulus condition and Event type, F (1,11) = 5.44, p < .05. For Type D responses there were significant main events of Stimulus condition, F (1,11) = 4.83, p = .05, and Cause-role, F (1,11) = 6.25, p < .05 and a marginal interaction between Stimulus condition and Event type, F (1,11) = 4.38, p = 0.06. Thus the findings of the items-as-subjects analysis are robust across participants.

Analysis of individual performances also provided additional support for the robustness of the main findings. The finding that response type A occurs more often in the verbal condition than in the visual was true for 8 of the 12 control participants, and for four of these this difference reached significance (Fishers exact test: JA, HS, p < .05; MW, p < .005; AS, p < .0001). The finding that response types C and D occur more frequently in the visual condition than in the verbal was true for 11 of the 12 control participants. For 7 of these 11, this difference reached significance (Fisher's Exact Test: JR, MW, HH, p < .05; JA, TH, DEB, RW, p < .005).

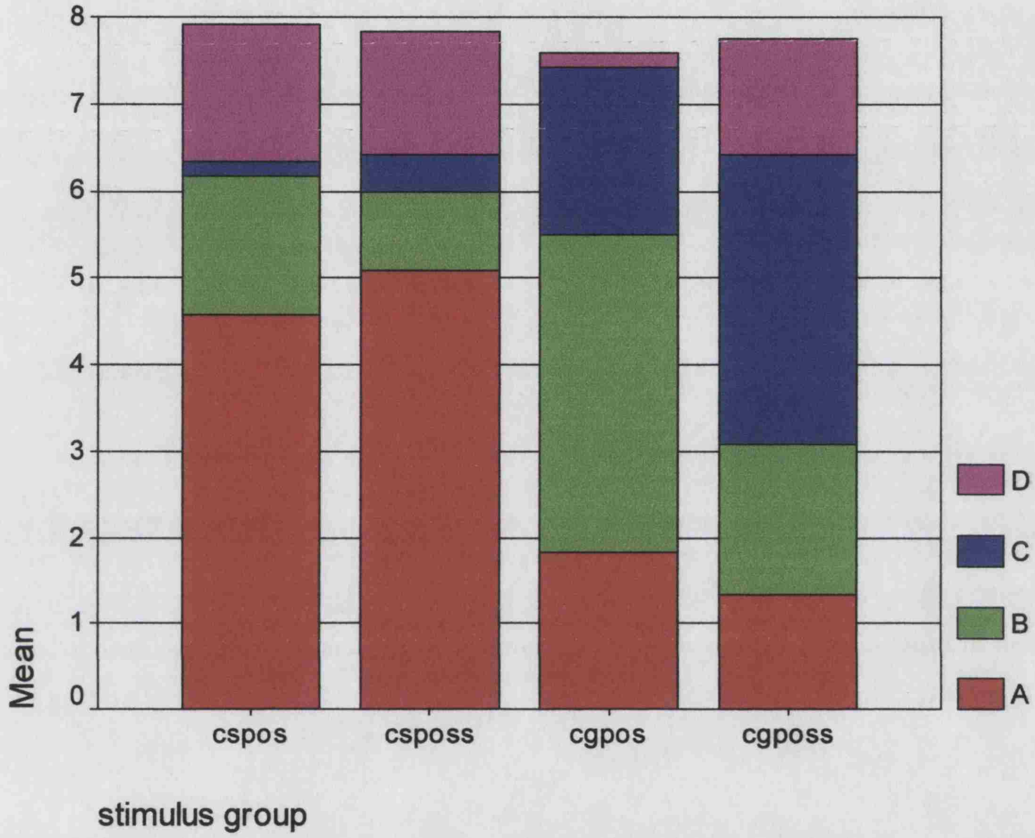
5.2.6.2 Results of within-Condition analyses

A. Within-condition analysis of Visual Condition

Figure 5.6 shows the mean numbers of the four response types A, B, C and D, produced in the different stimulus groups in the visual condition (see Appendix S for breakdown across individual participants).

Within the visual condition, there was no single temporal order response type that predominated overall. The most frequent response type was Type A, accounting for 40% of all responses. Type B occurred 25% of the time, Type C, 18%, and Type D, 14%. Thus there was considerable variation in temporal order of drawing by the control participants in the visual condition. There was also variation across the different stimulus groups, with Type A being the most frequent response in *give/put*-type position change and possession change groups (CSPOS and CSPOSS), Type B being the most frequent in the *take/pick*-type position change group (CGPOS) and Type C being the most frequent in the *take/pick*-type possession change group (CGPOSS).

Figure 5.6.
Mean number of temporal order response types A, B, C and D produced by control participants in the visual condition.



Key: CSPOS = put-type position change events; CSPOSS = give-type possession change events; CGPOS = pick-type position change events; CGPOSS = take-type possession change events

The between-conditions analysis had shown that Cause-role had a significant effect on the occurrence different response types in the visual condition. Response types A and D occurred more often in *give/put*-type events than in *take/pick*-type events, while response types B and C occurred more often in *take/pick*-type events than in *give/put*-type events. This was confirmed by individual analyses within the visual condition, which revealed that:

i) 10/12 control participants produced Type A responses more often in *give/put*-type events than in *take/pick*-type, and this difference was significant for 8 of these (Fishers exact Test: JH, MW, HS, RS, $p < .05$; TH, HH, $p < .01$; JR, JZ, $p < .0001$).

ii) 9/12 control participants produced Type B responses more often in *take/pick*-type events than in *give/put*-type, but this difference was significant for only 3 participants (Fisher Exact test: JR, TH, RS, $p < .05$).

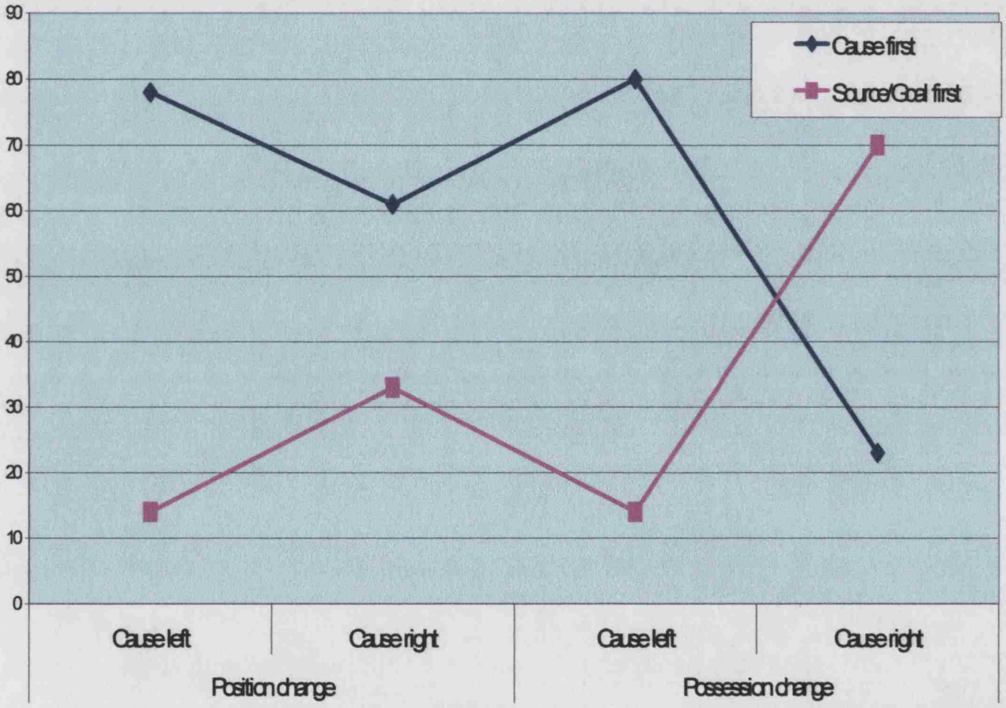
iii) 11/12 control participants produced Type C responses more often in *take/pick*-type events than in *give/put*-type and this difference was significant for 7 participants (Fisher Exact test: HS, RS, $p < .05$; JR, TH, JZ, $p < .01$, JH, HH $p < .001$).

iv) 7/12 control participants produced Type D responses more often in *give/put*-type events than in *take/pick*-type, but this difference did not reach significance for any participant, due to the small number of items involved.

These results suggest that most control participants did differentiate between *give/put*-type and *take/pick*-type events in the visual condition by means of temporal order of drawing, but there were individual variations in their preferred ordering choices. Type A was the preferred response for most control participants in *give/put*-type events, both in position change events and possession change events. In *take/pick*-type events, the preference for Type B and Type C responses varied amongst the participants.

There is one additional factor in the visual condition that might affect the temporal order of drawing, namely the manipulation of screen position. This is related to the graphic output modality constraint of 'start drawing on left' (van Sommers 1984). More Cause-first responses (Types A and B) might be expected when the Cause appears on the left of the screen (CL), and more Source/Goal-first responses (Types C and D) might be expected when the Source/Goal appears on the left of the screen (S/GL). To test for an effect of screen position, a univariate ANOVA with items as subjects was carried out (SPSS GLM procedure), with three between-subjects factors: Screen position (Cause-left (CL), Source/Goal left (S/GL)), Event type (Position change, Possession change) and Cause-role (*give/put*-type, *take/pick*-type). The dependent variable was the number of Cause-first responses (Types A and B). There was a highly significant effect of Screen position ($F(1,30) = 55.875$, p < .0001), with more Cause-first responses occurring when the Cause was on the left of the screen. There was also a significant interaction between Screen position and Event type (F (1,30) = 16.327, p < .001: the effect of Screen position was restricted to possession change events (see Figure 5.7). In position change events, the Cause was more likely to be drawn first even when it appeared on screen right. In possession change events, however, the Cause was more likely to be drawn first *only* when it appeared on screen left. When it appeared on screen right, it was less likely to be drawn first.

Figure 5.7.
Graph showing interaction between the visual input factor of screen position and the variable of Event type



<u>*B. Within-condition analysis of Verbal Condition*</u>

Figure 5.8 (overleaf) shows the mean numbers of the four response types A, B, C and D, produced in the different stimulus groups in the verbal condition (see Appendix S for breakdown across individual participants).

The most frequent response in the verbal condition was Type A which occurred on just over half (56%) of the total responses. Type B accounted for a further 30% of the total responses. Overall, there were relatively few Type C and Type

i) 11/12 control participants produced more Type A responses in *give/put*-type events than in *take/pick*-type, and for 6 of these this difference reached significance (Fishers Exact test: JR, $p < .05$, RS, $p < .0005$, DEB, HH, JZ, MW, $p < .0001$).

ii) 9/12 control participants produced more Type B responses in *take/pick*-type events than in *give/put*-type, and for 6 of these this difference reached significance (Fishers Exact test: JR, $p < .0001$; RS, $p < .0005$, HH, TH, JH & HS, $p < .05$).

Whilst there was an overall trend for *give/put*-type and *take/pick*-type events to be differentiated in terms of the occurrence of Type A and Type B responses, there were individual differences in performance. However, the fact that half of the group of participants *did* systematically differentiate these events in this way suggests that directional differences in the meaning of the verb and sentence might influence the temporal order in which the entities are drawn.

Discussion

As discussed in Chapter 4, section 4.4., this analysis was based on the hypothesis that of temporal order of drawing may be one way of signalling foregrounding choices in the graphic communication of events. The entity that is drawn first is assumed to be given the position of primary prominence (equivalent to the linguistic sentence-Subject position in English). This provides a "viewpoint" or perspective for potential interpreters from which the event is to be understood (Black & Chiat 2003a, see also Chapter 2, sections 2.3.2 and 2.4).

The findings of the current analysis provide support for the above hypothesis, since they indicate that similar prominence is given to the Cause (Actor) entity in the graphic communication of caused change of location (CCL) events as in their linguistic communication. Overall, the Cause entity was more likely to be drawn first, which mirrors its foregrounded position in linguistic descriptions of these events. This suggests that control participants were aware of the crucial role of the Cause entity as initiator of the event, and used temporal order of drawing as a means of signalling to a potential interpreter that the event should be viewed from the perspective of this entity. Thus graphic foregrounding of the Cause entity can be seen as a way of directing attention to the initiating Act component of these events, indicating an appreciation of their causal structure.

However, the findings also indicate that foregrounding choices in graphic communication of CCL events are contingent to some extent on the interaction between input and output modality related factors. As predicted, there were differences in foregrounding choices between the visual and verbal conditions. Control participants were significantly more likely to draw the Cause entity first in the verbal condition than in the visual. This can be attributed to the strong linguistic foregrounding of the input sentences, in which the Cause (Actor) role is mapped onto the sentence-Subject position. In the visual condition, as predicted, there was more variation in terms of foregrounding choices between the different stimulus groups. Specifically the findings indicated that primary foregrounding of the Cause in the visual condition depended on the ease of identification of the entity that played that role, which in turn depends on the degree of congruence between a number of perceptual and conceptual factors.

The effects of interactions between input modality and output modality constraints were also evident in secondary foregrounding choices in both the visual and verbal conditions. In linguistic communication of CCL events, secondary foregrounding is given to the Theme, which is mapped onto the Object position in English. This was often the case in control participants' graphic communication of these events, suggesting that the order in which they drew the entities may reflect the temporal order in which the event unfolds (Langacker 1998). Giving secondary foregrounding to the Theme may be one way of directing attention to the process subcomponent of these events. However, some control participants systematically differentiated between *give/put*-type and *take/pick*-type events in their choice of second-drawn entity. This suggests that directional information in the input stimulus might interact with constraints of the graphic output modality to affect secondary foregrounding choices when communicating about CCL events using drawing.

The findings of the temporal order analysis therefore provide more specific information about the interactions between input modality factors and graphic output modality constraints, and how these can affect foregrounding choices in the graphic communication of CCL events. This will be considered in more detail in the following section.

5.3 Foregrounding choices in the graphic communication of events

5.3.1 Foregrounding in the Visual condition

As discussed above, the analysis of temporal order of drawing in the visual condition demonstrates the effects of congruence between different perceptual, conceptual and output-modality factors in determining foregrounding choices in the graphic communication of CCL events.

Perceptual and conceptual factors identified in the literature review (Chapter 2, Section 2.4.2) as being influential were:

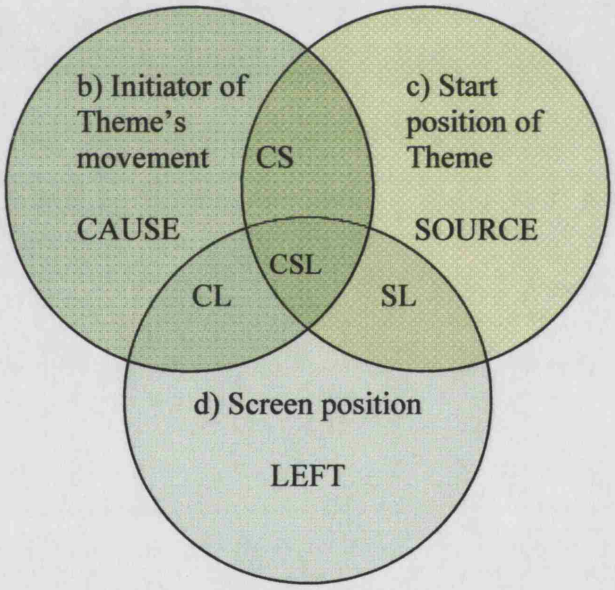
a) the number of animate entities in the event
b) the initiator of the event
c) the start position of the Theme
d) the left screen position

Factors (a) and (b) are both relevant to the identification of the Cause entity In the scenes. When there is only one animate entity acting in relation to two inanimate entities, as in the position change events, factor (a) provides a strong conceptual clue to agentivity. The animate entity is likely to be perceived of as the Cause. In position change events, this factor combines with factor (b) to increase the attentional salience of the Cause entity, resulting in consistent foregrounding of the Cause. This finding provides support for the claim made in the literature review that, when viewing events for the purpose of communication, we tend to seek out potential causes and present the event from the perspective of that entity (Griffin & Bock 2000, Zacks & Tversky 2001).

However, this depends to some extent on the ease of identification of the

Cause entity (Tomlin 1997, Hartsuiker & Kolk 1998). In the possession change events in the current experiment, conceptual cues to agentivity are less straightforward, since factor (a) provides two possible candidates for the role of the Cause entity, depending on the perspective one takes on the scene. In this situation, control participants' foregrounding choices depended on the degree of congruence between the remaining three perceptual factors. Factor (b) directs attention to the Cause entity, factor (c) directs attention to the position of the Theme at the start of the event and factor (d) directs attention to the entity on the left of the screen. This is represented in the Venn diagram below (Figure 5.9).

Figure 5.9.
Diagram showing interaction of perceptual factors that influence foregrounding choices in graphic communication of visual caused change of possession events.



When all three of these factors combine, as in events where the Cause is co-referential with the Source and also appears on the left of the screen (CSL), a high incidence of Cause-first responses occurs. Post-hoc analysis shows that the Cause was drawn first 47 out of a possible 48 times in this condition. When two of the factors coincide, the entity that they both direct attention to is more likely to be drawn first. Thus the congruence of factors (b) and (c) increase the attentional salience of the Cause entity, resulting in a predominance of

Cause-first responses in *give*-type possession change events (CS) (Binomial 2-tailed, $p < .0005$, see Figure 5.6). In *take*-type possession change events, however, these two factors act in conflict with one another. Post-hoc analysis revealed that, in this stimulus group, foregrounding choices were almost entirely dependent on the influence of factor (d), screen position. Cause-first responses occurred more often when the Cause appeared on the left (CL) (Binomial 2-tailed, $p = 0.01$), while Source-first responses predominated when the Source appeared on the left (SL) (Binomial 2 tailed, $p < .0001$).

The increased reliance on perceptual factors in the possession change scenes provides support for the claim that scenes that offer more perspective options, such as transactions between two animate participants, may involve increased 'paring down' in terms of conceptualisation for the purpose of communication (Black & Chiat 2000; Dipper et al 2005). This affects the performance of people with no language impairment, and may also have implications for the performance of the participants with aphasia.

The influence of factor (d), left screen position, provides a good example of the interaction between input and output-modality constraints. As previously discussed in Analysis 4, Section 5.2.4 the graphic output modality constraints of 'replicate spatial positions of the entities in the scene' and 'start drawing on the left' interact with the input factor of screen position to increase the likelihood of the entity on the left of the screen being drawn first (van Sommers 1984, 1989; Chaterjee et al 1995).

The interaction between input and output-modality constraints is also evident in the control participants' choice of secondary foregrounding in the visual condition of the event drawing task. Here, the output-modality constraint of 'draw reference object before Theme' was influential in determining which entity was drawn second. The results of Analysis 5, spatial position of the Theme, suggested that the start position of the Theme was generally selected as the primary reference object in the visual condition.

The analysis of temporal order (Analysis 6) showed that the Theme was likely to be drawn second only in situations where the first-drawn entity corresponded to its start position. This was the case in *give/put*-type events, both position change and possession change, where the Cause (i.e. the Theme's start position) was generally drawn first, followed by the Theme, and finally the Goal (see Figure 5.6 above, Type A responses, CSPos and CSPoss). This was also the case in *take*-type possession change events, but only on those occasions where the Source (i.e. the Theme's start position) was drawn first. Here the Theme was drawn second and the Cause last (Type C response). However, when the Cause (i.e. the Theme's end position) was drawn first in this stimulus group, the second-drawn entity was usually the Source and the Theme was drawn last (Type B response) (see Figure 5.6, CGPoss). Type B responses also prevailed in *pick*-type position change events in the visual condition. Here the Cause (i.e. the Theme's end position) was generally drawn first. This was followed by the Source to provide a reference object for the Theme, which was drawn last (see Figure 5.6, CGPos).

5.3.2 Foregrounding in the Verbal condition

The interaction between input modality and output modality constraints are also evident in the analysis of temporal order of drawing in the verbal condition. The strong linguistic foregrounding of the Cause (Actor) role in the input sentences was reflected in the primary foregrounding choices of control participants, who were significantly more likely to draw the Cause entity first across all stimulus groups. Cause-first responses (Types A and B) accounted for 86% of all responses in the verbal condition. This confirms the findings of previous research indicating that order of mention can act as a constraint on the temporal order of drawing of entities from a linguistic stimulus (Chaterjee et al 1995).

However, evidence from the secondary foregrounding choices indicates that, for some participants at least, order of mention is not the only influential input-modality factor (van Sommers 1984; Geminiani et al 1995). Half the control participants differentiated between *give/put*-type events and *take/pick*-type events by means of systematic variations in their choice of second-drawn entity.

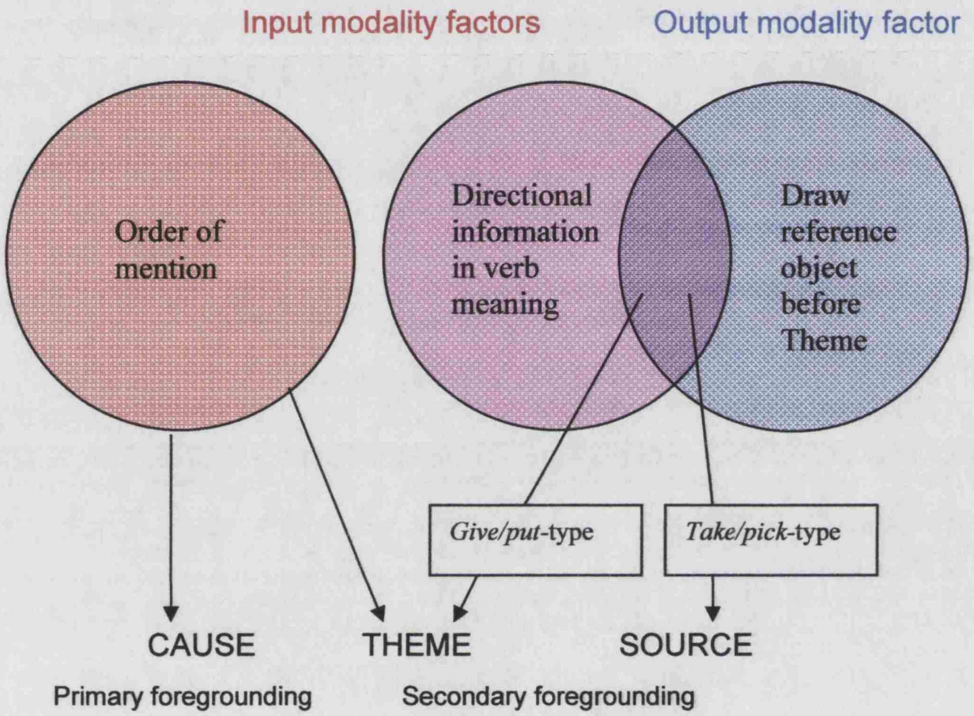
These participants were more likely to draw the Theme second in *give/put*-type events and last in *take/pick*-type events. In the current experiment, the order of mention constraint would predict that the Theme should always be drawn second, since the noun phrase corresponding to the Theme occurs in second position in all the stimulus sentences. For half the participants, this is indeed the case, suggesting that order of mention is the strongest constraint in determining foregrounding choices for these participants. For the other half, however, the directional information in the meaning of the sentence also influenced their choice of secondary foregrounding.

As in the visual condition, this can be attributed to the interaction between input modality factors and the output modality constraint of 'draw reference object before Theme'. Analysis 5, spatial position of the Theme, showed that the start position of the Theme was selected as the reference object by the majority of participants in all stimulus groups in the verbal condition, including those six participants who had differentiated between *give/put*-type and *take/pick*-type events by means of secondary foregrounding.

Having drawn the Cause first, following the input constraint of order of mention, these participants' choice of second-drawn entity depended on whether the Cause entity corresponded to the start position of the Theme and could thereby act as its reference object. This was the case in *give/put*-type events (Cause = start position), resulting in the Theme being drawn second and the Goal last (see Figure 5.7, Type A response, CSPos and CSPoss). In *take/pick*-type events (Cause = end position), these participants drew the Source (reference object) second and the Theme last (see Figure 5.7, Type B response, CGPos and CGPoss). This interaction between the input and output modality factors is represented diagrammatically overleaf (Figure 5.10).

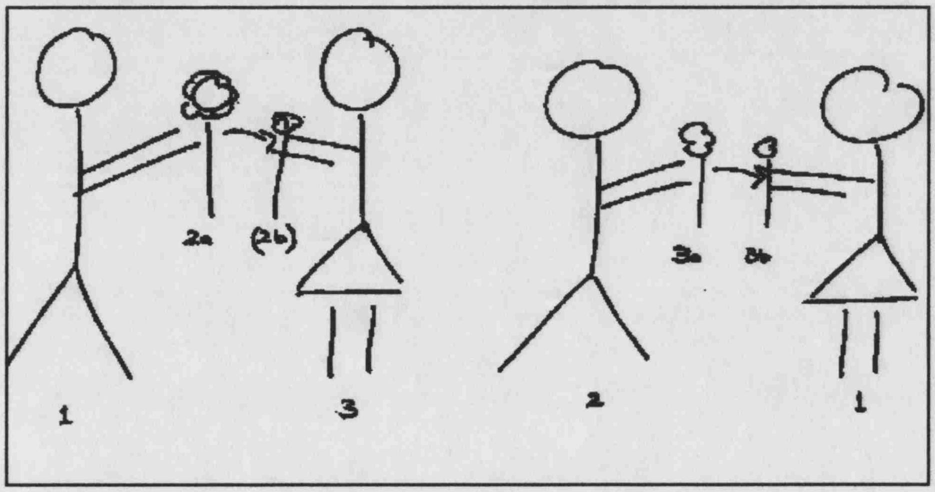
A good example of this interaction is provided by the two drawings in Drawing 4C overleaf, produced in response to the verbal stimuli: *"Bill gives the flower to Mary"* (example a) and *"Mary takes the flower from Bill"* (example b). These two drawings are virtually identical. However, the numbers below each entity, added by the investigator to indicate the temporal order in which they were drawn, show that JH has differentiated between the *give* and *take* perspectives by means of secondary foregrounding. In the *give* event, she has drawn the Theme second and the Source last, while in the *take* event, she has drawn the Source second and the Theme last.

Figure 5.10.
Diagram showing interaction between input and output modality factors that influence foregrounding choices in graphic communication of linguistically described CCL events.



Drawing 4C
Drawings produced by control participant JH in response to verbal stimuli: a) *Bill gives the flower to Mary* and b) *Mary takes the flower from Bill.*

Example a) Example b)



5.4 Summary of control study results and implications for aphasia

The results of the analyses carried out on the control participants' drawings have revealed a number of regularities that can provide some insights into how people with intact language approach the graphic communication of visually and verbally presented caused change of location events. A number of specific aspects of these events were identified in Chapter 2 as crucial for their effective communication. The results of the control study reveal that, when communicating these events via drawing, non-aphasic people have recourse to a number of graphic strategies to indicate these different communicatively-relevant aspects. Some of these strategies are similar to those found in linguistic communication of events, for example foregrounding entities by drawing them first, which is the graphic equivalent to placing them in positions of linguistic prominence. Others are specific to the graphic output modality, for example the use of arrows to indicate temporal and directional aspects of the events. The control study provided evidence about how input- and output-modality constraints interact to influence the graphic communication of CCL events from visual and linguistic stimuli.

The findings of the control study therefore provide a useful point of comparison for the performance of the participants with aphasia on this task. If the participants with aphasia are conceptualising the events in similar ways to control participants, individual analyses should reveal the use of similar strategies and should show the influence of similar input- and output-modality factors and interactions. Any deviations from control performance in the visual and verbal conditions would indicate problems with specific aspects of event processing and sentence comprehension. If the problem were specific to language, deviation from control performance would be expected in the verbal condition, while performance in the visual condition should be similar to that of control participants. Deviation from control performance in both conditions would indicate an underlying problem with the conceptualisation of events for the purpose of communication.

1) Number of repetitions

The control participants required few repetitions overall, with more repetitions in the visual condition than in the verbal (Analysis 1). A higher number of repetitions in comparison to controls in either condition would indicate that participants with aphasia had more difficulty with the task. This could have a number of causes, related both to processing and retaining the input stimuli and also to the production demands of the task. This analysis does not in itself permit a distinction between the various possible causes of difficulty, but may provide some pointers with regard to the interpretation of subsequent analyses. For example, differences in the number of repetitions required between the visual and verbal conditions might indicate specific problems with one or other input modality. Within-condition differences might indicate specific problems related to the variables of Event type and Cause role.

2) Identification of relevant participant entities

Control participants included all three main entities in their drawings, with no omissions or substitutions (Analysis 2). Omission or substitution of entities that play an integral role in the event, or inclusion of entities that are not involved in the target event by the participants with aphasia would have different implications in the visual and verbal conditions. In the visual condition, both of these problems might indicate a failure to process the structure of the whole event, which specifies the roles of the entities within the event (Dipper 1999; Dean & Black, in press). In the verbal condition, the relevant participant entities are clearly identified by the noun phrases in the sentence, thus inclusion of irrelevant entities is less likely. Omission or substitution of entities in the verbal condition might result from a number of sources. Participants may fail to retain the forms of the individual noun phrases in the sentence. A problem with understanding the individual noun phrases is less likely for most of these individuals, since their single noun semantics were relatively intact.

Alternatively, and/or additionally, omission of entities in particular might reflect a problem with building up the semantic structure of the events described, implying reduced access to the meaning of the verb. However, it must be noted that inclusion of all three entities in the verbal condition does not necessarily imply understanding of the meaning of the sentence, since the input sentence could simply be processed as a string of nouns.

3) Appreciation of the causal structure of the event.

Appreciation of the causal structure of the events is bound up with the ability to take a perspective and to identify the roles of the entities. The main method used by control participants to signal the causal structure of the events was by foregrounding the causal instigator of the event, thus giving prominence to the ACT component of the event (Analysis 6). By drawing the Cause entity first, control participants indicated that the event should be viewed from the perspective of this entity.

However, in the visual condition, this was influenced by the number of perspective options offered by the stimuli. The Cause entity was consistently foregrounded by control participants in the position change events, where perspective choices are limited, due to there being only one candidate for the role of Cause. In the possession change events, which offer a choice of perspective, foregrounding of the Cause entity depended on the congruence of a number of perceptual and conceptual factors. Scenes that offer options in perspective therefore add a further layer of complexity to visual event conceptualisation and may cause particular difficulties for some participants with aphasia (Black & Chiat 2000; Dipper et al 2005). In this case, they might show a similar pattern of performance to the controls, i.e. an increased reliance on perceptual factors in possession change events, but consistent foregrounding of the Cause in position change events. However, if this reliance on perceptual factors and associated reduced foregrounding of the Cause extends to position change events, this might indicate a more general problem with schematisation in visual event conceptualisation.

Foregrounding of entities other than the Cause in the visual condition might indicate an unusual focus being taken on the event. For example, foregrounding the Theme might indicate a focus on the Process subcomponent, while foregrounding the end position might indicate a focus on the end state subcomponent. This would in turn imply a failure to appreciate or attend to the causal structure of the events and the related role of the Cause entity within the events.

In the verbal condition, the Cause entity was consistently foregrounded by control participants throughout, reflecting the linguistic foregrounding of the sentences, where the Cause (Actor) is mapped onto the Subject position, therefore given linguistic prominence. A similar pattern of performance might be predicted for participants with aphasia, providing they are able to maintain a record of the order of the noun phrases in the sentence. Thus consistent primary foregrounding of the Cause entity in the verbal condition does not necessarily imply intact ability to process the meaning of the sentence.

Participants who are able to retain the order of the noun phrases could simply reproduce this order in their drawings, without understanding the roles of these noun phrases and the relationship between them. Failure to consistently foreground the Cause entity in the verbal condition might be indicative of a problem maintaining the order of the noun phrases around the verb in the sentence. Alternatively, and/or additionally, it may indicate a problem with interpreting the semantic structure of the event described, i.e. that it involves a causal act resulting in a process of change. This information is the joint product of general mapping procedures, for example that the role of Actor (Cause) is assigned to the first noun phrase in English, and thematic information encoded in the lexico-semantic representation of the verb.

Failure to consistently foreground the Cause in either position change or possession change events in the verbal condition might indicate a problem with both these aspects of sentence processing, i.e. inability to apply general mapping procedures and reduced access to thematic aspects of the verb's meaning. Consistent foregrounding of the Cause in position change events but not possession change might imply access to thematic-syntactic mapping procedures to build up the semantic structure of the event. However, this pattern of performance might indicate a problem in accessing verb-specific thematic information, and/or a problem maintaining the order of the noun phrases in the sentence, since the possession change sentences offer no semantic/pragmatic clues to thematic role assignment. Interpretation of performance on this analysis must therefore be supported by evidence from other analyses that indicate appreciation or otherwise of verb meaning, for example evidence of appreciation of temporal structure and directional or manner information.

4) Appreciation of temporal structure

Appreciation of the causal structure of the events implies awareness of their temporal structure. However, control participants also used other strategies to indicate that the events involved a process of change. The main strategy used consistently by all controls was the use of arrows (Analysis 3). The position and orientation of the arrows in control participants' drawings suggested that they were generally used to mark the Process subcomponent of these events, i.e. the subcomponent in which the main change occurs. The inclusion or non-inclusion of arrows by the individuals with aphasia would provide some indication of whether they are processing the temporal structure of the event, (i.e. that a change had occurred), even if they had failed to process its causal structure.

Another strategy used by control participants to indicate the temporal structure of the events was the preferential location of the Theme at its start position in the event (Analysis 5). This was interpreted as indicating that control participants focus on the beginning of these events when communicating them graphically. A similar pattern of performance by the participants with aphasia would provide evidence of a similar focus being adopted, but additional evidence of the ability to process temporal structure would be required.

Consistent location of the Theme at its end position by participants with aphasia might suggest an unusual focus on the event, i.e. a focus on the end state. In the visual condition, this might imply a problem with appreciating the temporal structure of the events, i.e. the process of change that led up to this end state. However, this interpretation would depend on whether any other strategies were used to signal the causal or temporal structure of the event. In the verbal condition, consistent location of the Theme at its end position might indicate a problem with interpreting the focus of the verb in descriptions of events. However, once again this must be viewed in the context of evidence from other analyses.

5) Appreciation of directionality

The inclusion of arrows and consistent location of the Theme at its start position were also used to indicate directional information by the control participants. The position and orientation of the arrows in control participants' drawings corresponded to that of the input stimuli. The position and orientation of any arrows in drawings produced by the participants with aphasia would therefore provide some evidence about their ability to process directional information in the visual and verbally described events. However, failure to include arrows in drawings might indicate a difficulty developing an appropriate graphic strategy to signal this aspect of the event, rather than a problem with processing directionality per se. Comparisons across modalities might be informative here, since directional information in the visual condition is directly perceived: the movement of the Theme can be separated from the act that caused that movement. In the verbal condition, on the other hand, it is intrinsic in the meaning of the verb and the prepositional phrase. For some participants with aphasia, the verbal condition might be more affected than the visual.

A problem with processing directional information might also be indicated by inconsistent location of the Theme. This would imply a failure to identify the beginning or endpoint of the events, which suggests a problem with interpreting the directional roles of the entities or participants in the input stimuli. Once again comparison across the visual and verbal conditions is important.

One final strategy used by some control participants to indicate directional differences between *give/put*-type and *take/pick*-type events was by means of secondary foregrounding choices. Use of this strategy by the participants with aphasia would provide positive evidence of their ability to process this aspect of the stimulus. However, failure to use this strategy would not be informative, since its use amongst control participants was idiosyncratic.

6) Appreciation of specific action-related features of the event, e.g. manner.

Control participants used some graphic strategies to indicate specific features of events, such the manner or means by which the change of location took place. For example, they consistently included a symbol for money in *buy/sell* events in both the visual and verbal conditions. There was also some indication that arrows, in particular double arrows, were used by a minority of control participants signal manner differences between similar types of events. A similar use of such graphic strategies by participants with aphasia would be positive evidence that these features of the events had been processed. In the verbal condition, this would suggest intact access to 'core' aspects of verb meaning. However, a failure to use such strategies would not necessarily imply a problem with processing these aspects of events, but might instead be related to difficulties in developing an appropriate graphic strategy to signal these aspects of events. Comparison across the visual and verbal conditions would again be informative. The use of these strategies in one condition but not the other would imply an input-modality-specific problem, rather than a problem with the graphic output modality itself.

To summarise, comparison of the performance of the individuals with aphasia with that of the control participants on the various analyses in the visual and verbal conditions should allow us to hypothesise about particular aspects of event conceptualisation and sentence processing that are intact and those that may be causing difficulties for each individual. Comparisons across the two conditions of the task will determine whether similar patterns of impairment occur across linguistic and non-linguistic modalities. This would argue for a more general problem with the conceptualisation of events for the purpose of communication, rather than a problem specific to language. Comparisons across the two conditions and between the participants with aphasia should also be informative with regard to the interaction between event conceptualisation and language impairment. If, as suggested in Chapter 2, the language impairment itself contributes to problems at the conceptual preparation level, this would predict a correlation between the extent and nature of individuals' language impairments and their performance on the visual condition of the event drawing task. Specifically, individuals who are more impaired in those aspects of meaning related to event structure (i.e. thematic information) should show an increased reliance on bottom-up perceptual factors in the visual condition in comparison to individuals whose access to these aspects of meaning is relatively spared.

The performances of the individual participants with aphasia on the experimental event drawing task are presented in the following chapter, with reference to the control study findings and to the results of other assessments of event and sentence processing described in Chapter 4, Section 4.3. Results for the visual and verbal conditions are presented separately for each individual, followed by a summary of their event conceptualisation performance based on comparisons between the two conditions. Comparisons between participants will be discussed in Chapter 7, which summarises the main findings and implications of the current study.

Chapter 6

INDIVIDUAL PERFORMANCES OF PARTICIPANTS WITH APHASIA

6.1 JOK

A. Processing of visual events

i) Performance on visual condition of event drawing task

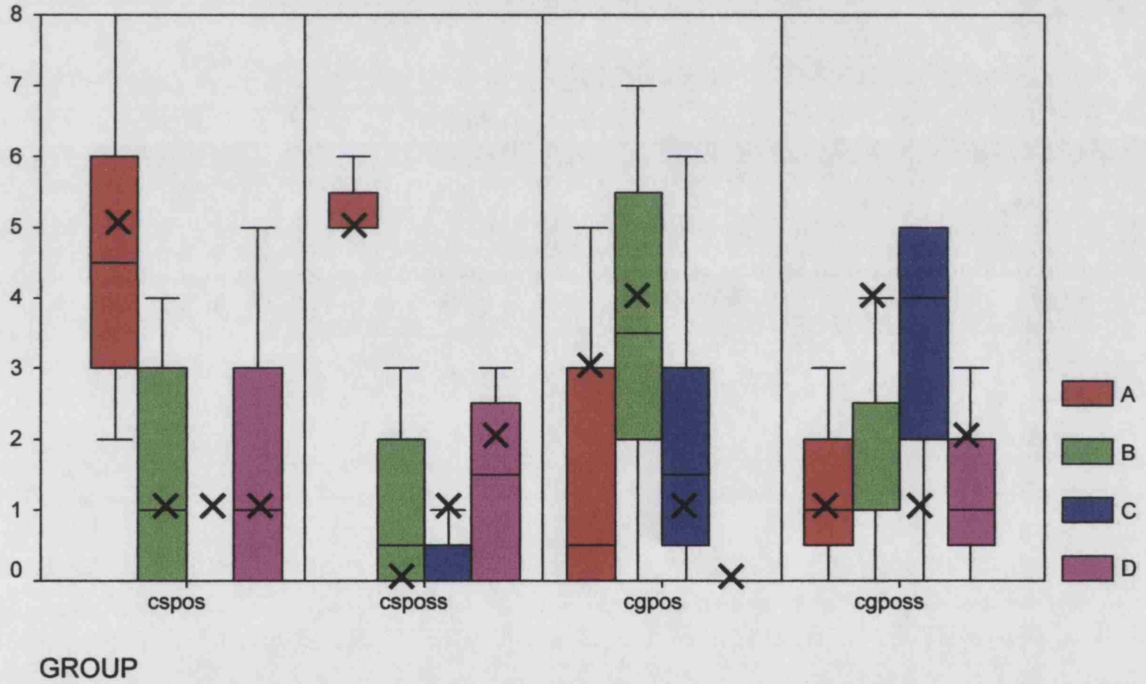
JOK's performance on the visual condition of the event drawing task was similar to that of the control participants in most respects, suggesting that his processing of visual events for the purpose of communication is intact. However, he required a total of 16 repetitions over the whole test which was outside the control range of 2 -10, and more than two standard deviations over the control population mean (control mean = 4.917, S.D = 2.59).[14] This suggests that he may have a mild difficulty in storing and maintaining the input stimulus in working memory, whilst engaging in further processing and execution of the drawing. JOK was able to identify the relevant participants in the events, as shown by the inclusion of the three main entities in his drawings, with no omissions or additional entities, other than a table as support for the Source/Goal entity in certain position change events. This reflects control performance.

Ability to process the causal structure of the events is indicated by consistent primary foregrounding of the Cause entity. Figure 6.1.1 shows JOK's performance on Analysis 6, temporal order of drawing of the entities, which shows that he made similar foregrounding choices to those of control participants. JOK drew the Cause entity first (type A & B responses) significantly more often in position change events (χ^2 = 6.25, df 1, p = .01). In possession change events, this effect did not reach significance, which mirrors control performance. JOK in fact produced slightly more Cause-first

[14] The standard deviations were calculated using Excel STDEVPA, the control participants being the whole population from which the data were derived. Although the repetition 'scores' may not have been normally distributed, this analysis was felt to be most suitable for the current data.

responses than controls in possession change events and his performance, even on possession change events, was not affected by the perceptual factor of screen position as he was more likely to draw the Cause entity first even when it appeared on the right of the screen. The reduced influence of perceptual and graphic constraints suggests that JOK attends to the role of the Cause entity as initiator of the event. He presents the event from the perspective of the Cause entity, even when there is a choice of perspective options. This indicates that JOK is focusing on the Act component and has no difficulty in taking a perspective on a visual event.

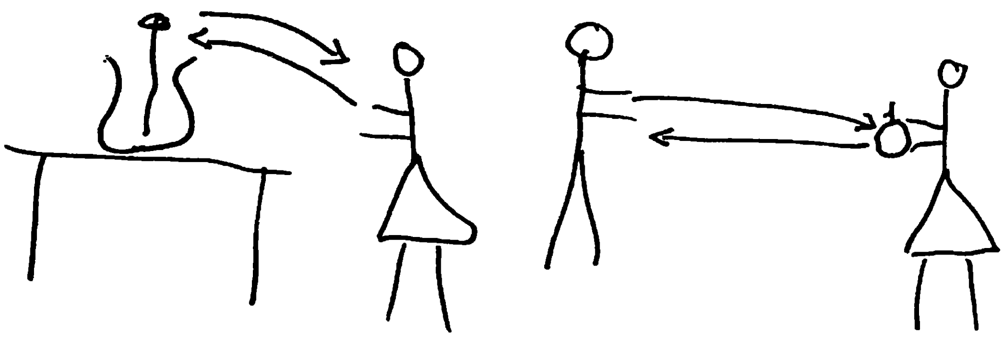
Figure 6.1.1
JOK Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by JOK (X) in the visual condition stimulus groups compared with control median and range.



Further evidence that JOK has processed the Act component of the events comes from his use of double arrows in a similar way to some control participants in *take/pick*-type events (Analysis 3). The first arrow, positioned from the Cause to the Theme, signals the initiating act, while the second indicates Theme's movement back to the Cause, i.e. its end position. Examples are provided in Drawing 6A overleaf. JOK also used double-arrows in his drawings of *buy/sell* events and in some *grab* and *throw* events, as a means of indicating specific features of the events, such as the dual nature of the transaction and the manner of the action.

Drawing 6A.
Examples of double-arrow strategy in *take/pick*-type events in JOK's visual condition drawings, indicating the initiating action of the Cause and the subsequent movement of the Theme.

a) Girl picks flower from vase   b) Boy takes apple from girl



JOK's consistent use of arrows in all his drawings also demonstrates appreciation of temporal structure and directional information. Like control participants, the position and orientation of single arrows in JOK's drawings generally signalled the movement of the Theme to its end position (86%, 19/22 times), suggesting that arrows are used to indicate the process subcomponent of the events.

Further indication of intact ability to process temporal structure and directionality comes from JOK's tendency to locate the Theme at its start position in his drawings, which also mirrors control performance (Analysis 5) (see Figure 6.1.2). In *take/pick*-type events (CGPOS and CGPOSS), JOK was significantly more likely to locate the Theme at its start position (Binomial 2-tailed, $p < .05$). In *give/put*-type events (CSPOS and CSPOSS), the high number of exclusions can be explained by his frequent use of the double-Theme strategy (13/16 times), whereby the Theme is drawn first at its start position, and a second Theme is drawn at its end position. Examples are provided in Drawing 6B overleaf. This use of the double-Theme strategy is similar to some of the control participants. Like the control participants, therefore, JOK's *initial* drawings represented the pre-event locational state, and were turned into representations of events by means of graphic artefacts such as the addition of an arrow or a second Theme.

Drawing 6B.
JOK: Examples of use of double-Theme strategy to indicate movement and direction in the visual condition

a) boy takes box from girl

b) boy drops ball into box

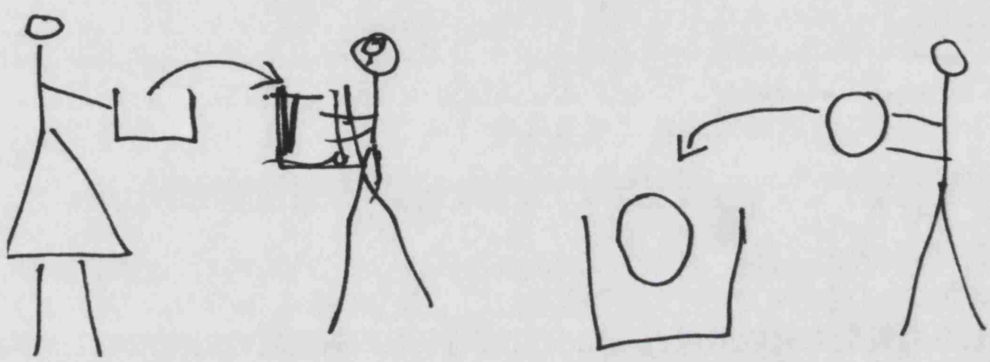
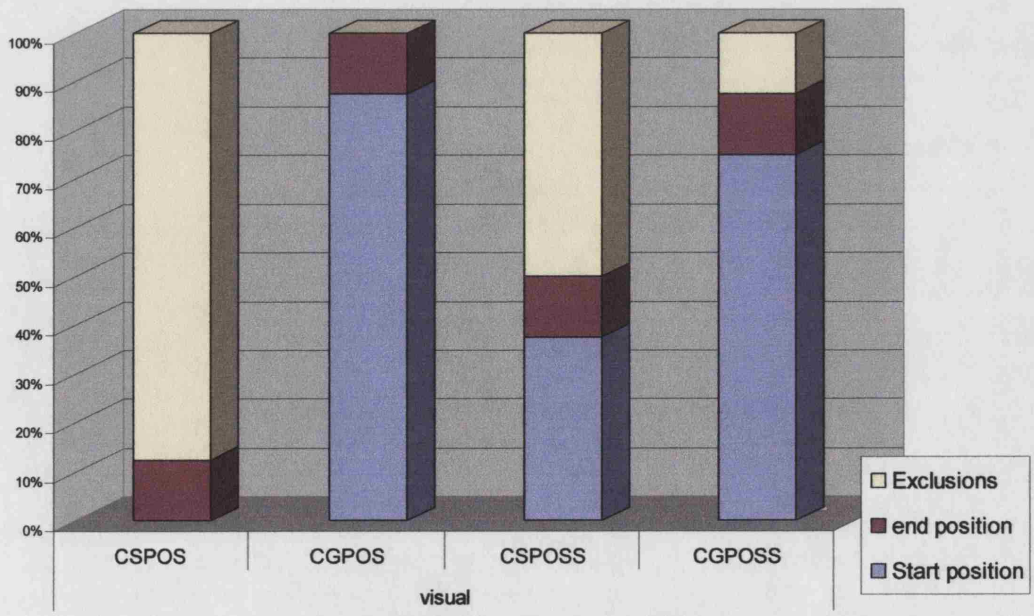


Figure 6.1.2
Graph showing location of the Theme in JOK's drawings in the visual condition



In summary, JOK's performance in the visual condition of the event drawing task suggests that he has no difficulty processing visual events for the purpose of communication. His drawing performance matched that of the control participants and provided positive evidence of the ability to conceptualise communicatively-relevant aspects of events.

ii) Evidence from non-linguistic event processing assessments

JOK's good event processing skills were confirmed by his performances on the other assessments of non-linguistic event processing (see Chapter 4, Section 4.3.2). He scored 57/60 on the Event Perception Test and 30/32 on the Role Video, both of which were within normal limits. This confirms that JOK is able to analyse both specific action-related aspects of visual events and the roles of the entities in these events.

This therefore allows us to rule out a problem with event conceptualisation as a possible source of JOK's language production deficits, in particular his difficulty retrieving verbs. Conversely, it would suggest that difficulty in accessing verbs for output does not necessarily impact on the conceptualisation of events. This will be discussed further in Section C below.

B. Processing of linguistically encoded events

i) Performance on verbal condition of event drawing task

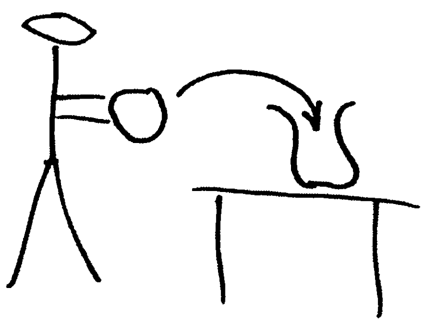
JOK appeared to have more difficulty with the verbal condition of the event drawing task. Several aspects of his performance suggest a difficulty with maintaining the input in auditory memory whilst engaging in further processing. Firstly, he required a total of 68 repetitions over the whole test, which is significantly higher than the control range of 0 – 3 (control mean = 0.417, S.D = 0.87), and also significantly higher than his requests for repetition in the visual condition ($\chi^2 = 32.19$, df 1, $p < .0001$) (Analysis 1). Requests for repetition occurred equally across position change and possession change sentences. Secondly, JOK made several "substitution errors" in his drawings, where he drew a different entity than that mentioned in the sentence (Analysis 2). This occurred on 10/32 items, equally across position change and possession change sentences. He drew the wrong Cause four times (Drawing 6C, example a) , the wrong Theme three times (Drawing 6C b) and the wrong Source or Goal three times (Drawing 6C c). A semantic source of these errors is unlikely since JOK's single noun semantics are intact (PALPA 47, see Chapter 4, Section 4.2.1). A more likely source is therefore a problem retaining the nouns in the sentence.

Drawing 6C.
JOK: examples of substitution of entities in the verbal condition, indicating a problem retaining the individual noun phrases in the sentences

a) Bill picks the flower from the vase

b) Mary gives the flower to Bill

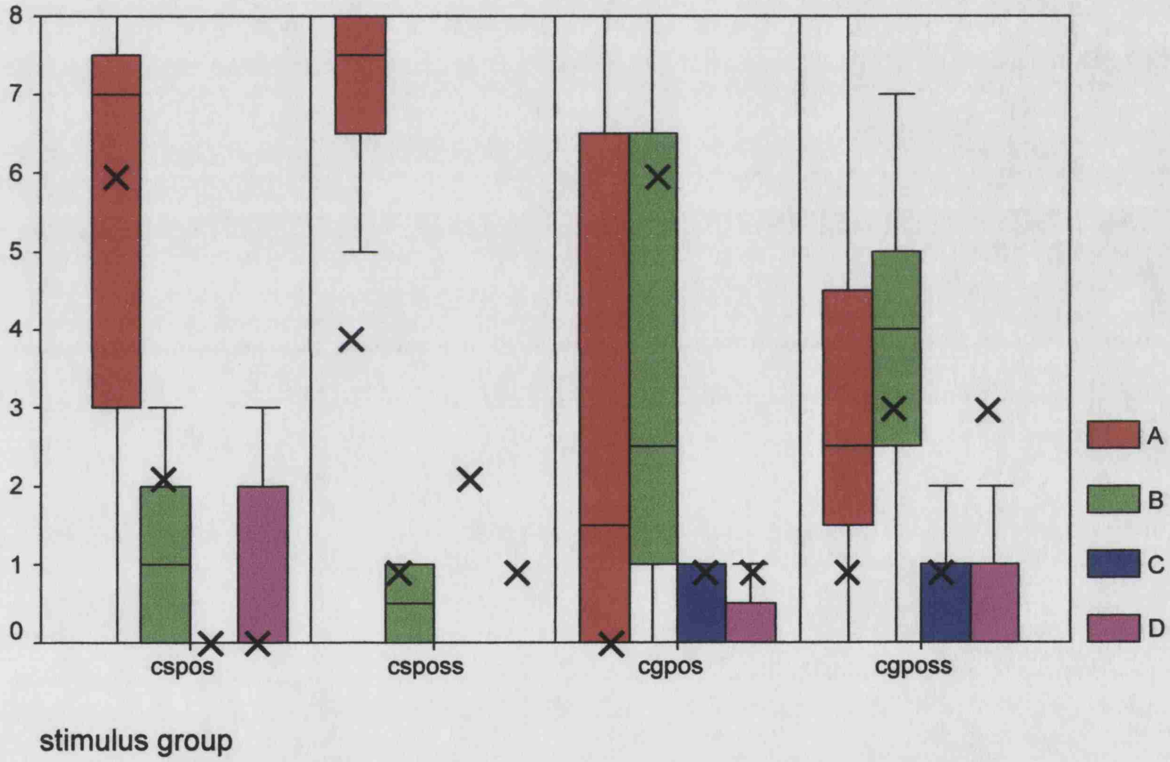
c) Bill throws the ball into the bucket



Evidence from the analysis of temporal order of drawing (Analysis 6) suggests that, even when JOK did remember the individual nouns, he may have had difficulty retaining their linear order in the sentence, i.e. maintaining the content of the noun phrases in registration with the syntactic structure of the sentences.

This problem selectively affects the sentences that describe possession change events. In position change events, his foregrounding choices mirrored those of the control participants, in that he consistently drew the Cause entity first (14/16 times: see Figure 6.1.3, CSPos and CGPos, response types A & B). However, in possession change events, he produced fewer Cause first responses than controls. He was equally likely to draw the Source/Goal first (Figure 6.1.3, CSPoss and CGPoss, Types C & D) even though the corresponding noun phrase always occurred in sentence-final position.

Figure 6.1.3
JOK Verbal condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by JOK (X) in the verbal condition stimulus groups compared with control median and range.



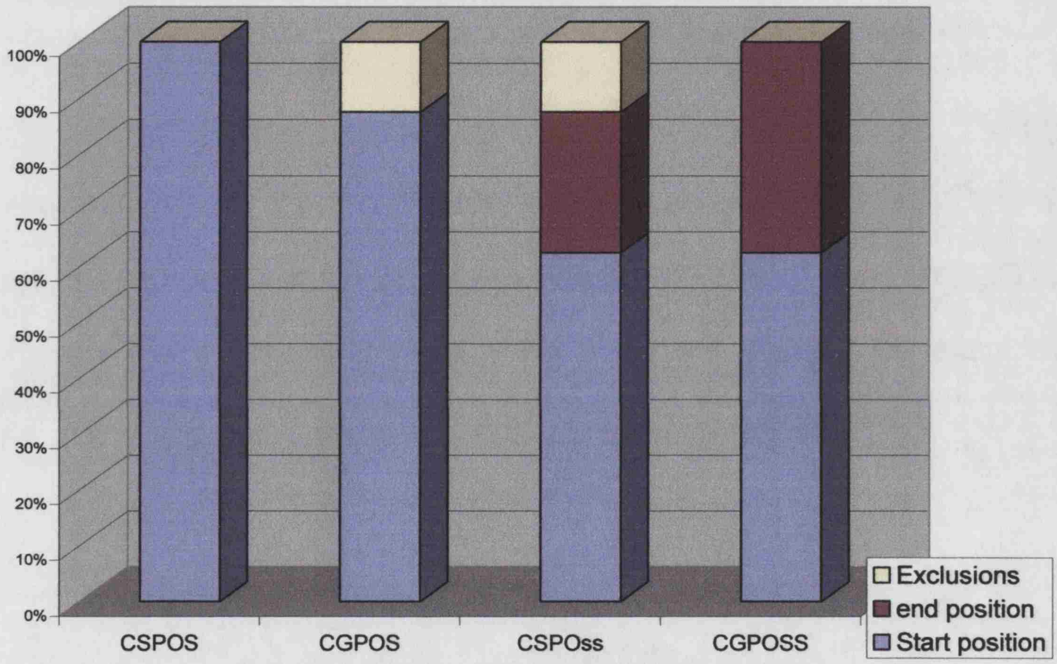
This selective effect can be explained by the fact that the sentences that describe possession change events do not provide any semantic/pragmatic clues to help 'fix' the content of the individual nouns into their appropriate noun phrase slots in the sentence structure. In the sentences describing position change events, only one of the nouns fulfils the semantic/pragmatic criteria for the Actor role, which is assigned to the noun phrase in sentence-initial position. However, in the reversible possession change sentences, both the proper names, *Bill* and *Mary*, are plausible Actors and could therefore fill the sentence-initial noun phrase slot. Thus if JOK cannot remember the order in which he heard the names *Bill* and *Mary* in the possession change sentences, he may assign these nouns randomly to the sentence-initial and sentence-final noun phrase positions. Under this interpretation, JOK's apparent Source/Goal-first responses in possession change events might actually be what *he intends* as Cause-first. This will be discussed further in the light of evidence from other analyses, which support intact semantic processing of the sentences.

Evidence that JOK has interpreted the semantic structure of the event and specific verb-related information comes from the use of similar strategies to controls to indicate the initiating Act and resultant Process subcomponents of the events described. Like controls, JOK used arrows in all his drawings in the verbal condition (Analysis 3). He also used double arrows in response to sentences that included verbs like *throw* and *grab*, the first positioned from the Cause to the Theme to indicate the initiating action, and the second positioned from the Theme to its end position, indicating the effect of that action. This also suggests that JOK had processed the specific manner differences expressed by these verbs in comparison with the more neutral *put* or *take*. He also included double arrows in all of his drawings of *buy* and *sell* events, indicating understanding of the specific kind of transaction described by these verbs. The position and orientation of the arrows in JOK's drawings also indicate that he has processed directional information in the sentences. In the majority of his drawings (78%, 25/32), the orientation of his arrows corresponded to the direction implicit in the sentence meaning.

Another indication of intact processing of directional information in the stimulus sentence was shown by the fact that, like some control participants, JOK systematically differentiated between *give/put*-type events and *take/pick*-type events through his choice of secondary foregrounding (Analysis 6). He was significantly more likely to draw the Theme second in *give/put*-type events (response types A & C) and last in *take/pick*-type events (response types B & D) (Fisher exact, $p < .005$) (see Figure 6.1.3).

He also showed a similar performance to the controls by consistently locating the Theme at its start position in his drawings (Analysis 5). He drew the Theme at its start position significantly more often than at its end position in both *give/put*-type and *take/pick*-type events ($\chi^2 = 6.25$, $p < .01$; $\chi^2 = 9.0$, $p < .05$) (see Figure 6.1.4). Once again, this indicates that JOK has interpreted the directional roles of the noun phrases in the sentences implicit in the meaning of the verb and prepositional phrase (see Chapter 5, Section 5.2.5).

Figure 6.1.4
Graph showing location of the Theme in JOK's drawings in the verbal condition

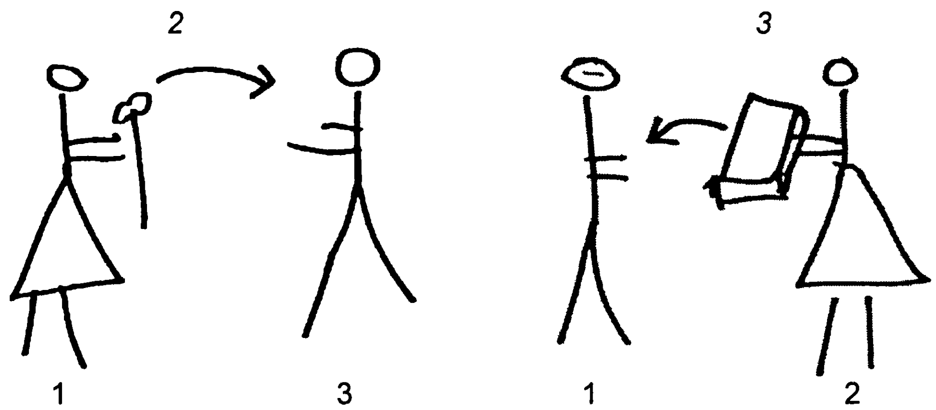


As can be seen from Figure 6.1.4, there were some exceptions to JOK's tendency to locate the Theme at its start position. Post-hoc analysis revealed that these all occurred on those possession change sentences where JOK had drawn the Source/Goal entity first (Pearson correlation, $\chi^2 = 15.7$, $p < .0001$) and where he had produced an apparent "directional error" in his arrow use (Pearson correlation, $\chi^2 = 7.31$, $p < .005$). This performance is not inconsistent with the interpretation of a problem in retaining the order of the noun phrases in these sentences in the context of intact access to verb meaning, if JOK's performance is considered in its entirety.

Consider the two drawings below (Drawing 6D), produced by JOK in response to the sentences (a) *Bill gives the flower to Mary* and (b) *Mary takes the book from Bill.* The numbers were added to the drawings by the investigator to indicate the temporal order in which the three main entities were drawn.

Drawing 6D. Drawings produced by JOK indicating failure to retain order of noun phrases *Bill* and *Mary*

Stimulus: a) *Bill gives the flower to Mary* b) *Mary takes the box from Bill*



At first sight, the completed drawings might suggest that JOK has misinterpreted the directional information in the sentence. However, closer analysis of the process of his drawings allows us to reject this interpretation. Firstly, according to JOK's secondary foregrounding choices, the order in which he has drawn the entities, indicated by the numbers under each entity, is consistent with a *give*-type interpretation for example (a), where he drew the Theme second, and a *take*-type interpretation for example (b), where he drew the Theme last. This suggests that JOK has correctly interpreted the meaning of the verb in these sentences, but has assigned the two names to the incorrect noun phrases, resulting in a misinterpretation of sentence (a) as *Mary gives the flower to Bill,* and sentence (b) as *Bill takes the box from Mary.* Secondly, JOK's strong tendency to draw the Cause on the left of the page ($\chi^2 = 8.00$, df 1, $p < .005$) (Analysis 4) suggests that he is treating *Mary* as the Cause in sentence (a) and *Bill* as the Cause in sentence (b). Under JOK's (mis)interpretation of the sentences, *Mary* would correspond to the Theme's start position in both these sentences, which explains his location of the Theme with *Mary* in these drawings. It also suggests that the apparent "directional errors" in the arrows in these drawings are not in fact errors at all, since the orientation of the arrows corresponds to the direction implied in JOK's (mis)interpretation of the sentences.

In summary, JOK's overall performance in the verbal condition of the event drawing task supports the hypothesis that he has a single problem in the comprehension of sentences, namely maintaining the content of the noun phrases in registration with the sentence structure. His semantic processing is hypothesized to be intact. The differences in his performance across the position change and possession change sentences indicate that, where possible, he uses intact semantic level information to compensate for these syntactic level problems. JOK's performances on the other assessments of language processing provide support for this interpretation.

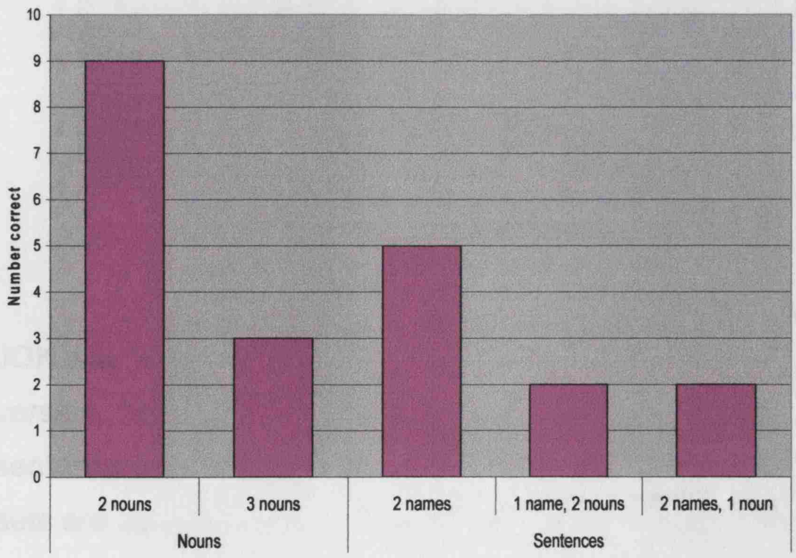
ii) Evidence from other language assessments

Support for a problem retaining the linear order of noun phrases comes from JOK's performance on the Noun Pointing task (NPT). His overall score of 21/50 was significantly below the control score of 48 (Fisher's exact test, $p < 0.0001$). Figure 6.1.5 shows his scores on the different levels of the task. Credit was given only if all the correct lexical items were selected and placed in the correct linear order on the template (see Chapter 4, section 4.3.2.A, p 112). He matched the expected score of 10 only on the two-noun lists. His performance dropped significantly on the three-noun lists (McNemar, $p < 0.05$), which suggests that he has difficulty remembering more than two nouns even when they do not occur within a sentence. JOK's worst scores occurred on three-noun sentences, which are most similar in structure to those used in the event drawing task.

JOK made both lexical and sequencing errors in both noun lists and sentences, suggesting that he has difficulty retaining the actual lexical items as well as their order, which is consistent with his substitution errors in the event drawing task. Lexical errors are unlikely to be due to a semantic deficit, since JOK's single noun semantics is intact (PALPA 47, see Chapter 4, Section 4.3.1). Sequencing errors significantly exceeded lexical errors in the sentences involving two proper names and one inanimate noun (Fisher exact, p = .01). These sentences are similar in structure to the change of possession sentences used in the event drawing task. In the NPT sentences, JOK's sequencing errors generally involved transposition of the final two nouns, with the initial noun being correctly remembered in 8/10 of the sentences. This differed from his performance in the event drawing task, where he transposed the initial and the final nouns. This may reflect differences in the requirements of the two tasks. In the NPT, there is no requirement to process the relations between the noun phrases or to attend to the meaning of the whole sentence. In the event drawing task, however, where the task is to communicate about the event described, the meaning of the sentence must be processed, including the roles of the individual noun phrases and the relations between them. JOK therefore has to retain the content of the noun phrases at the same time as building up syntactic and semantic structure, keeping the two in registration, and this is where his difficulty lies.

Figure 6.1.5

JOK: Scores for each level of the Noun Pointing Task[15]

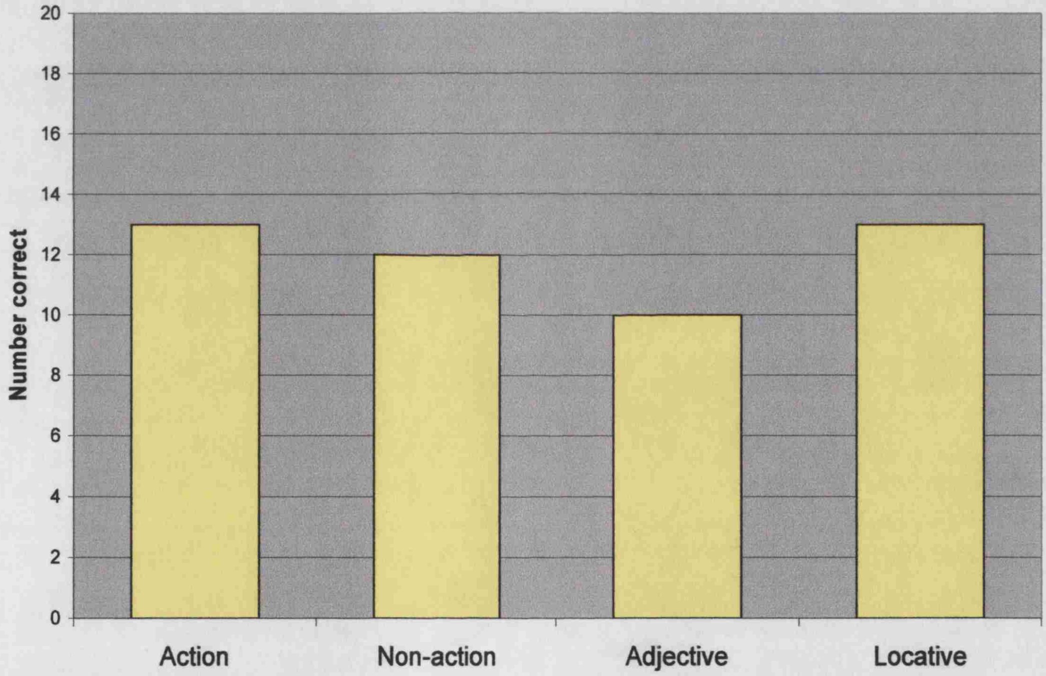


[15] For convenience, the labels 'name' and 'noun' have been used in the graph legend to differentiate between nouns which are proper names and general nouns. See Chapter 4, section 4.3.2.

A difficulty in retaining the linear order of noun phrases in a sentence could account for JOK's poor performance on the Singles version of the Reversible Sentences Comprehension Test (RSCT). His score of 48/80 placed him at chance. He achieved roughly equal scores on all sentence types as shown in Figure 6.1.6. Interpretation of the sentences in the RSCT relies on correctly processing and maintaining the order of the two noun phrases around the predicate. If, as hypothesized, JOK is not sure whether the sentence he heard was *"The nun splashes the queen"* or *"The queen splashes the nun"*, he would not be able to match it with the event in the accompanying picture, even if he has correctly processed the verb meaning.

Figure 6.1.6

Graph showing JOK's scores in each sentence set on the Reversible Sentences Comprehension Test



JOK was further tested on a different version of the RSCT, the "Who is ...?" version, which requires that the position of only one noun phrase in the sentence be retained. 10 items from each of the action and non-action verb sets are used. The noun labels are replaced with proper names, such as *Alison* and *Philippa*. Participants are shown one picture, followed by the sentence *"Alison splashes Philippa."* They then have to answer a question such as *"Who is Alison?"* or *"Who is Philippa?"* by pointing to the relevant person in the picture. On this version of the test JOK scored 9/10 on the action verbs set, which represents an improvement over his score in the Singles version, suggesting that reducing the memory demands of the test positively affects his ability to process thematic information in sentences involving action verbs.

However, JOK's score on the non-action verbs in the "Who is ...?" version of the test remained low at 3/10. The difference between his action verb score and his non-action verb score was significant (McNemar, $p < .05$). This may be related to the fact that interpretation of non-action verb sentences relies more on verb-specific thematic information. The verbs used in this set assign the thematic roles of Stimulus and Experiencer to their complements and differ in respect of how these roles are mapped onto positions in the sentence structure. An additional source of difficulty with the non-action verbs set is that the relationship between the situation described in the sentence and that depicted in the accompanying picture relies on conceptual and pragmatic knowledge and inference. There are fewer conceptual or perceptual cues to distinguish the character who is more "causally weighted" (Black et al 1991) and therefore the more obvious "anchoring point" from which to view the scene. Black et al (1991) found that difficulties with this set of stimuli are not confined to people with aphasia, but were also apparent in non-aphasic controls. They suggest that increased error rate on these sentences may not be due to problems with the verb or sentence processing per se, but arise in the construction of representations that "mediate the translation between language and pictures" (p 79). In other words, the problem is not just in the conceptual representation of the scene itself, nor just in the perspective of the verb and sentence. Rather it is in the interaction between the two, i.e. in the "thinking for listening" that problems arise (Black & Chiat 2000).

JOK's performance on the Perspective Video task provides additional evidence that he has access to the meanings of verbs. His score of 15/18 did not differ significantly from the expected score. This task places no demands on auditory memory and does not require any syntactic processing.

C. Summary and interpretation of JOK's performance

JOK's performance on the event drawing task provides strong evidence that his problems with communicating about events are specific to the linguistic modality and are not attributable to problems with the conceptual preparation level of production. His performance in the visual condition of the task was similar to that of controls and provided evidence of intact processing of all communicatively-relevant aspects of caused change of location events. His performance also demonstrated that he was able to use this information to communicate effectively about the events in the non-linguistic modality of drawing. The only significant difference between JOK and the controls in the visual condition was the higher number of repetitions requested by JOK. This indicates that JOK had more difficulty than controls in storing and maintaining a visual stimulus in working memory, despite his intact event conceptualisation.

The available evidence therefore allows us to reject an event conceptualisation source of JOK's language production difficulties, and suggests that his problems with verb and sentence production result from a deficit at the post-semantic stage of language production. Further supporting evidence comes from JOK's performance on the Object and Action Naming Battery (see Chapter 4, Section 4.2.1 and Appendix G). Adoption of less strict scoring criteria on this test, which would allow for inclusion of ambiguous 'noun errors', e.g. "slide" or "drink", and possible errors in verb morphology, e.g. "tickler" for *tickling,* "painter" for *painting,* would bring JOK's action naming score up to 37/50, which is not significantly below his object naming score of 44/50. JOK failed to produce any response at all to four items. On four items he produced an ambiguous verb, based on a noun or adjective appropriate to the situation: "bottled" for *floating* (the stimulus shows a bottle floating), "frozen" for *melting,* "baller" for *kicking* and "build" for *leaning (against a wall).* On the remaining five items he produced a response that indicated appreciation of the target event: *playing* → "toy, build" (the stimulus shows a child playing with bricks), *begging* → "thank", *shooting* → "blast", waving → "bye bye, exch _ e", *posting* → "Post box was letter". However, JOK indicated awareness of the inappropriateness or insufficiency of these responses, which suggests that his semantics are intact. The most likely source of JOK's verb production deficit is therefore a failure to access orthographic representations of verbs from intact semantic representations.[16] This is similar to other cases reported in the aphasia literature (Marshall et al 1998; Dean & Black in press). JOK's performance therefore shows that verb retrieval deficits can occur in the absence of any event conceptualisation problems.

Comparison across the visual and verbal conditions confirmed that JOK's access to verb semantics was intact. He was able to process both thematic and core aspects of verb meaning. However, JOK showed a selective difficulty with reversible sentences describing possession change events. The fact that these kinds of events caused him no difficulty in the visual condition confirms a linguistic source of this deficit, namely a single problem with maintaining the content of the noun phrases in registration with the sentence structure. This degree of specificity regarding the source of JOK's sentence processing problems was not available from the other assessments of language processing, where differentiation between a semantic-level and a syntactic-level deficit is usually hard to test.

16 It is possible that JOK also has a deficit in accessing the phonological form of verbs from semantics. However, his severe apraxia makes this difficult to assess. Silent tests of phonology such as rhyme judgement would be helpful here, but these have not been carried out with JOK. Also, existing tests are not specific to verbs.

6.2 PZ

A. Processing of visual events

i) Performance on visual condition of event drawing task

Like JOK above (section 6.1), PZ's performance on the visual condition of the event drawing task showed some similarities to that of controls, indicating that she is able to process several communicatively-relevant aspects of visual events. She required only 6 repetitions of the stimuli which was within the control range of 2 -10, and less than one standard deviation above the control mean (control mean 4.917, S.D 2.59). This suggests that PZ can store and maintain the input stimulus in working memory (Analysis 1). PZ always included the three main entities in her drawings and did not include irrelevant entities, suggesting that she can identify the relevant participants in a visual event (Analysis 2).

Analysis of temporal order of drawing (Analysis 6) demonstrates that PZ has processed the causal structure of the events. Like the control participants she usually gave primary foregrounding to the Cause entity by drawing it first, suggesting that she is aware of the crucial role of this entity as initiator of the event. She drew the Cause first consistently in position change events, even when it appeared on the right of the screen (16/16 times) (Figure 6.2.1, CSPos and CGPos, type A & B responses). However in possession change events, there was a significant effect of screen position as shown in the graph in Figure 6.2.2. She was more likely to draw the entity on the left of the screen first in possession change events (Fisher exact, $p < .005$). This pattern mirrors control performance and is therefore consonant with the normal tendency when faced with the additional decision of choosing a perspective in the possession change events. Consistent foregrounding of the Cause entity in position change events suggests intact ability to process the causal structure of the events, since it gives prominence to the Act subcomponent of the events.

Figure 6.2.1
PZ Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by PZ (X) in the visual condition stimulus groups compared with control median and range.

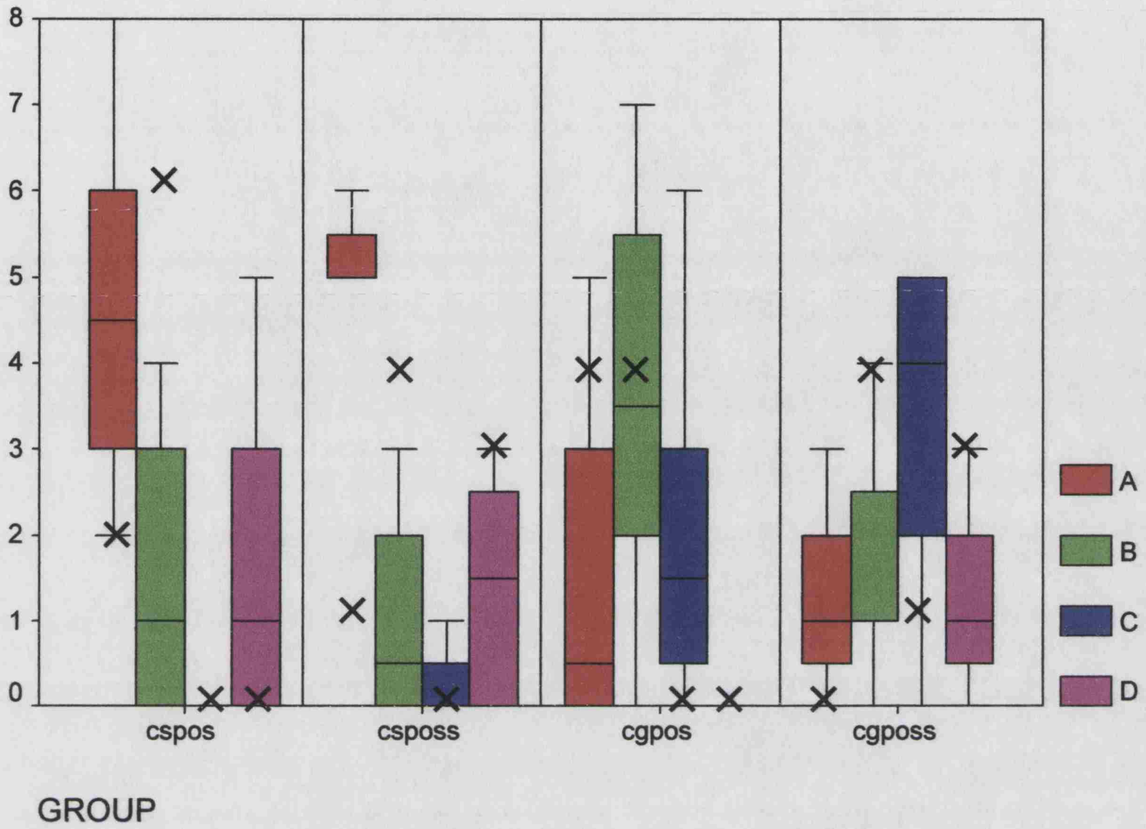
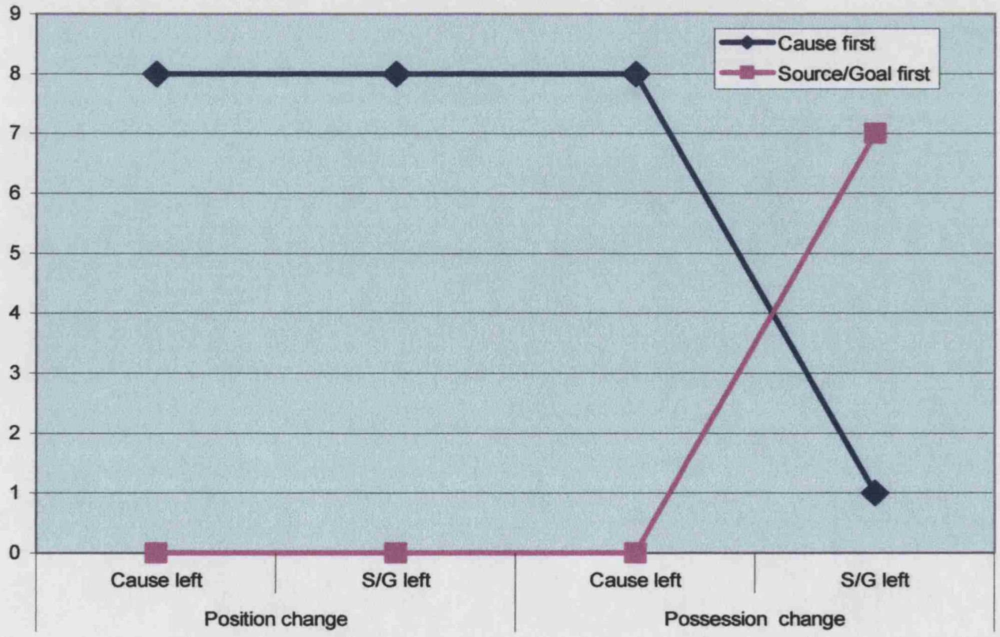


Figure 6.2.2
PZ, visual condition: Graph showing selective effect of screen position on primary foregrounding choices in visual possession change events.



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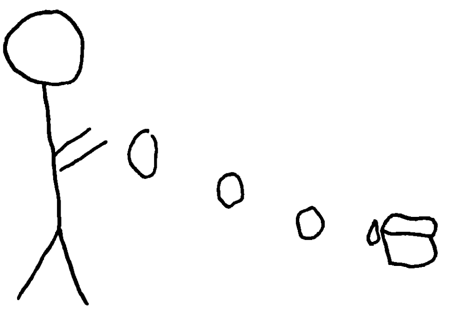
There is also evidence that PZ has appreciated the effect of the causal Act and how it links to the Process subcomponent, i.e. that it results in the movement of the Theme to its end state. This is demonstrated by her use of the double-Theme strategy in 10 of her drawings, which is comparable to its use by control participants (control range 0 – 9). This strategy also indicates that she has processed directional information in the stimuli, since she drew a series of Themes, representing the whole of its trajectory from its start position to its end position, as shown in Drawing 6E below. In PZ's case, her reduced use of graphic strategies to indicate temporal and spatial direction in comparison to controls is likely to be due to a delay in developing such a strategy, rather than a problem with processing these aspects of the stimuli. Support for this comes from the fact that her use of the double-Theme strategy did not appear until about half way through the visual condition, from item 17 onwards, and was used almost consistently after that.

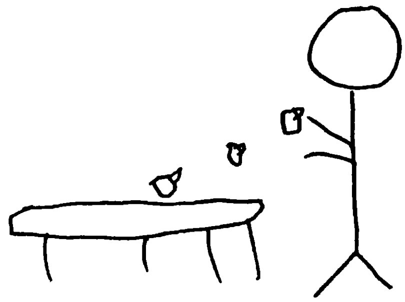
Drawing 6E.

PZ: Examples of double-Theme strategy indicating movement and direction in the visual condition

a) Boy throws ball into bucket

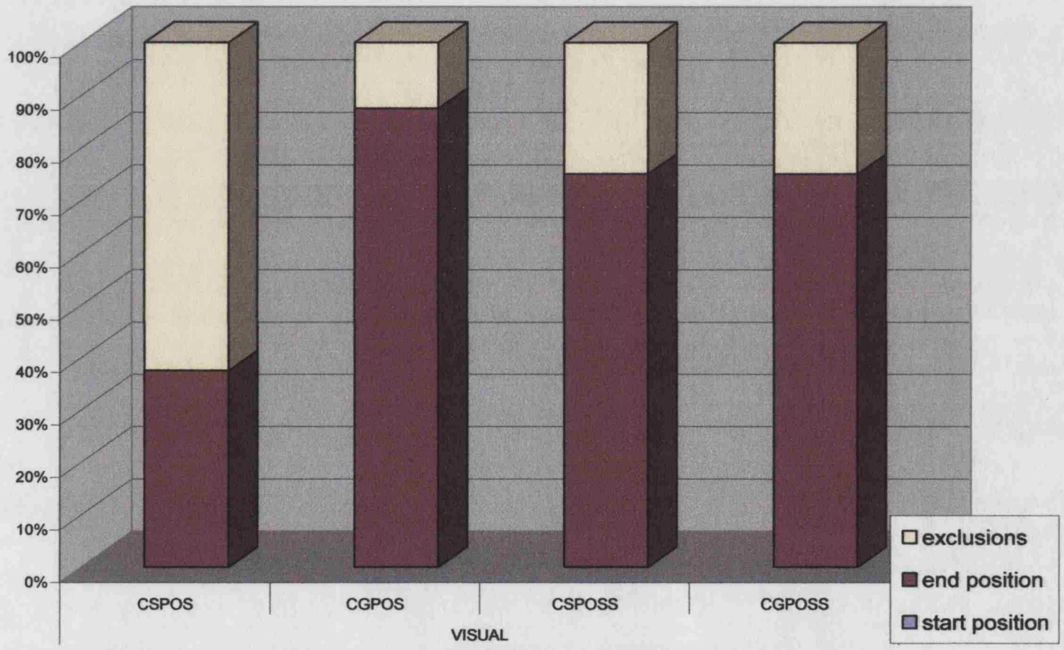


b) Boy puts cup on table



In situations where PZ did not use the double-Theme strategy, she showed a preference for locating the Theme at its end position in her drawings, as shown in Figure 6.2.3 below (Analysis 5). She was significantly more likely to draw the Theme at its end position than its start position in both *give/put*-type events (Binomial 2-tailed, $p < .005$) and *take/pick*-type events (Binomial 2-tailed, $p = .0005$). This differed from the performance of the controls, who tended to locate the Theme at its start position. In PZ's case she may have used the spatial location of the Theme as a means of directing attention to the end state subcomponent of the events, having already highlighted the initiating Act subcomponent through her primary foregrounding choices. PZ's preference for locating the Theme at its end position can also explain why her secondary foregrounding choices differed from those of controls, particularly in the *give/put*-type events (CSPos and CSPoss) where she produced more Type B responses: Cause first, Goal second, Theme last (Figure 6.2.1). PZ appears to treat the Theme's end position as its reference object, which results in her drawing the Goal before the Theme in *give/put*-type events.

Figure 6.2.3
Graph showing location of the Theme in PZ's drawings in the visual condition stimulus groups



PZ's performance differed from that of controls in one further respect, namely her failure to include arrows in any of her drawings in the visual condition (Analysis 3). This also differs from PZ's performance in the verbal condition, where she included arrows in all her drawings. Some control participants had used arrows both to indicate direction and to highlight specific features of the action such as manner in *throw* and *grab*. However, not all controls differentiated between similar events in this way, which may be related to the particular problems associated with the graphic representation of action (see Chapter 2, section 2.4.2). Furthermore, specific features of the action are not so relevant to graphic communication, since there is no graphic equivalent to accessing a verb label. Interestingly, PZ did include arrows in all her drawings in the verbal condition (see section B below), which might be related to the fact that the verbal stimuli do contain a specific verb label.

PZ's failure to signal specific action-related features of the events in her drawings leaves open the possibility that she has failed to process specific features of the actions in these events. However, some evidence that PZ is able to process certain event-specific features comes from the fact that she included a symbol for money in her drawings of *buy/sell* events, suggesting that she is aware of the specific transaction involved. This information is not so dependent on perceiving differences in the *manner* of the action itself, and can be graphically communicated simply by the inclusion of the money entity.

ii) Evidence from non-linguistic event processing assessments

Evidence from the other assessments of non-linguistic processing confirms a problem with processing specific action-related features of visual events. On the Event Perception Test (EPT), PZ's score of 45/60 was significantly worse than the expected score (χ^2= 7.91, p = .005). She made 9 close semantic errors, 2 distant semantic errors and 4 gross errors. The predominance of semantic errors indicates problems in interpreting specific features of visual events that enable one event to be distinguished from other similar events (Marshall et al 1999).

On the Role Video, PZ made two event errors and no role errors. Although her performance is within the control range on this task, the presence of event errors could indicate a failure to identify the specific action occurring in the video scene, since they involve selection of a photograph showing the outcome of a different action (Dipper 1999). The absence of role errors confirms that PZ's interpretation of thematic aspects of visual events is intact.

In summary, PZ's performance on the visual condition of the event drawing task indicates that most aspects of event conceptualisation for the purposes of communication are intact. She is able to process the causal and temporal structure of the events and to interpret the roles of and relations between the participant entities. However, she has some problems processing specific features of visual events, even when there is no requirement to communicate about them linguistically. These features are relevant to linguistic communication, since they are critical for verb selection and retrieval. This therefore suggests a link between PZ's specific event processing problems and her verb retrieval deficits. This will be discussed further in Section C below.

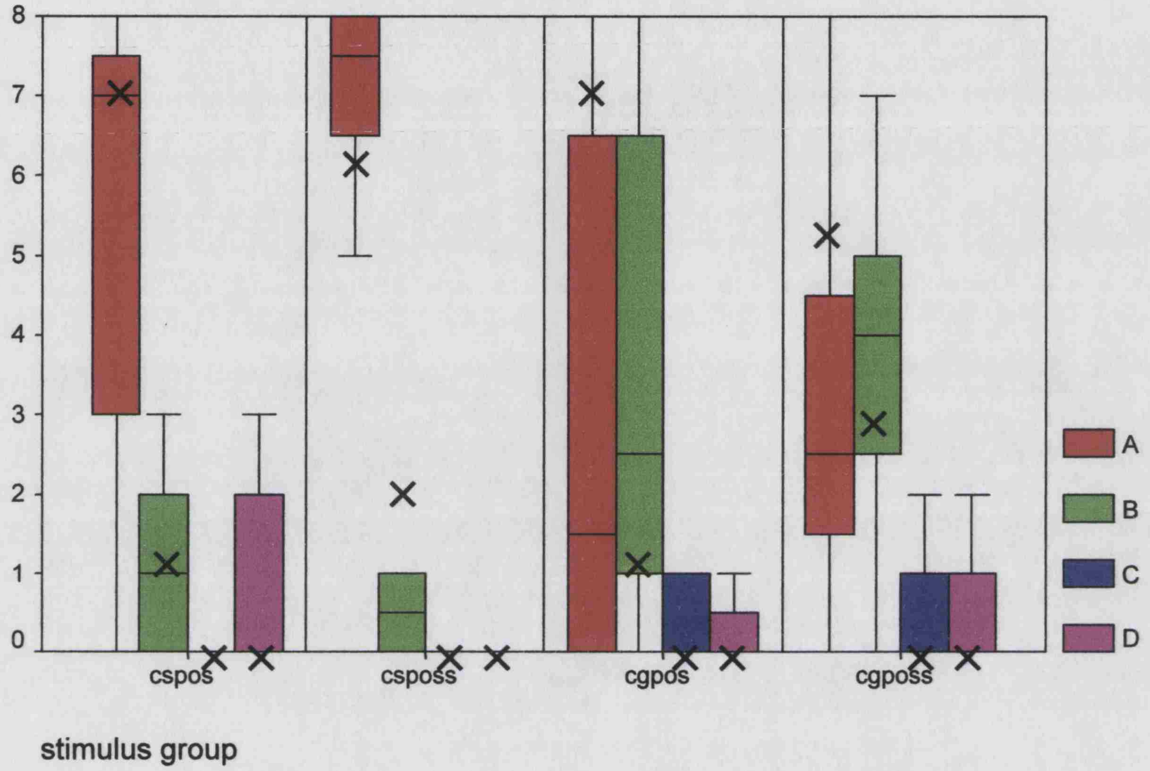
B. Processing of linguistically encoded events

i) Performance on verbal condition of event drawing task

PZ found this version of the task more difficult than the visual condition. She required a total of 86 repetitions in the verbal condition, which was well outside the control range of 0 – 3 and more than two standard deviations above the control mean (control mean 0.417, S.D. = 0.87). It was also significantly higher than her repetition requests in the visual condition (χ^2 = 69.57, df 1, p < .0001) (Analysis 1). Requests for repetition occurred equally in response to sentences describing position change and possession change events. This suggests a problem with maintaining the information in working memory whilst engaging in further processing. Other aspects of PZ's performance indicate relatively good ability to process the form of the input sentences. She was able to process the individual noun phrases, as shown by her inclusion of the three main entities in her drawings, with no omissions or substitutions (Analysis 2).

Analysis of the temporal order of drawing (Analysis 6) showed that PZ was able to process and maintain the order of the noun phrases in the sentences. She produced significantly more Type A responses: Cause first, Theme second, Source/Goal last (χ^2 = 10.31, df 1, p = .001) which replicates the order in which the corresponding noun phrases occur in the sentence. Her foregrounding choices in the verbal condition fell within the control range in all stimulus groups (see Figure 6.2.4). However, this pattern of performance does not of itself tell us whether she has processed the meaning of the sentence, in particular whether she has interpreted the thematic roles of the noun phrases. Other aspects of PZ's performance suggest that she is able to interpret some thematic information, but that she has problems with accessing specific aspects of verb meaning.

Figure 6.2.4
PZ: Verbal condition. Performance on Analysis 6, temporal order of drawing. Graph showing number of each response type produced by PZ in the verbal condition stimulus groups compared with control median and range

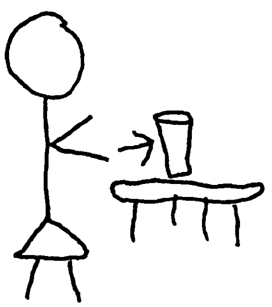


Evidence that PZ has processed the semantic structure of the events described comes from her consistent use of arrows (Analysis 3). Like the controls, PZ included arrows in all her drawings in the verbal condition. The position and orientation of the arrows indicate appreciation that an initiating act has occurred that triggers a process of change. She always included an arrow positioned from the Cause to the Theme, thus signalling the initiating act. In possession change events, she also included a second arrow from the Theme to the Source/Goal, signalling the movement of the Theme subsequent to this act. This suggests that PZ has correctly interpreted the sentences as describing causal acts resulting in a process of change, and that she has correctly assigned the roles of Cause/Actor and Theme to the initial two noun phrases in the sentence.

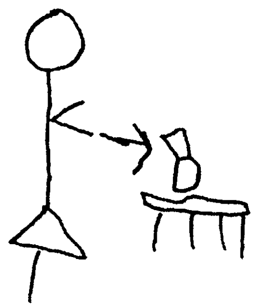
However, the orientation of the arrows in PZ's drawings suggests that she has not processed directional information in the sentences, implicit in the meaning of the verb and prepositional phrase. As can be seen in the examples in Drawing 6F below, she did not differentiate between similar *give/put*-type and *take/pick*-type events in either possession change or position change sentences. All of PZ's arrows point in the same left to right direction. This is appropriate for the *give/put*-type events (examples (a) and (c)), but not for the *take/pick*-type events (examples (b) and (d)). Here the orientation of the arrows is opposite to that implied by the verb and sentence meaning, suggesting movement of the Theme away from rather than towards the Cause. This suggests that, in the absence of any clues about direction from the sentence meaning, PZ is unable to assign appropriate directional roles to the noun phrases. Possibly she uses general mapping procedures to assign the role of Goal to the final noun phrase, but fails to confirm this from verb-specific thematic information, or from the meaning of the prepositional phrase.

Drawing 6F. PZ: Examples of PZ's failure to differentiate between similar *give/put*-type and *take/pick*-type events in the verbal condition.

a) Mary puts the vase on the table

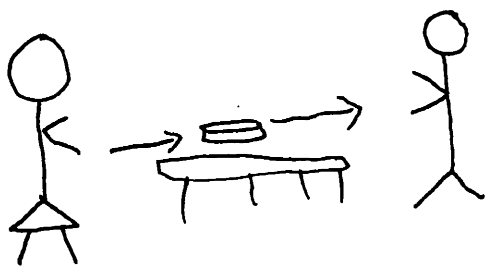


b) Mary picks the vase off the table



c) Mary gives the box to Bill

d) Mary takes the box from Bill

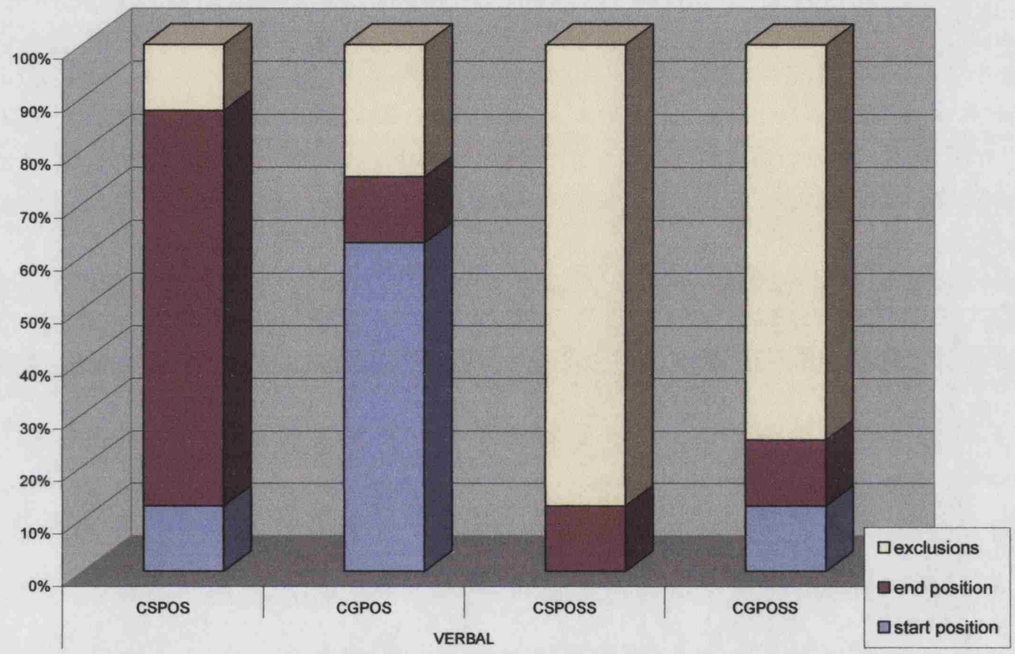


Another possibility is that PZ bases her directional decisions on the constraints of the graphic output modality, which dictate a left-to-right order in producing drawings. She consistently drew the Cause on the left of the page, suggesting that she follows the graphic output modality constraint of 'start drawing on left of page' (Analysis 4). She may apply the same left to right order in deciding on the orientation of arrows. This interpretation is compatible with a failure to process directional information in the stimulus sentence.

Additional evidence that PZ has failed to process the directional information in the sentences comes from the analysis of the location of the Theme in her drawings (Analysis 5). She showed little consistency in the location of the Theme in the verbal condition. This contrasts with her performance in the visual condition, where she consistently located the Theme at its end position. It also contrasts with the performance of control participants in the verbal condition, who consistently located the Theme at its start position. As can be seen in Figure 6.2.5 overleaf, PZ showed a different pattern of performance between position change and possession change events. In position change events, she was significantly more likely to draw the Theme at its end position in *put*-type events (CSPOS) and at its start position in *pick*-type events (CGPOS) (Fisher exact, $p < .05$) (see Drawing 6F (a) and (b) above for examples). This suggests that PZ treats the noun phrase that occurs at the end of the sentence as the reference object for the Theme, regardless of its directional role. In possession change events, the high number of exclusions was due to the fact that PZ usually drew the Theme equidistantly between the two human entities (13/16 times) (see Drawing F (c) and (d)). Thus, although PZ is aware that the Theme is moving between these two entities, she cannot reliably identify which one corresponds to the Theme's start position and which to its end position.

Comparison across the two conditions of the task confirms that PZ's difficulties with directional information are specific to the linguistic input modality. In the visual condition, she had demonstrated appreciation of directional information by means of the double-Theme strategy and consistent location of the Theme. This selective difficulty in the verbal condition rules out a problem related to the graphic output modality. Also, it was precisely PZ's use of a graphic strategy in the verbal condition, namely arrows, that demonstrated her problems with processing directional information implicit in the meaning of the verb and prepositional phrase. Further support for a problem with processing the meanings of verbs comes from PZ's failure to include a symbol for money in her drawings of *buy* and *sell* events. This differs from control participants and also from PZ's own performance in the visual condition, which again rules out a graphic output modality related explanation.

Figure 6.2.5
Graph showing location of Theme in PZ's drawings in the verbal condition.



Thus the hypothesized sentence processing deficit for PZ is a problem with accessing the full meaning of the verbs, in the context of intact syntactic abilities. She has some access to the thematic structure of the verbs in these sentences, which allows her to confirm her initial role assignment decisions for these sentences. However, she fails to access specific aspects of verb meaning, such as directional and manner information, that allows differentiation between similar verbs. This therefore prevents her from forming a precise conceptual representation of the event described in the sentences.

ii) Evidence from other language assessments

This hypothesis is supported by PZ's performance on the other language assessments. Firstly her good performance on the Noun Pointing task confirms that she has no difficulties retaining the form of a sentence, including the order of the noun phrases. She made only three errors on this task and her scores were comparable to those of controls in all levels.

PZ's performance on the RSCT might at first sight appear to contradict the claim that she is has access to the thematic structure of verbs that describe Act events, since her lowest score occurred on the action verb set of the RSCT (see Figure 6.2.6 overleaf). However, more detailed qualitative analysis of PZ's performance revealed some differences in her approach to the action verb set in comparison to the other sentence sets, which support the initial hypothesis. Firstly, she made significantly more errors on congruous stimuli than on incongruous on the action verb sentences ($\chi^2 = 5.33$, $p < .05$). On the other sentence sets, in contrast, she made roughly equal numbers of congruous and incongruous errors (see Table 6.2.1). Secondly, analysis of response time data in the action verb set showed that PZ took significantly longer to respond to congruous stimuli than incongruous (Mann Whitney U = 61.25, z =2.81, p < .005). The mean response time for congruous stimuli was 18152.29 ms. (range 14309 – 22450), compared with 8777.29 ms. (range 4570 – 15433) for incongruous stimuli.

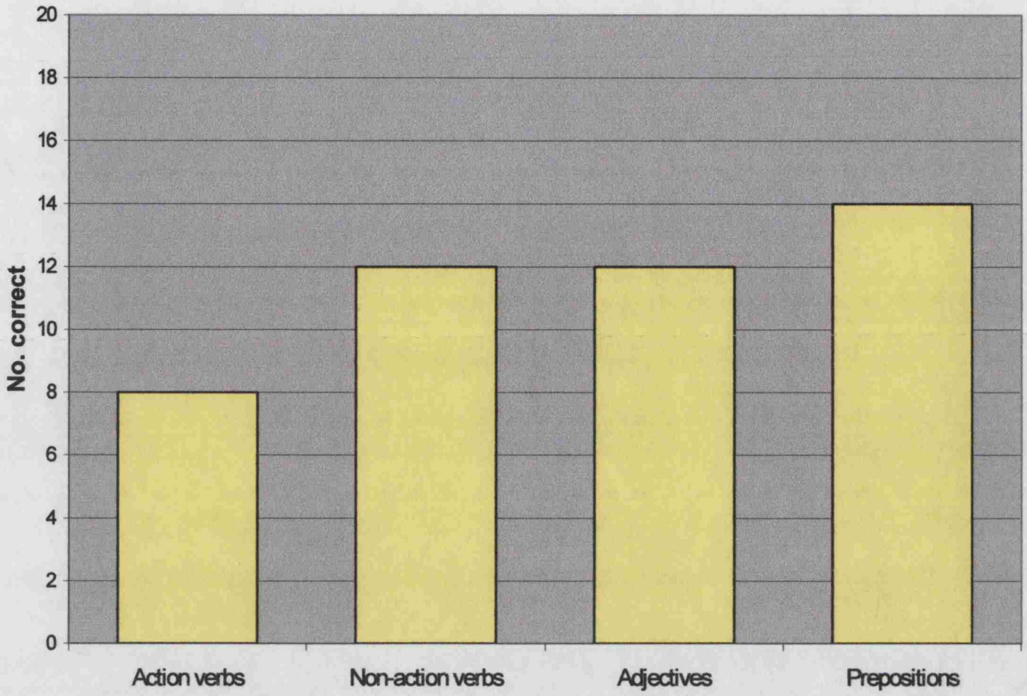
Table 6.2.1

PZ: Number of congruous and incongruous errors in each sentence set in the RSCT

	Incongruous errors	Congruous errors
Action verbs*	2	10
Non-action verbs	3	5
Adjectives	4	4
Locatives	3	3

Figure 6.2.6

PZ. Number correct in each sentence set in the RSCT



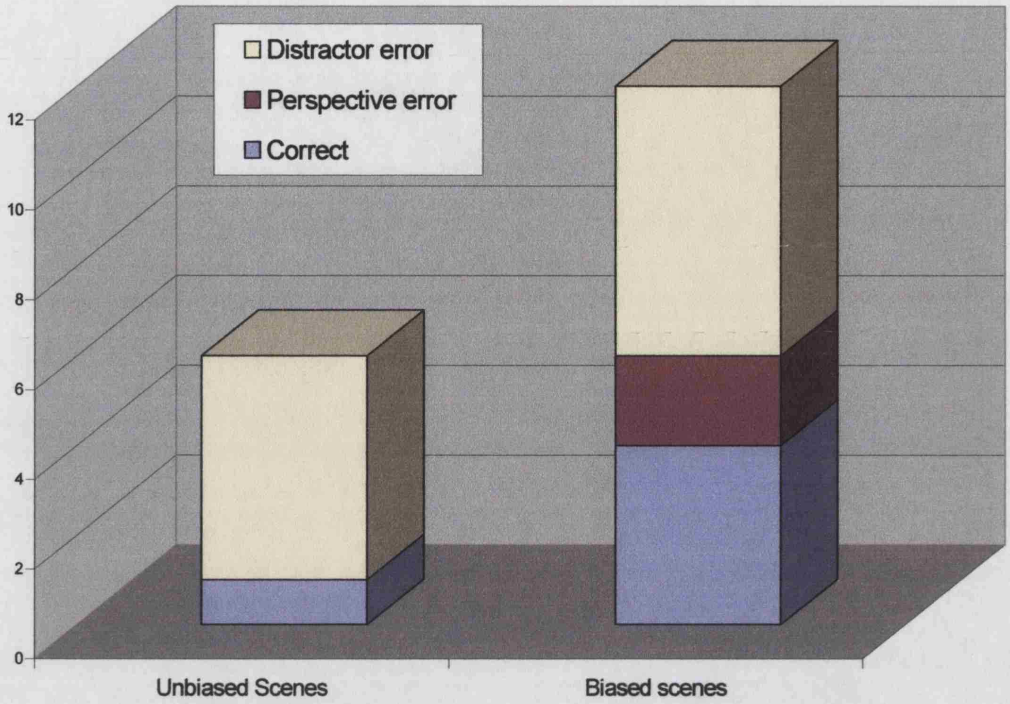
These qualitative aspects of PZ's performance suggest that she may be getting sufficient information from the action verbs to confirm her initial thematic role assignment decisions, i.e. that the first noun phrase has the role of Actor. This would allow her to reject an incongruous stimulus relatively easily, since the conceptual actor in the picture does not correspond to the noun phrase in sentence initial position. However, when presented with a congruous stimulus in the action verb set, the conceptual actor in the picture does correspond to the first noun phrase in the sentence. The longer response times in response to congruous stimuli may be attributable to the fact that PZ then has to access the meaning of the verb to determine whether the action in the picture corresponds to that described by the verb. Her tendency to eventually reject these congruous items suggests that this process has failed, i.e. that she has failed to access the meaning of the verb and/or to process the specific action in the picture. This latter interpretation would be in keeping with her performance in the visual condition of the event drawing task and on the Event Perception Test, where a problem with processing specific action-related features was hypothesized. This suggests that her difficulties with the RSCT may be attributable to the interaction between her visual event processing difficulties and her difficulties accessing the core aspects of verb meanings.

Faster response times and a more random pattern of congruous and incongruous errors in the other sentence sets may be attributable to the fact that appreciating thematic information in these sentences is dependent on access to the full meanings of verbs or predicates, including their specific role assignment information. Since none of the sentences involve an Actor role, basing thematic role decisions on general mapping procedures would not assist in the interpretation of these sentences. Likewise, the information from the pictures does not assist PZ in interpreting the roles of the participants, since they offer alternatives in perspective or interpretation (see JOK above). During the course of the assessment, PZ indicated that she was resorting to guesswork on these stimuli.

Further evidence of a failure to differentiate between verbs with similar meanings comes from PZ's poor performance on the Perspective Video. Her score of only 5/18 on this task was significantly lower than that of controls (Fisher exact, 2 tailed, $p < .0001$). Distractor errors significantly exceeded perspective errors ($\chi^2 = 7.07$, $p < .05$) occurring on both the unbiased and the biased scenes, as shown in Figure 6.2.7 overleaf. Distractor errors involve selection of a verb label that does not correspond to either of the two possible perspectives on the event, e.g. the selection of the verb LIFT in response to a scene showing a *push/pull* event. The presence of distractor errors on both unbiased and biased scenes implies that the problem is not restricted to processing perspective information in the verb labels, but also extends to other aspects of verb meaning. Because this test involves both conceptual processing of a visual event and selection of a lexical label, an additional problem in PZ's case may be related to a difficulty processing the specific event occurring in the visual scene, as identified in her visual condition performance. As with the RSCT above, PZ's problems with this assessment may be exacerbated by the interaction between her visual and linguistic event processing impairments.

Figure 6.2.7.

PZ: Error breakdown on Perspective Video



C. Summary and interpretation of PZ's performance

The combined evidence from the visual and verbal conditions of the event drawing task identifies a strong link between PZ's ability to conceptualise events for the purpose of communication and her language impairments. Comparison of PZ's performance across the two conditions of the task revealed that the same conceptual/semantic aspects of events are impaired in both modalities. In both the visual and verbal conditions she was able to process those aspects of the stimuli related to the structure of the events and the roles of the participants, such as causal structure in the visual condition and thematic structure in the verbal. However, she had difficulty interpreting specific aspects of the stimuli that would enable her to differentiate between similar events, such as specific action-related features of the visual events and 'core' aspects of verb meaning. These similarities across the two conditions indicate that her event conceptualisation abilities and her access to 'core' aspects of verb meaning may be related.

One possibility is that PZ's problems with identifying specific features of the action might play a causal role in her verb retrieval deficits, since it is precisely these features that make up the 'core' semantic features of a verb. PZ's performance on the Object and Action Naming Battery confirms a selective and severe problem with verb retrieval. She produced only one unambiguous verb, "weigh" and two further ambiguous verbs/nouns, "drive" and "snow"[17] (see Chapter 4, Section 4.2.2 and Appendix G).

An alternative interpretation for PZ's verb retrieval deficits could be that she has impaired or underspecified semantic representations for verbs, particularly in view of her problems with accessing 'core' aspects of meaning in input. These two interpretations are not mutually exclusive, however, and can be accommodated under a single explanation. It is possible that PZ's reduced access to 'core' aspects of verb meaning may affect her conceptualisation of visual events by failing to direct her attention to precisely those features of events that are more relevant to linguistic communication. Thus lack of feedback from the linguistic system might impact negatively on PZ's event processing when her intention is to communicate about the event, resulting in what Black and Chiat (2000) call a "spiral of impairment" in language production (see also Dipper et al 2005). This will be discussed more fully in Chapter 7 (section 7.1.2) in the light of evidence from the performance of the other participants.

[17] PZ had severe difficulty with the action naming section of the Object and Action Naming Battery and requested that the test be discontinued after only 10 items. Her score might have been higher had she completed the test, but it is unlikely that she would have matched her object naming score of 36/50.

6.3 JT

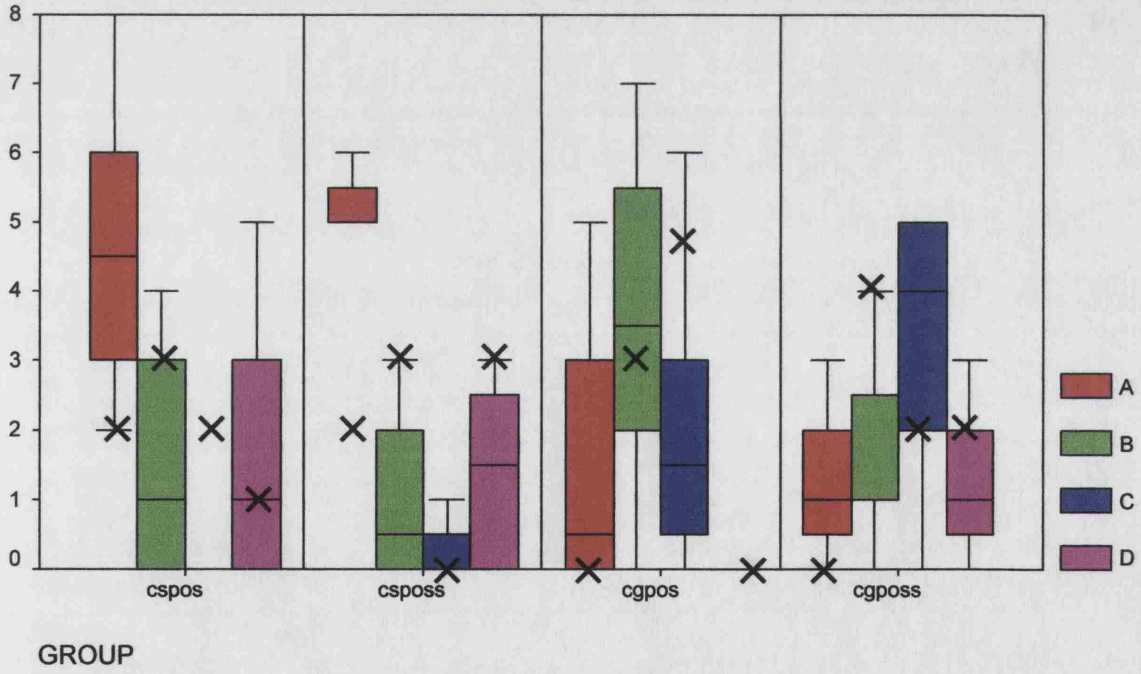
A. Processing of visual events

i) Performance on visual condition of event drawing task

JT's performance in the visual condition of the event drawing task differed from that of the controls in several respects, indicating problems with processing some aspects of visual events. She required a total of 42 repetitions over the whole task, which is well outside the control range of 2 –10, and more than two standard deviations above the control mean (control mean 4.917, S.D = 2.59). These occurred equally across position change and possession change events (Analysis 1). This suggests that she has some difficulty storing or maintaining the visual stimuli whilst engaging in further processing. JT always included the three main entities in her drawings and there were no additions, omissions or substitutions, indicating that she can identify the relevant participants in the events (Analysis 2). In addition, she followed the spatial position of the entities on the screen in her drawings, i.e. she always draw the entity that appeared on the left of the screen on the left of the page, suggesting that she can retain spatial information from the visual stimuli (Analysis 4).

However, evidence from the temporal order of drawing (Analysis 6) suggests that JT's appreciation of or attention to the causal structure of the events is reduced. She failed to consistently foreground the Cause entity in both position change and possession change events. Thus, even when there is only one possible candidate for the role of Cause (i.e. in position change events), she does not present the event from the perspective of that entity. As can be seen in Figure 6.3.1, her foregrounding choices differed from those of control participants in all stimulus groups, confirming that she is influenced by different factors. JT's primary foregrounding choices are influenced mainly by perceptual constraints in both position change and possession change events. The most influential factor was that of 'screen position': the entity on the left of the screen was significantly more likely to be drawn first (Fisher exact, $p < .005$). This effect was stronger in possession change events than in position change, which is consonant with the normal tendency when faced with the additional decision of choosing a perspective in the possession change events. However screen position had not influenced control participants' performance in the position change events. Screen position also interacted to some extent with the factor of 'start position of Theme', since JT drew the Cause entity more often in *give/put*-type events (Figure 6.3.1, Types A & B, CSPos and CSPoss) and the Source entity more often in *pick*-type position change events (Type C CGPos). However, these differences did not reach significance. The interaction of these two perceptual factors resulted in what appears to be a somewhat random pattern of performance. An increased reliance on perceptual factors in both position change and possession change events suggests that JT does not direct attention to the triggering Act subcomponent of the events and the related role of the Cause entity as initiator of the event.

Figure 6.3.1
JT Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by JT (X) in the visual condition stimulus groups compared with control median and range.

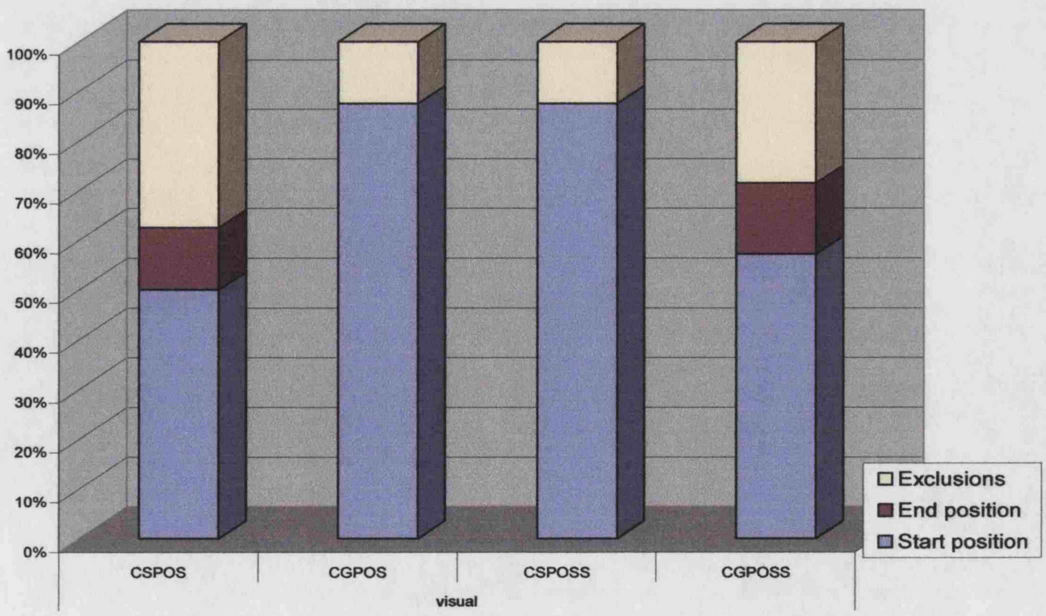


Despite failing to appreciate the causal structure of the events, JT showed some ability to process temporal structure and directionality. Firstly, she made some use of graphic strategies to indicate the Theme's movement and its direction. She included arrows in seven of her drawings, and their position and orientation were similar to controls, in that they indicated the Theme's movement to its end position (Analysis 3). She also used the double-Theme strategy on a further six occasions, which identifies both the beginning point and the end point of the Theme's trajectory. JT's less frequent use of these strategies in comparison with controls can be attributed to a delay in developing an effective graphic strategy to convey these aspects of event, since they began to emerge and were used more consistently towards the end of the task, i.e. from item 17 onwards.

Appreciation of temporal structure and directionality in the scenes was also indicated by JT's significant tendency to locate the Theme at its start position in her drawings (Analysis 5) ($\chi^2 = 6.23$, $p = .01$). This mirrors control participants' performance. Figure 6.3.2 shows the number of times JT drew the Theme at its start position and at its end position in the different stimulus groups. The exclusions refer to occasions where she used a double-Theme strategy. Like JOK and the control participants, therefore, JT's initial drawings represented the pre-event locational state, and were on occasion turned into representations of events by means of other graphic strategies, such as arrows or a second Theme.

Figure 6.3.2

Location of Theme in JT's drawings in the visual condition.



JT's performance in the visual condition of the event drawing task therefore suggests a problem with processing or attending to the causal structure of the events and identifying the action-related roles of the entities, in the context of intact appreciation of temporal structure and directional information. Failure to process the causal structure of the events would predict a problem identifying specific features of the causal action involved, since the initiating act is not attended to. JT made no use of graphic strategies such as double arrows to indicate manner differences between events. Also, in contrast to the controls and to JOK and PZ, she did not include a symbol for money in her drawings of *buy/sell* events, which suggests that she may not have processed the specific kind of transaction involved in these events.

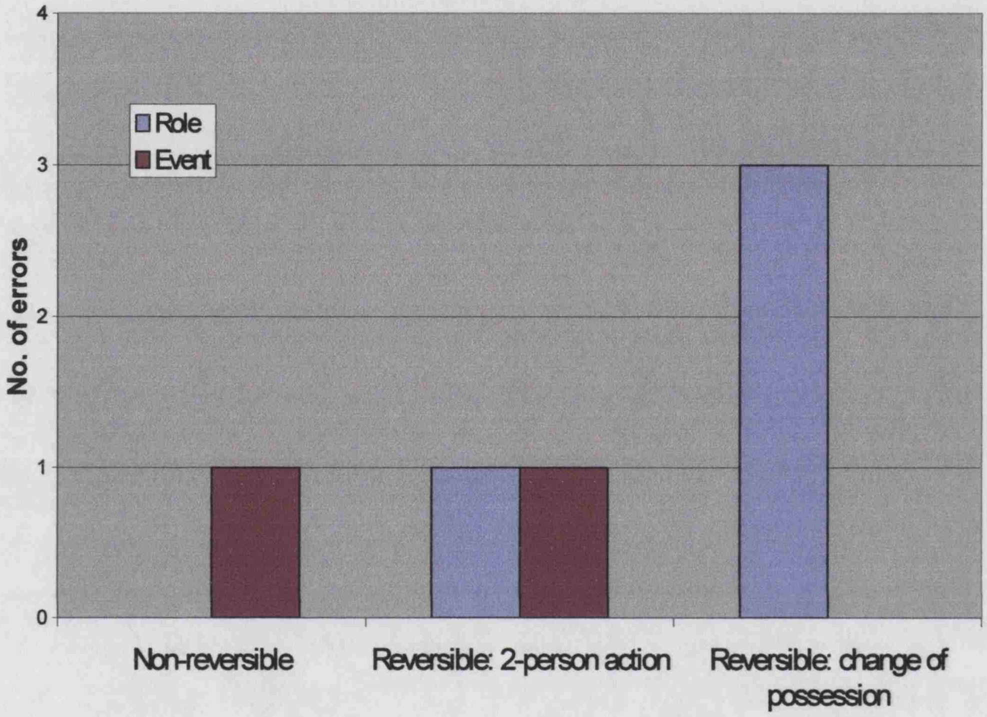
ii) Evidence from non-linguistic event processing assessments

JT's performance on the Role Video confirms a difficulty with interpreting role information in visual events and also indicates a possible problem with identifying specific actions in scenes. She scored 26/32, which is outside the control range on this version of the test. Figure 6.3.3 (overleaf) shows the breakdown of errors on different scene types in the Role Video. She made four role errors on reversible scenes, three of which occurred on change of possession scenes. This supports a problem with interpreting role information in these scenes. The remaining two event errors support a problem with identifying the specific action involved in the scene (see PZ above). None of her errors occurred on the four items that had caused particular difficulties for controls, thus a problem related to the quality of the stimuli can be ruled out.

JT's performance on the Event Perception Test (EPT) provides additional evidence in support of a problem processing specific features of visual events. Her score of 53/60 was outside the control range, though not significantly so. She made 4 close semantic errors, 3 distant semantic errors and 1 gross error. As discussed for PZ above, the prevalence of semantic errors suggests that JT had difficulty matching events on the basis of shared semantic features. Several of her errors occurred on stimuli where the target differed from the distractor in terms of perspective, for example *chase/lead, eat/feed,* which supports the hypothesis that she has difficulty taking a perspective on visual events. This is consistent with her event drawing performance, where she failed to present the event from the most obvious perspective of the Cause entity.

Figure 6.3.3

JT Role Video: breakdown of errors on different scene types



In summary, JT's performance on the visual condition of the event drawing task provides evidence in support of an event conceptualisation source of her difficulties in communicating effectively about events. Her failure to attend to or process the causal structure of events, and associated problems with identifying action-related roles and specific features of the action, result in conceptualisations not optimally organised for communication in either graphic or linguistic output modalities. The consequences for linguistic communication of events might be a failure to produce a main relational term to describe the event and corresponding linguistic structure (Dipper et al 2005). The relationship between linguistic communication and event conceptualisation will be discussed further in Section C below.

B. Processing of linguistically encoded events

i) Performance on verbal condition of event drawing task

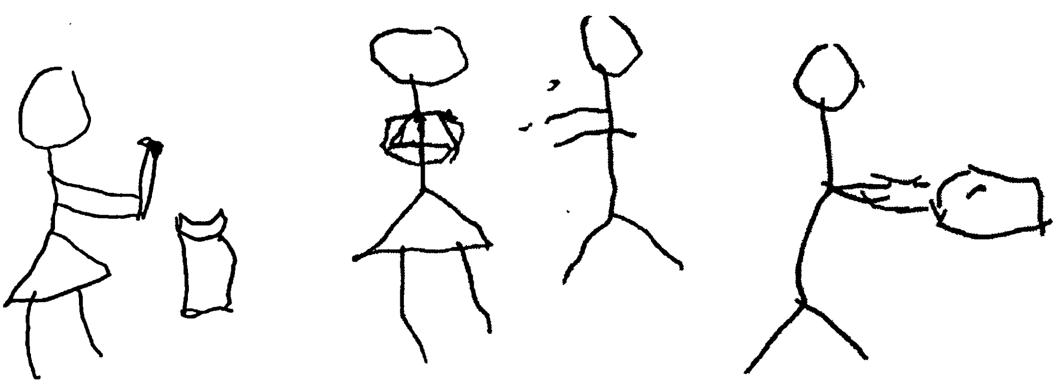
JT's performance on the verbal condition of the event drawing task differed from that of the controls in several respects. She required significantly more repetitions in the verbal condition than in the visual ($\chi^2 = 5.33$, df1, $p < .05$), requesting a total of 66 repetitions over the whole test, which is well outside the control range of 0-3 and more than two standard deviations above the mean for the controls (control mean = 0.417, S.D = 0.87) (Analysis 1). These occurred equally across possession change and position change sentences. This suggests that JT has difficulty storing and maintaining the input sentences in memory, whilst engaging in further processing.

The majority of JT's drawings included the three main entities, showing that she can generally process the individual noun phrases in the sentences (Analysis 2). However, she made occasional substitution and omission errors. She drew the wrong Cause once (Drawing 6G a), the wrong Theme once (Drawing 6G b), and the wrong Goal once, and omitted the Goal once (Drawing 6G c).

Drawing 6G.

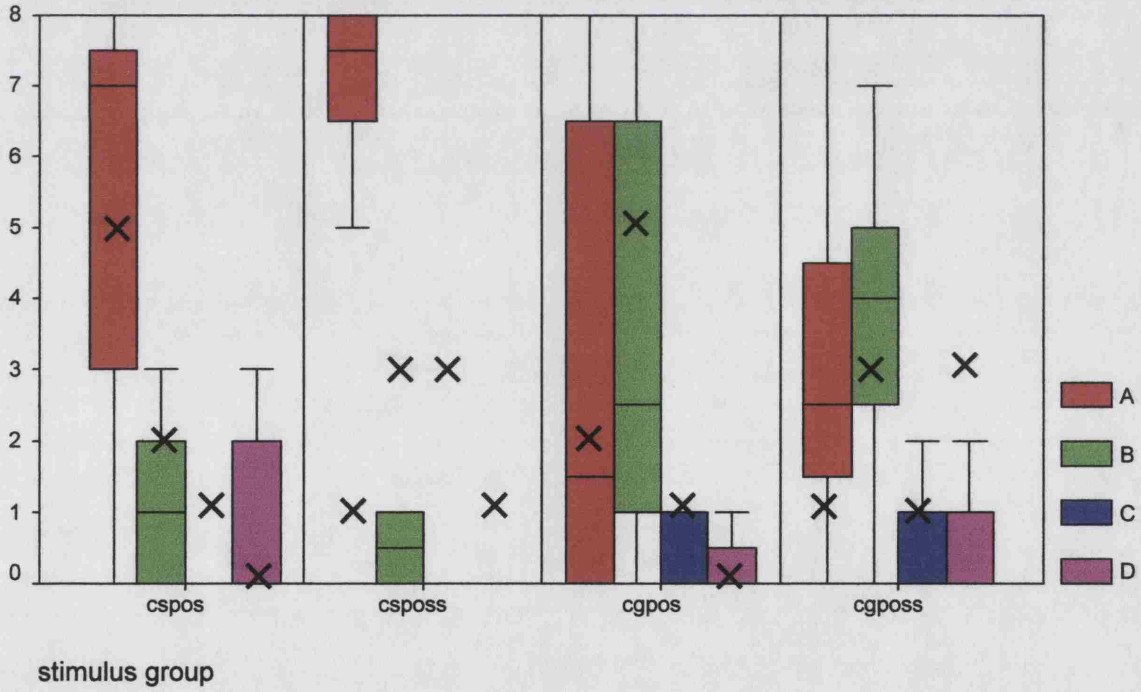
JT: examples of substitution and omission errors in verbal condition drawings, indicating failure to process or retain individual noun phrases

a) <u>Bill</u> puts the flower in the vase   b) Mary takes the <u>flower</u> from Bill   c) Bill lifts the box off the <u>table</u>



Evidence from the analysis of temporal order of drawing (Analysis 6) suggests that even when JT does process the noun phrases, she has difficulty retaining their linear order in the sentence. As with JOK above, this appears to selectively affect the sentences that describe possession change events. In position change events, JT's foregrounding choices mirrored those of controls, in that she consistently drew the Cause first (14/16 times, see Figure 6.3.4, CSPos and CGPos). In possession change events, however, she produced fewer Cause first responses than the majority of controls and was equally likely to draw the Source/Goal first as the Cause (see Figure 6.3.4, CSPoss and CGPoss). Thus JT did not follow the linear order of the noun phrases in the possession change sentences.

Figure 6.3.4.
JT Verbal condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by JT (X) in the verbal condition stimulus groups compared with control median and range.



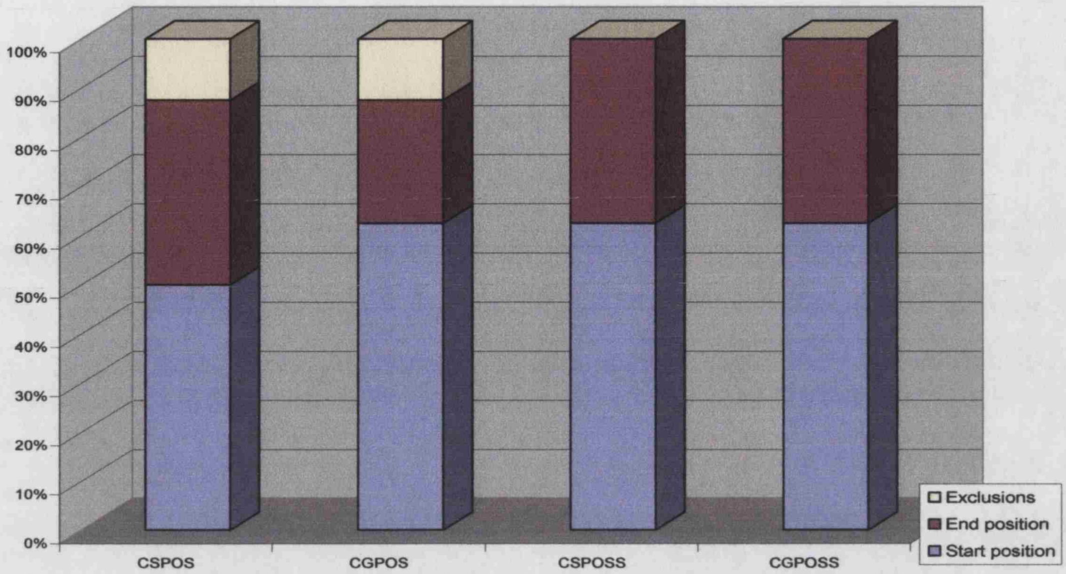
As with JOK (section 6.1 above), this pattern of performance might be indicative of a problem maintaining the content of the noun phrases in registration with the structure of the sentence. JT may be able to use semantic/pragmatic information to compensate for her failure to retain the order of the noun phrases in position change sentences, where there is only one noun that fulfils the criteria for the role of Actor. This interpretation would imply that JT has some ability to process thematic information in the sentences, at least on the basis of general mapping procedures, since it assumes that she has assigned the role of Actor to the first noun phrase. However, in contrast to JOK, other aspects of JT's performance indicate that her access to verb-specific meanings, including their thematic structure, is reduced. Thus, even if she does assign the role of Actor to the first noun phrase, she may be unable to confirm initial thematic role decisions.

Several aspects of JT's performance suggest that she fails to interpret directional meaning implicit in the verb and prepositional phrase. Unlike the control participants and JOK and PZ above, she failed to use any graphic strategies, such as arrows or double-Theme, to indicate the movement or direction of the Theme (Analysis 3). This contrasts with her performance in the visual condition, where she used them on almost half of the stimuli. Since the visual condition was completed before the verbal condition, the expectation would be that JT would carry over these strategies. Her failure to do so cannot therefore be attributed to a problem with the graphic output modality, but must be related to a problem processing directional information from the linguistic input stimulus.

Analysis of the spatial location of the Theme in JT's drawings provides additional evidence that she has failed to process directional information in the sentence (Analysis 5). In contrast to her performance in the visual condition and to performance of the controls, there was no consistency in the location of the Theme in JT's drawings. She was equally likely to draw the Theme at its start or its end position in both position change and possession change events (see Figure 6.3.5 overleaf). Examples are provided in Drawing 6H overleaf. This suggests that JT cannot reliably identify the directional roles of the noun phrases in the sentences, confirming a problem with accessing the full meaning of the verb and prepositional phrase. As with PZ above, comparison of JT's performance across the two conditions of the event drawing task suggests that her difficulties with processing directional information in the verbal condition are attributable to the input modality itself, rather than to the constraints of the graphic output modality.

Figure 6.3.5.

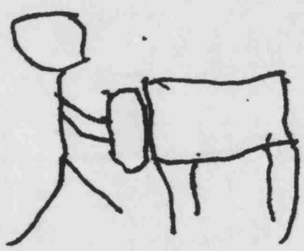
JT: Location of Theme in relation to the other entities in the verbal condition



Drawing 6H.
Examples of inconsistencies in the location of the Theme entity in JT's drawings in the verbal condition

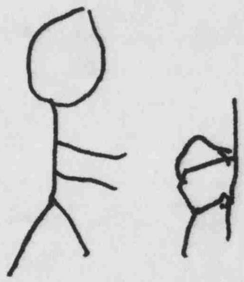
<u>Theme located at start position</u>

a) Bill places a box onto the chair

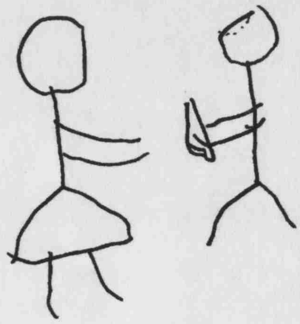


<u>Theme located at end position</u>

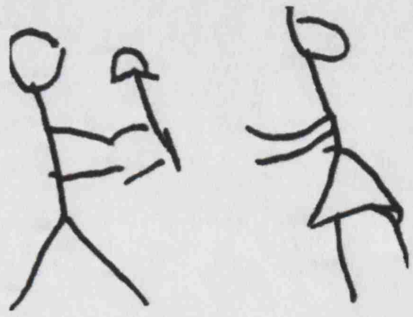
b) Bill throws a cushion onto the chair



c) Mary grabs the ball from Bill



d) Bill takes the flower from Mary



JT's performance in the verbal condition of the event drawing task therefore suggests two possible sources of difficulty in constructing a representation of an event from a linguistic description:

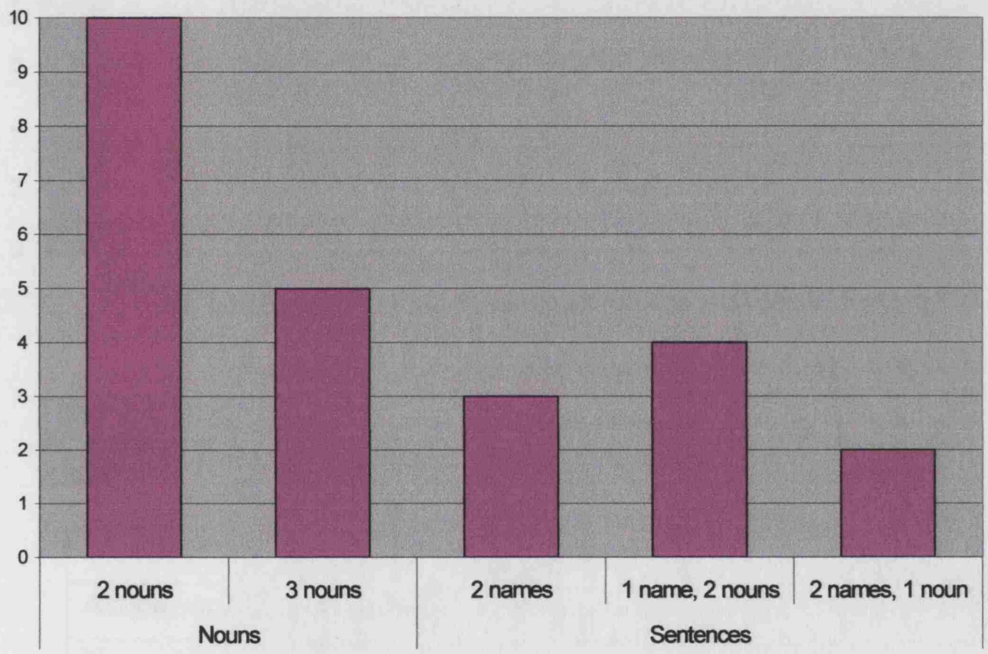
1. A problem in retaining the linear order of the noun phrases, which prevents the integration of content and structure. This selectively affects her ability to interpret reversible sentences, where no semantic/pragmatic clues are available to compensate for this problem.
2. A problem at the semantic level with accessing the full meaning of the verb and prepositional phrase in the sentences, which prevents her from confirming initial thematic role decisions and in interpreting specific aspects of the events described. Her performance on non-reversible position change sentences suggests that she may have some spared ability to interpret thematic information on the basis of general mapping procedures.

ii) Evidence from other language assessments

Support for both of the hypothesized deficits comes from JT's performance on the other language assessments. A problem with retaining noun phrases and their order is confirmed by her poor performance on the Noun Pointing task. Her total score of 24/50 was significantly worse than the expected score of 48 (Fisher's exact test: $p < 0.0001$). Figure 6.3.6 shows a level-by-level breakdown of her performance. Her score matched that of controls only on the two-noun lists, with a significant drop in performance on the three-noun lists (Fisher exact, $p < .05$). This suggests that she has difficulty maintaining more than two nouns in auditory memory even when they do not occur within a sentence. However, her performance on sentences was significantly worse than on noun-lists (Fisher exact, $p < .005$), suggesting that in this task, she was not helped by the meaning of the sentences.

JT made mainly lexical errors on the three-noun lists. On the three-noun sentences, however, she made significantly more sequencing errors than lexical errors (Fisher exact, $p < .05$), confirming that her problem with these sentences is related to retaining the *order* of the words, and not just the words themselves. These sentences are most similar in structure to those used in the event drawing task. Most of JT's sequencing errors on three-noun sentences involved transposition of the final two nouns, while the first-mentioned noun was generally correctly selected (18/20 times). This contrasts with her performance on the possession change sentences in the event drawing task, where she generally transposed the initial and final noun phrases. As discussed for JOK above, this is likely to reflect differences in the requirements of the two tasks, i.e. the requirement to access the meaning of the sentences and the relationship between the noun phrases in the event drawing task.

Figure 6.3.6. JT: Scores on different levels of Noun Pointing Task



A problem in maintaining the order of noun phrases in a sentence would predict difficulties with all sentence types in the Reversible Sentences Comprehension Test (RSCT). This is confirmed by JT's poor performance on this test. Her score of 49/80 was significantly below the performance of non-aphasic controls on this version of the test (Fisher exact, $p < .0001$). She achieved roughly equal scores on all sentence types as shown in Figure 6.3.7 (overleaf). Error analysis revealed significantly more errors on incongruous items than congruous in all sentence sets (see Table 6.3.1 overleaf). This suggests that JT has particular difficulties with interpreting sentences when there is a conflict between what she manages to construct from the linguistic input and the information from the picture (Cupples & Inglis 1993; Black & Chiat 2000).

Figure 6.3.7.

JT: Scores on each sentence set in the RSCT

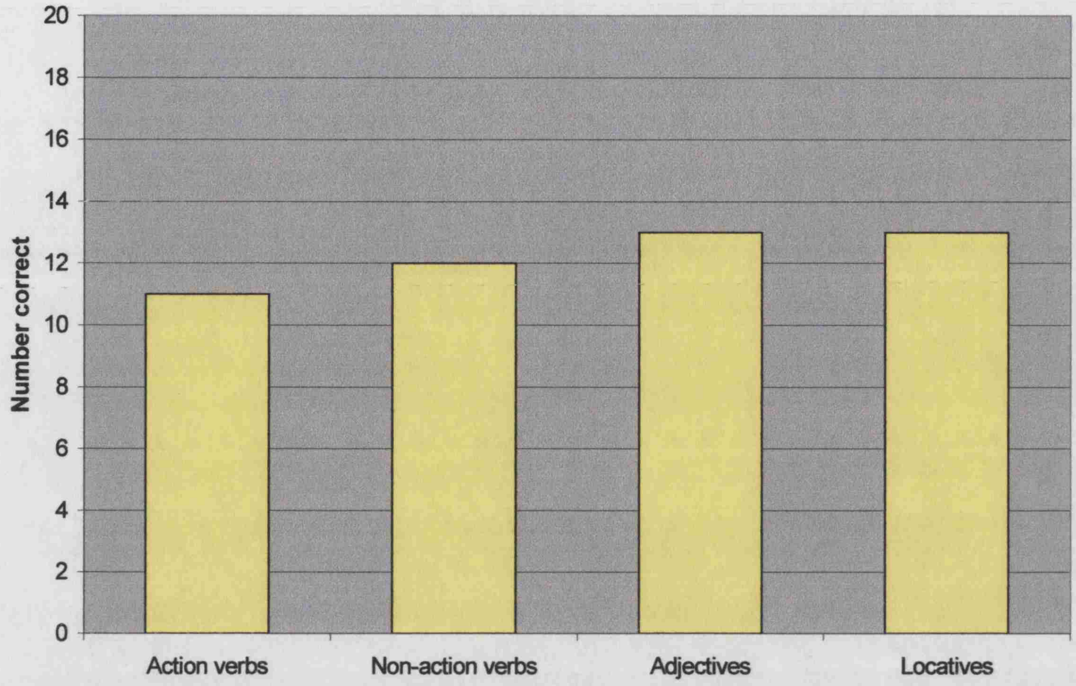


Table 6.3.1
JT: Number of congruous and incongruous errors in each sentence set in the RSCT

	Incongruous errors	Congruous errors
Action verbs*	9	1
Non-action verbs**	8	1
Adjectives***	7	1
Locatives ***	7	1

* $\chi^2 = 6.4$, $p = .01$; ** $\chi^2 = 5.44$, $p < .05$; *** $\chi^2 = 4.5$, $p < .05$

There was a significant "Yes" bias in JT's responses ($\chi^2 = 26.45$, $p < .0001$). One possibility is that she may have been basing her match between the linguistic and visual inputs on the basis of the meanings of the individual nouns rather than their roles in the event, replying "Yes" to both congruous and incongruous items because the relevant noun phrases were represented in the corresponding pictures. Another possibility is that JT's performance was affected by memory difficulties, in view of her performance on the event drawing task, in particular the high number of repetitions requested, and the noun pointing task. Although the computerised version of the RSCT used in this investigation permits unlimited repetitions of the stimulus sentence, JT usually made her choice after only one repetition. Possibly she did not allow herself sufficient processing time in this task. The presence of a Yes bias makes interpretation of JT's performance on the RSCT difficult and highlights the problems inherent in tasks that involve forced choice responses and matching between linguistic and visual stimuli. The event drawing task avoids both these problems.

Evidence in support of the hypothesized problem with interpreting verb-specific meanings comes from JT's performance on the Perspective Video. Her score of 13/18 was significantly lower than the expected score (Fisher's exact test $p < .05$). As this task involves no processing of sentence form or structure, difficulties are more readily attributable to the meanings of the verbs themselves and/or the conceptual processing of the visual events. JT's errors all occurred on the biased scenes and 4/5 were perspective errors. Thus even when the scene was heavily biased to be viewed from the perspective of one of the participants, she nevertheless had problems selecting the verb label to match that perspective. The predominance of perspective errors in JT's case is likely to be attributable to the interaction of visual and verbal problems, specifically:

a) a problem with the identification of the perspective of the visual event, which is consistent with her performance on the visual condition of the event drawing task;
b) impaired/underspecified representation of the meaning of verb, which is consistent with her performance on the verbal condition of the event drawing task.

C. Summary and interpretation of JT's performance

JT's performance on the event drawing task provides evidence that she has problems with the schematization and structuring of events for the purpose of communication in general. She had difficulty processing communicatively-relevant aspects of events even when no linguistic output is involved, which suggests that her difficulties describing events are not solely related to linguistic output problems. A problem at the conceptual preparation level of production is hypothesized that underlies, or at least contributes to, her difficulties in communicating about events both non-linguistically and through language. JT's written attempts at event description show a paucity of verbs and a lack of structure, which are consistent with this account of her output deficits (see Chapter 4, Section 4.2.3).

Comparison of JT's performance across the visual and verbal conditions of the event drawing task revealed some discrepancies in her performance, which are consistent with a proposed problem in "thinking for communication" as a source of output problems. These between-condition differences may be attributable to the different forms of interaction between thinking and communication involved in the production and comprehension of messages (Black & Chiat 2000; Dipper et al 2005). In the visual condition, JT had problems processing the causal structure of the events, whilst her ability to process temporal and directional information was intact. In the verbal condition, in contrast, she showed some ability to interpret the sentences as describing causal acts, while her processing of directional information was impaired.

Appreciation of causal structure in the visual condition requires constructional effort in order to determine how the initiating act subcomponent of the event links to the ensuing process of change. This suggests that JT's problems at the conceptual preparation level of message production are related to difficulties with 'paring down' perceptual information to arrive at a structured conceptualisation of the event (Black & Chiat 2000; Dipper et al 2005). This problem affects some aspects of events more than others. Aspects of events that can be more readily processed on the basis of perceptual factors are likely to be less impaired, as confirmed by JT's performance. She showed an increased reliance on perceptual factors, such as screen position and 'start position of Theme', in determining the perspective she took on events. Temporal structure and directional information in the visual condition are less reliant on 'paring down', since they can be perceived by attending only to the movement of the Theme, without the need to process the action that triggered this movement.

In the verbal condition, appreciation of the causal structure of the events can be deduced on the basis of the form of the input sentence and access to the general mapping principle that assigns the role of Actor to the first noun phrase, even if access to the meaning of the verb is reduced. Thus the form of the linguistic input, together with semantic/pragmatic constraints on interpretation from the meanings of the individual noun phrases, "sets in motion" the process of building up a conceptual representation of the sentence, even though some aspects of linguistic access or processing may be impaired (Black & Chiat 2000). JT's ability to interpret the causal structure of the linguistically-described events also confirms that her failure to focus on causation in the visual condition is not due to a problem with the cognitive notion of causality per se.

Appreciation of directional information in the verbal condition *is* dependent on access to verb-specific meaning, which in JT's case is hypothesized to be impaired. However, in contrast to PZ above, JT's difficulties with accessing verb meanings were not restricted to core aspects, but extended to thematic aspects of verb meaning, which are relevant to the structure of events. There may therefore be an interaction between her language impairments and her event conceptualisation problems. Her problems with event schematization affect her ability to produce structured descriptions of visual events. However, as discussed in Chapters 2 and 3, it is possible that impaired access to the full lexico-semantic representations of verbs could reduce the effects of linguistically-mediated constraints on schematisation, thus resulting in conceptualisations of events poorly structured for communication (Black & Chiat 2000; Dipper et al 2005). This will be discussed further in Chapter 7.

6.4 BP

A. Processing of visual events

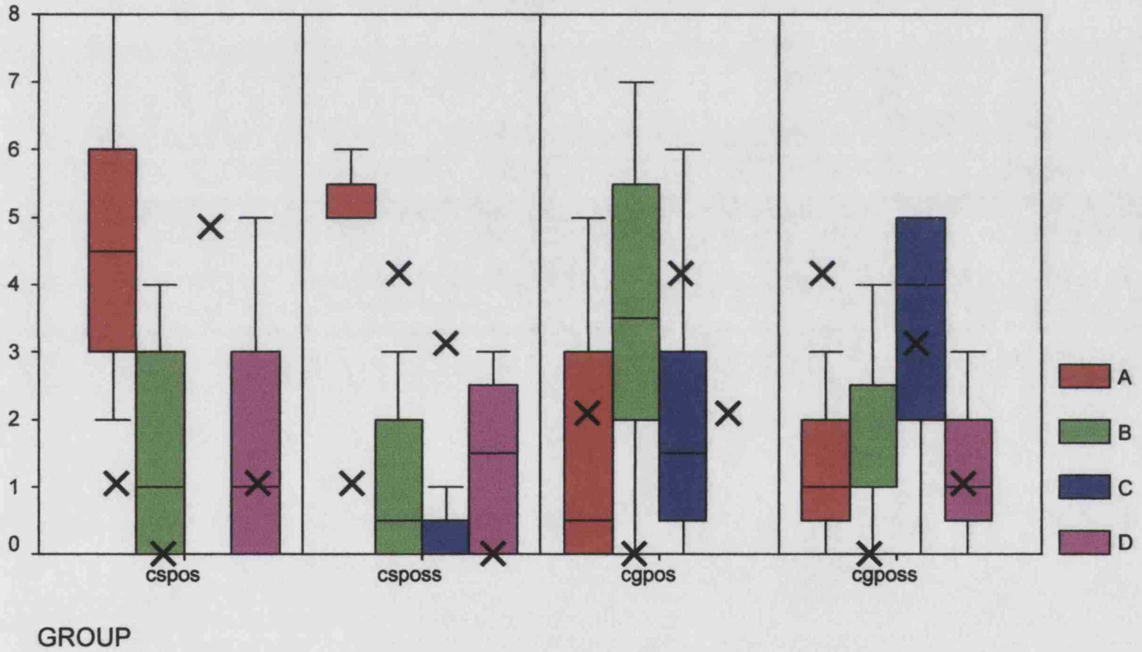
i) *Performance on visual condition of event drawing task*

As with JT above, BP's performance on the event drawing task indicated some difficulties processing visual events for the purpose of communication. He required a total of 43 repetitions over the whole task, which is well outside the control range of 2 -10 and more than two standard deviations above the control mean (control mean 4.017, S.D = 2.59). This suggests a problem with storing and maintaining the incoming information whilst engaging in further processing (Analysis 1). Requests for repetition occurred equally across position change and possession change events.

BP was able to identify the participants in the event, shown by his inclusion of all three entities in his drawings, with no omissions or substitutions (Analysis 2). However, the temporal order in which he drew these entities suggests that he has failed to attend to or process the causal structure of the events. He did not consistently foreground the Cause entity in either position change or possession change events. Thus he does not present the event from the perspective of the Cause entity even when there is only one possible candidate for that role, suggesting that he fails to attend to its role as initiator of the event.

As can be seen in Figure 6.4.1, his foregrounding choices differed from those of control participants in all stimulus groups, confirming that he is influenced mainly by perceptual factors. In position change events, his performance was influenced by the interaction between perceptual/conceptual constraints that lead him to treat the more stable Source or Goal entity as the reference object and the graphic output modality constraint of 'draw reference object before Theme'. This resulted in a significant tendency to draw the Source or Goal entity first in position change events ($\chi^2 = 5.40$, df 1, $p < .05$) (CSPos and CGPos, Types C & D). In possession change events, the most influential factor was that of screen position. BP was significantly more likely to draw the entity on the left of the screen first in possession change events (Fisher exact, p < .005), resulting in equal numbers of Cause-first and Source/Goal first responses (CSPoss and CGPoss). This is consonant with the normal tendency when faced with the additional processing requirement of selecting from two alternative perspectives. However, an increased reliance on perceptual factors in *both* position change and possession change events suggests that BP was not attending to the causal structure of the events, i.e. that they involved an initiating act on the part of the Cause entity.

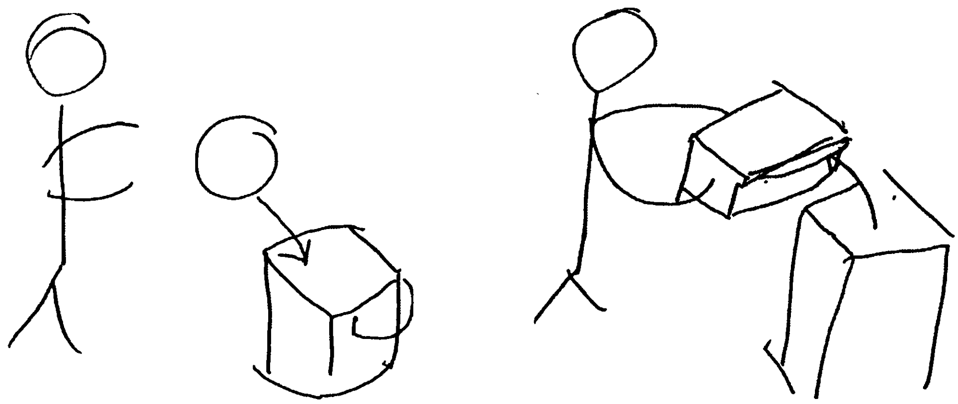
Figure 6.4.1
BP Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by BP (X) in the visual condition stimulus groups compared with control median and range.



BP's performance is also similar to that of JT in that he showed some ability to process the temporal structure and directionality of the events, despite failing to attend to their causal structure. This is shown by his occasional use of arrows to indicate the movement of the Theme to its end position (Analysis 3). However, his use of arrows was limited in comparison with control participants: he included a single arrow in only six of his drawings, all of them position change events. The orientation of the arrows always reflected the directional information of the stimulus event (see Drawing 6J overleaf for examples). Failure to include arrows in his drawings of possession change events might suggest that his ability to process temporal structure and directional information is affected by the additional processing demands of having to decide between two perspective options.

Drawing 6J.
BP: Examples of use of arrows to indicate temporal and directional information in position change drawings in the visual condition

a) boy throws ball into bucket *b) boy lifts box off table*

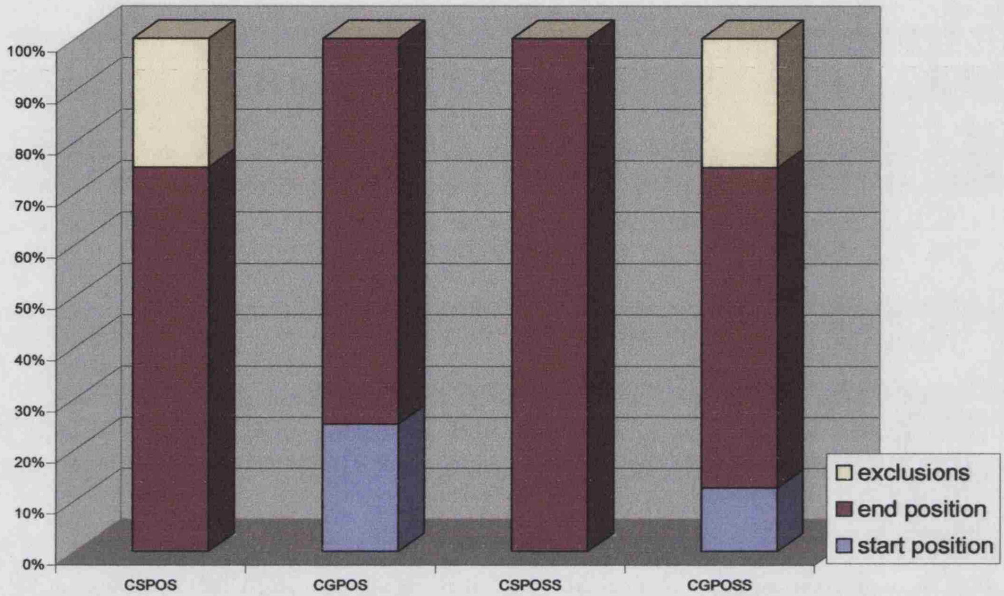


Further evidence that BP has processed directional information comes from his significant preference for locating the Theme at its end position in his drawings in both position change events (χ^2= 12.5, p < .005) and possession change events (χ^2= 16.85, p < .0005) (Analysis 5) (see Figure 6.4.2 overleaf). A similar interpretation can be put forward for BP as for PZ above, who showed the same pattern of performance on this analysis. Consistent location of the Theme at its end position may be a means of directing attention to the end state subcomponent of the events. However, although BP shows some appreciation of the process of change that led up to this end state through his use of arrows, he does not indicate appreciation of the initiating act that triggered this process. This suggests that BP is adopting an unusual temporal perspective on the event, focusing primarily on the Process and End-state subcomponents, rather than the Act.

A failure to attend to the causal structure of the events would also predict difficulties in identifying the action-related roles of the entities and in processing specific features of the causal action in the events. BP did include a symbol for money in his drawings of *buy/sell* events, suggesting that he may have processed the specific kind of transaction in these scenes. However there is no positive evidence that he has processed other action-related aspects of the events, such as manner differences.

Figure 6.4.2

Graph showing location of Theme in BP's drawings in the visual condition



BP's performance in the visual condition of the event drawing task therefore indicates that he has difficulties in schematizing events for the purpose of communication, and suggests that this may be a possible source of BP's problems with describing events using language.

ii) Evidence from other assessments of non-linguistic event processing

Support for a problem with identifying specific features of visual events comes from BP's performance on the Event Perception Test (EPT). His score of 51/60 was outside the control range. He made predominantly semantic errors (Close semantic: N = 5; Distant semantic: N = 3), suggesting that he had difficulty selecting between alternatives that shared several semantic features. Several of his errors occurred on events that differed in the type of Theme involved, such as *eat/drink* and *read/write* or in terms of specific features such as direction, e.g. *open/close* and *fall/rise*.

The hypothesized difficulty with interpreting role information in visual events would at first sight seem to be contradicted by BP's good performance on the Role Video. His score of 30/32 was within normal limits and both his errors were event errors occurring on non-reversible scenes. The absence of role errors would, according to the test authors, suggest intact ability to identify the roles of participants in visual events. This apparent discrepancy between BP's event drawing task performance and his performance on the Role Video can be explained by a re-consideration of the task requirements of the Role Video. Specifically BP's performance suggests that identification of the Cause/Actor role may not, in fact, be a requirement for success on the Role Video. Because the Role Video involves selection of a photograph representing the final outcome of the event, it may be possible to achieve success by focusing on the movement (process) and end-state of the Goal or Theme. For example, in the scene involving a man tripping a woman, selection of the correct outcome photograph, i.e. a woman lying on the floor, can be achieved on the basis of attending to the woman falling over and ending up on the floor. Likewise in a change of possession scene, such as a woman giving flowers to a man, the correct outcome photograph, i.e. the man holding the flowers, can be selected on the basis of the final position of the flowers. This interpretation of BP's performance on the Role Video is consistent with his event drawing task performance, where he showed appreciation of both the process and end-state subcomponents.

In summary, the evidence from BP's performance on the visual condition of the event drawing task provides strong indications that his problems with conceptualizing caused change of location events are related to a difficulty in adopting an appropriate temporal perspective. He failed to appreciate the causal structure of these events, focusing instead on the process and end-state subcomponents. These difficulties with event conceptualisation affected his ability to communicate effectively about them using drawing, and may also underlie his problems in linguistic description of events, at least in part. This will be discussed further in Section C below.

B. Processing of linguistically encoded events

i) Performance on verbal condition of event drawing task

BP's performance on this task indicated significant problems understanding linguistic descriptions of events at both the syntactic and semantic levels of processing. He requested that the task be discontinued after only 25/32 items, and did not wish to complete it on a different occasion. His difficulties with the verbal condition cannot be attributed to problems with producing the drawings, since similar events and entities were used in the visual condition, which he completed in just one session. His difficulties must therefore be related to problems with interpreting the information in the input sentences.

Several aspects of BP's performance suggest a problem with retaining the form of the sentence whilst engaging in further processing. He required a total of 59 repetitions over the 25 items, which is above the control mean for the whole test (control mean = 0.417, S.D = 0.87). Requests for repetition occurred equally in possession change events and position change events (Analysis 1). BP also made several omission and substitution errors as shown in Table 6.4.1 (Analysis 2). These errors occurred on both position change and possession change sentences. Most of his omissions were of the Cause entity. Examples are provided in Drawing 6K overleaf.

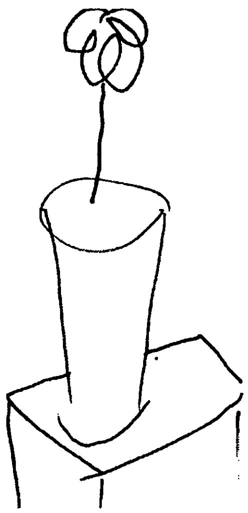
Table 6.41.
BP: number of omission and substitution errors occurring on different entities in the verbal condition of the event drawing task

	Omission error	Substitution error
Cause	4	2
Theme	2	2
Source/Goal	1	1
Total	7	5

Drawing 6K.
BP: examples of omission and substitutions in verbal condition drawings, indicating difficulties processing and retaining the individual noun phrases in the sentences

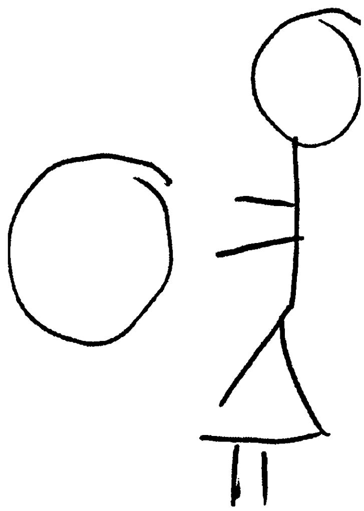
a) Omission of Cause:

{Mary} places the vase on the table



b) Omission of Cause, wrong Theme:

{Bill} passes the box to Mary



These difficulties in processing and maintaining the individual noun phrases were also reflected in differences in the temporal order of drawing as compared to the control participants (Analysis 6). Because of the high number of omissions in BP's drawings, his responses could not be classified according to the response types A, B, C etc. Comparison with controls was based primarily on the first-drawn entity. As can be seen from Table 6.4.2, one of the main differences here was BP's failure to foreground the Cause entity. In fact, BP generally drew the Cause last, after requesting a repetition of the stimulus, or omitted it altogether from his drawings. He drew the Cause last 9/10 times in position change events and 8/11 times in possession change events. Instead, BP frequently drew the Theme first, which was very rare amongst controls. He drew the Theme first more often than other entities in possession change events and in *put*-type position change events. In *pick*-type position change events, however, he drew the Source first. This difference may be attributable to the output-modality factor of "draw reference object before Theme". As in the visual condition, BP may treat the larger, more stable item as the reference object.

Table 6.4 2: Number of times BP drew each of the 3 main entities first in the verbal condition of the event drawing task.

		Cause first	Theme first	Source/Goal first
position change	put-type	0	4	1
	pick-type	0	0	7
possession change	give-type	1	5	1
	take-type	0	4	2

Thus BP's foregrounding choices in the verbal condition do not reflect the order of the noun phrases in the input sentences. His performance suggests that he has particular difficulty processing and/or retaining the beginning of sentences, which affects his ability to build up the appropriate syntactic structure. One possibility is that he may be aware that the sentence involves three noun phrases, but fails to retain the content of the noun phrase in sentence initial position. Alternatively, on first hearing the sentence, he may not process the first noun phrase at all, only becoming aware of its occurrence in the sentence after a repetition. The evidence from the event drawing task is insufficient to distinguish between these possibilities.

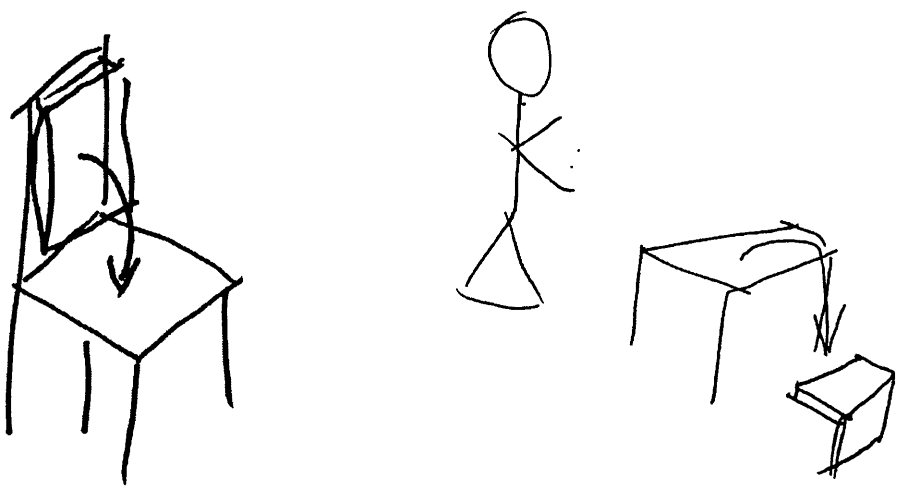
Several aspects of BP's performance suggest that he fails to interpret the thematic roles of the noun phrases, either on the basis of general mapping procedures or by accessing the meaning and thematic structure of the verb itself resulting in a failure to build up the appropriate semantic structure of the event. His tendency to present the events from the perspective of the Theme suggests that he interprets the sentences as describing a process rather than an externally caused act. He fails to assign the role of Cause/Actor to the initial noun phrase even when the corresponding entity is included in the drawing.

Evidence in support of this comes from BP's use of arrows and the positions of the various entities in his drawings. The inclusion of arrows in 11/25 drawings suggests that he understands that the sentences describe movement or change of some kind (Analysis 3). However, the position and orientation of the arrows suggests that he is not aware of how this change came about.

This is particularly evident in his drawings of position change events (see Drawing 6L), where the position and orientation of the arrows and the Theme suggests that he has processed these sentences as describing an (internally caused) *falling* event. There is no indication that the Theme's movement came about as a result of an external triggering act. The Cause is omitted in drawing (a), while in drawing (b) *Mary* does not appear to have a participant role in the event, either as its initiator or as the eventual end position of the Theme, both of which are implicit in the meaning and thematic structure of the verb *pick.*

Drawing 6L.
BP: Examples of Process-focus interpretation of the sentences, indicated by position and orientation of arrows in his drawings in the verbal condition.

a) Bill grabs the cushion off the chair b) Mary picks the book off the table

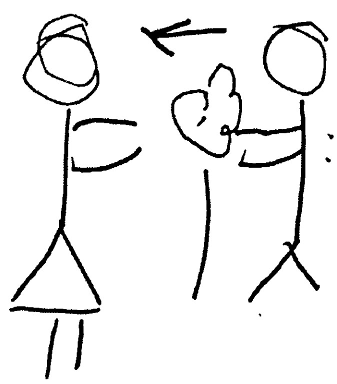


In his drawings of possession change events, BP tended to draw the Theme first, followed by the two human entities equidistantly on either side. Finally he added an arrow, indicating awareness that the Theme moved between these two entities. This again suggests a focus on the Theme's movement rather than an appreciation of the initiating role of either of the two human entities.

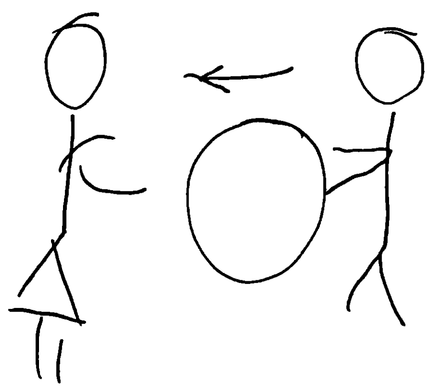
The orientation of BP's arrows in his drawings of possession change events provides further evidence that he has failed to process the meaning of the verbs in these sentences. On five occasions, the arrows pointed in the opposite direction than that implied by the verb, as shown in Drawing 6M, examples (a) and (b) . On one occasion BP drew a double-headed arrow, accompanied by the phrase *"eeny meeny miny mo",* indicating that he was guessing the direction (Drawing 6M c). This suggests that he fails to identify the directional roles of the two human entities, i.e. which one corresponds to the Theme's start position and which to its end position.

Drawing 6M.
BP: Examples of problems with processing directional information in possession change events in the verbal condition

a) Mary gives the flower to Bill



b) Bill grabs the ball from Mary



c) Mary takes the flower from Bill

Directional information in these sentences is carried by the meanings of both the verb and the preposition, the former specifying the directional role of the first noun phrase and the latter that of the final noun phrase. BP's position change drawings indicate that he may have access to the locational meanings of some prepositions, for example information about containment and contact. In 9/12 of his position change drawings, the location of the Theme corresponded to that implied by the locational meaning of the preposition (Analysis 5). This is demonstrated in Drawing 6L (b) above. This information might provide BP with some clues to directionality in position change events. For example BP's interpretation of the sentence corresponding to Drawing 6L (b): *Mary picks the book off the table*, might be something like:

"book (moves to) $_{\text{Place}}$ (OFF the table)".

This would enable him to identify the table as the start position of the book's movement even if he has not understood the meaning of the verb. However, this information would not provide any indication of Mary's role either as initiator of the event or as the end position or Goal of the Theme's movement, both of which are dependent on access to the meaning of the verb.

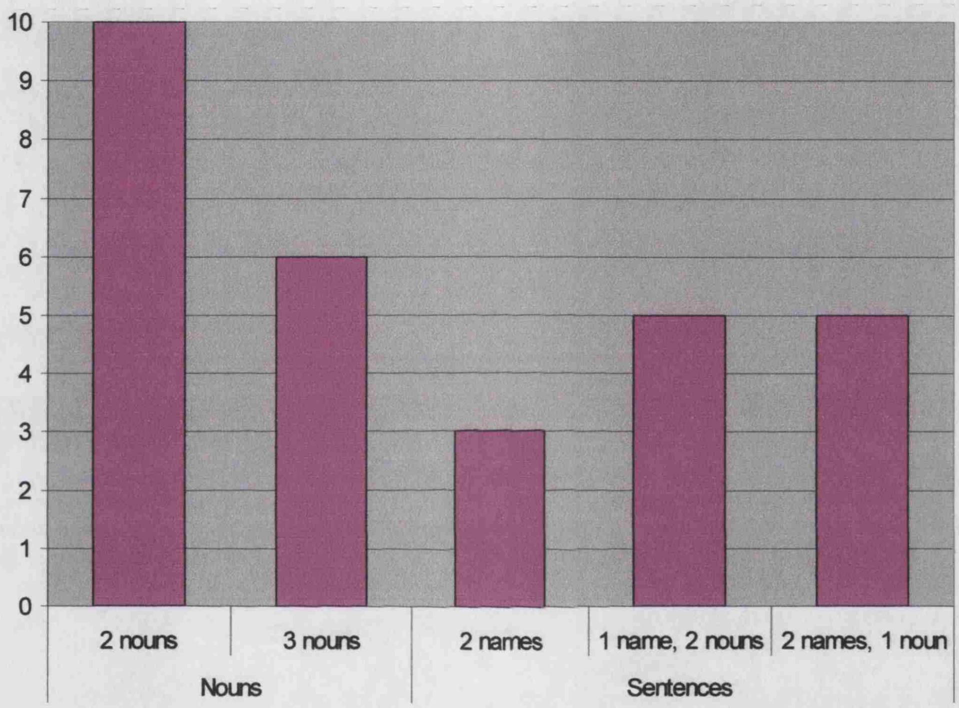
BP's performance in the verbal condition of the event drawing task therefore suggests problems with both the content and the structural side of sentence processing at both syntactic and the semantic levels. He fails to build up a syntactic representation of the event due to problems retaining the noun phrases in the sentence, in particular the first noun phrase, and to difficulties in accessing the verb's subcategorisation frame. He also fails to build up the semantic structure of the events, either on the basis of general structure-building procedures or by accessing the meaning of the verb, including its thematic structure.

ii) Evidence from other language assessments.

Support for these hypothesized deficits comes from BP's performance on the other assessments of language processing. A problem retaining noun phrases and their order in sentences is confirmed by BP's performance in the Noun pointing task, which also provides evidence of a recency effect in his auditory memory. This is consistent with his failure to process the beginning of the sentences in the event drawing task. His score of 29/50 was significantly worse than the expected score of 48 (Fisher exact test: $p < 0.0001$). Figure 6.4.3 shows a breakdown of his scores on the different levels of the task.

Figure 6.4.3

BP, Noun pointing task. Number of correct items in each level



On the noun lists, BP's scores were comparable to the expected score of 10, while in the sentences they were significantly worse than those of controls (Fisher exact, $p < .05$). This confirms that BP's ability to retain nouns and their order is not helped by the structure or meaning of the sentences. In fact, there was some evidence to suggest that his retention of nouns and their order improved when he did not attempt to process the meaning relations between them. In the three-noun sentences, he was more successful when he "worked backwards", i.e. he selected the picture corresponding to the final noun phrase first, followed by that in sentence-medial position, and finally the sentence-initial noun. Often he asked for a repeat of the sentence before selecting the sentence-initial noun. In this task, credit was given for correct placement of pictures on a grid, rather than correct order of selection. This strategy therefore led to several correct responses. However, when BP attempted to select the items in the order in which they had occurred in the sentence, he made both sequencing and lexical errors.

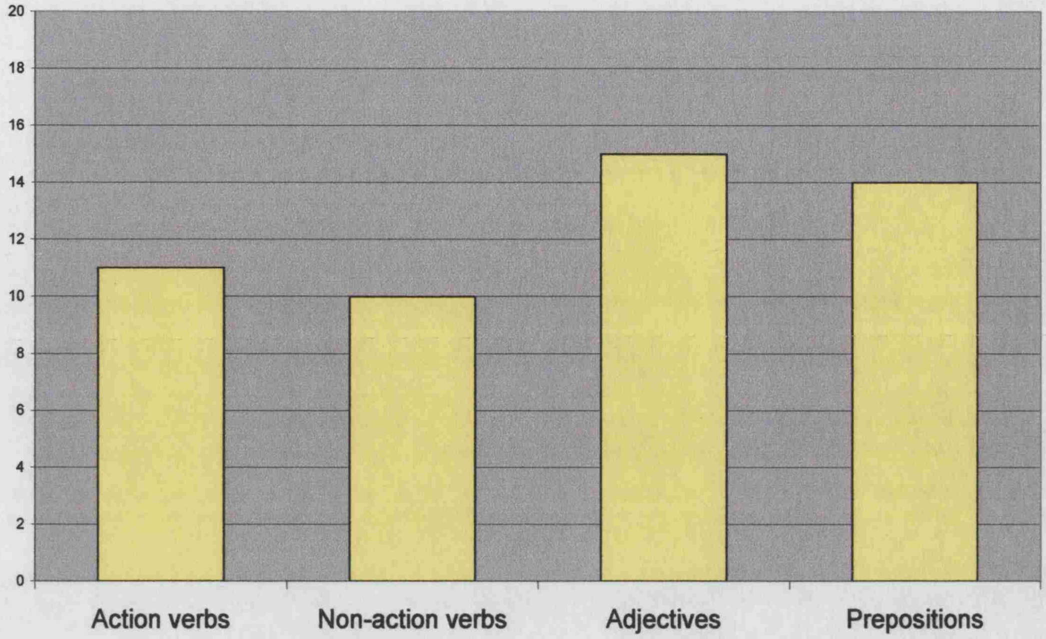
This "working backwards" strategy is not an option in the event drawing task, where processing of the meaning of the sentence is a pre-requisite for its effective graphic communication. As BP's performance showed, failure to process the beginnings of sentences and the roles of and relations between the noun phrases severely affected his ability to communicate about the events described.

A problem with processing thematic information in sentences is confirmed by BP's performance on the RSCT. He scored a total of 49/80, which is significantly below the norm (Fisher exact test, $p < .0001$). He made errors on all sentence sets, but achieved slightly higher scores on the adjective and locative sets than on the action verb and non-action verb sets, although these differences were not significant (see Figure 6.4.4 overleaf). A problem maintaining the order of noun phrases in the sentence would undoubtedly contribute to BP's difficulties in the single version of the RSCT. However, this is not the only source of BP's difficulties with reversible sentences since his performance was not improved by reducing the memory demands of the task. On the "Who is ....?"[18] version of the test, BP scored only 4/10 on the action verb set and 3/10 on the non-action verb set. His poor performance on the action verbs set confirms that he is not able to interpret thematic information in sentences, either on the basis of verb-specific thematic information or on the basis of general mapping procedures. This is supported by qualitative aspects of BP's performance on both versions of the RSCT. He frequently made comments like "Eeny, meeny, miny, mo" to indicate that his responses were no more than guesses, and he seemed very aware of his failure on this task.

[18] See Section 6.1 B this chapter for description of this version of the test

Figure 6.4.4.

BP: Scores on different sentence sets in RSCT



Further evidence in support of a problem processing verb meanings comes from BP's poor performance on the Perspective Video. Since this test involves processing of single written verb labels, difficulties cannot be attributable to problems remembering verbs or processing the syntactic structure of sentences, but must be related to the meanings of the verbs themselves. His score of 9/18 was significantly lower than the expected score (Fisher exact: $p < 0.001$). He made 2 distractor errors on the unbiased scenes and 7 perspective errors on the biased scenes. This pattern of performance suggests that, even when there are strong clues to perspective in the accompanying visual scene, BP has some difficulty in selecting a verb label to match that perspective. As with JT above, BP's performance on this task is likely to have been affected by problems in identifying perspective information in the visual scene, as indicated by his performance on the visual condition of the event drawing task. His difficulties in selecting a correct verb label in this test are therefore hypothesized to be due to the interaction between his linguistic processing problems and his visual event conceptualisation difficulties.

C. Summary and interpretation of BP's performance

BP's performance on the event drawing task provides evidence in support of an event conceptualisation source of his problems with describing events. His performance in the visual condition indicates that his problems in output cannot be solely attributable to linguistic processing, since he has difficulties in communicating about events even when no language is involved. This argues for a more general problem with the schematisation of events that affects "thinking for communication" for both non-linguistic and linguistic production.

BP had difficulty processing aspects of the stimuli related to the structure of the events, from both visual and verbal input. In both conditions, he failed to indicate appreciation of the whole causal structure of the events, i.e. that they involve an initial triggering act. Instead, he focused on the movement of the Theme i.e. the Process subcomponent of the events. This performance indicates a problem with interpreting the focus of events. In the caused change of location (CCL) events in the current study, this resulted in a failure to integrate the Act subcomponent with the other subcomponents. This problem would be likely to affect his ability to describe these kinds of events linguistically as well as in drawing. In particular it would affect his selection of an appropriate verb label to describe the event. This is confirmed by BP's performance on the Object and Action Naming Battery, where he showed a selective verb deficit (see Chapter 4, section 4.2.4 and Appendix G).

BP did manage to name some verbs however (18/50), and his naming performance is interesting in the context of the current study. Firstly, his verb naming indicates that his failure to process the causal structure of the CCL events in the event drawing task is not related to a problem with the cognitive notion of causality per se. Some of his correct productions were verbs that expressed causality, e.g. *drinking, eating.* In these kinds of events, the nature of the participants in the scenes restricts the range of possible actions and perspectives (Black & Chiat 2003a), and in fact, BP cued himself in to the verb by naming the entities in the scene, e.g.:

drinking	→	"a cup, tea ... drinking, hooray!"
eating	→	"supper, biscuits ... eating, hooray!"

Sometimes, however, this strategy resulted in BP producing a verb that described the situation from the perspective of a different entity, e.g.:

lighting → "candle, burning"
riding → "a horse, carrying".

Most of BP's other correct verb naming responses (11/18) occurred on situations involving a single subcomponent, i.e. what Black & Chiat (2003a) refer to as "narrow-focus" situations. Five were Acts: *crying, yawning, blowing, waving, watching (TV),* and six were Processes: *walking, running, sliding, swimming, dancing, skipping.* It could be argued, as some researchers have done, that these kinds of situations require less 'paring down', since they are perceptually unitary and do not require the integration of information from different subcomponents (Dipper et al 2005; Black & Chiat 2003a). It is possible therefore, that BP's verb naming performance might be influenced by conceptual and/or semantic factors, such as the number of subsituations that the event involves. However the effects of factors such as age of acquisition and frequency on verb retrieval must also be taken into account. Thus no firm conclusions can be drawn about this aspect of BP's verb naming performance from the evidence currently available. Nevertheless, it raises an interesting theoretical question for further investigation.

It also raises the possibility that BP's performance on the event drawing task might be affected by the fact that CCL events involve the integration of information from three separate subcomponents into a single event schema. Once again, this suggestion must remain speculative, since the current version of the event drawing task does not specifically compare performance across different kinds of events, although there is potential for development in this respect.

An alternative explanation for BP's pattern of verb retrieval deficits could be related to the argument structure complexity of the verbs themselves. As discussed in Chapter 3, there is evidence that verbs with a greater number of arguments are harder to name for some people with aphasia (Thompson et al 1997, Kim & Thompson 2000). The Object and Action Naming Battery does not test this hypothesis specifically. However, the fact that BP had similar difficulties in communicating these complex events in drawing argues against this interpretation, since there is no requirement to produce a verb or its arguments in the event drawing task.

Similarly BP's problems with understanding the sentences used in the event drawing task are unlikely to be due solely to the fact that they include three arguments, since there was no improvement in his sentence comprehension when the number of arguments was reduced, e.g. in the "Who is..?" version of the RSCT. This confirms that his sentence processing problems are not purely syntactic, but that impairments at the semantic level also play a role.

As with JT above (section 6.3), BP's performance on the event drawing task may suggest an interaction between his language impairment and his event conceptualisation. His problems with accessing the full meanings of verbs, including their thematic structure, might reduce the effects of linguistic sources of constraint on event conceptualisation. BP's increased reliance on perceptual factors, such as the relative stability of the entities and their positions on the screen, in the visual condition of the event drawing task, particularly in terms of perspective taking, provide support for this interpretation. This will be discussed further in the following chapter.

6.5 DN

A. Processing of visual events

i) Performance on visual condition of event drawing task

DN appeared to perform this task with relative ease. He requested only 4 repetitions of the stimuli throughout the task, which is within the control range of 2 – 10, and lower than the control mean of 4.917 (Analysis 1). He included the three main entities in all of his drawings, with no omissions, additions or substitutions, suggesting that he is able to identify the relevant participants in the event (Analysis 2). He also followed the spatial position of the entities on the screen in his drawings, i.e. drew the entity that appeared on the left of the screen on the left of the page, suggesting that he can retain spatial information from the visual stimuli (Analysis 4).

However, as with JT and BP above, DN's drawing performance did not provide any indications that he had processed the causal relationship between these entities in the event. He did not consistently foreground the Cause entity by drawing it first in either position change or possession change events (Analysis 6). As can be seen from Figure 6.5.1, he produced roughly equal Cause-first (A & B) and Source/Goal-first (C & D) responses in all the stimulus groups. Thus even when there is only one possible candidate for the role of Cause, i.e. in position change events, DN does not present the event from the perspective of that entity. This indicates that he fails to interpret the crucial role of the Cause entity as initiator of the event. Support for this comes from the fact that DN was reliant on the perceptual factor of screen position in his primary foregrounding choices. The entity on the left of the screen was significantly more likely to be drawn first in *both* position change events (Fisher exact, $p < .01$) and possession change events (Fisher exact, $p < .005$) (see Figure 6.5.2). This differs from control participants' performance, where an effect of screen position was found only in possession change events. Thus DN's performance suggests a failure to attend to or process the causal structure of the events.

Figure 6.5.1
DN Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by DN (X) in the visual condition stimulus groups compared with control median and range.

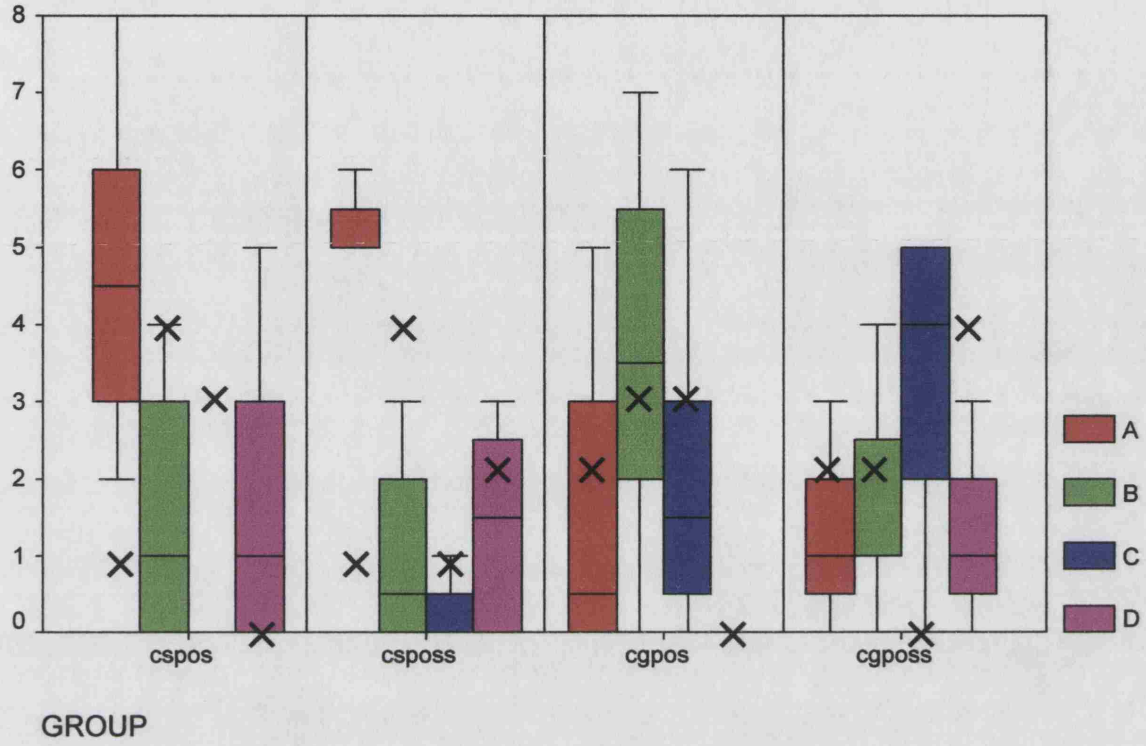
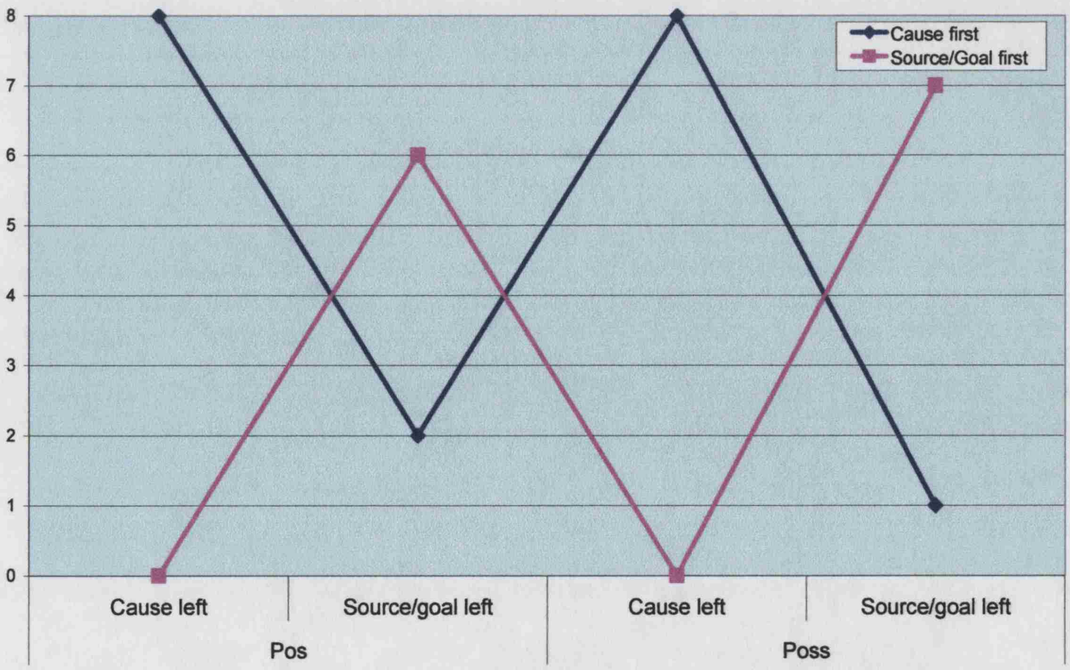


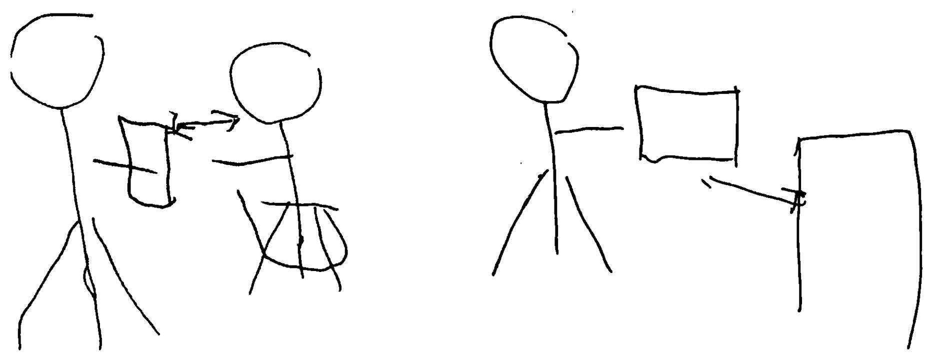
Figure 6.5.2:
Graph showing significant effect of screen position on DN's primary foregrounding choices in both position change and possession change events in the visual condition.



DN showed some appreciation of the temporal structure of the events by the occasional inclusion of arrows in his drawings. He used arrows in seven of his drawings (Analysis 3), equally on position change and possession change events. However, the orientation of the arrows suggests that DN does not reliably process the directionality of the events. On two occasions he drew a double-headed arrow, suggesting that he was unsure of the direction (see Drawing 6N, example (a)), and on two other occasions, the direction of the arrow did not correspond to the direction of the Theme's movement in the scene (Drawing 6N b).

Drawing 6N:
DN: examples of arrow use indicating failure to interpret directional information from the visual condition scenes

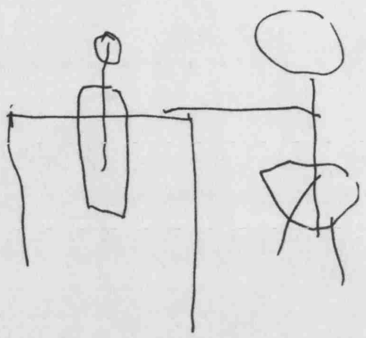
a) girl takes case from boy b) boy takes book out of box



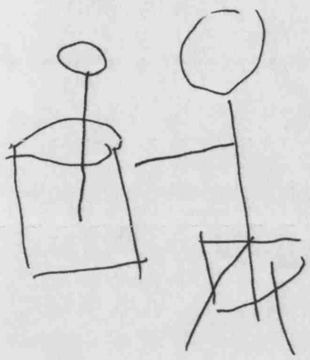
A problem with interpreting directional information in the scenes is also indicated by the lack of consistency in his location of the Theme (Analysis 5). As can be seen in Figure 6.5.3 (overleaf) there was a tendency to draw the Theme at its end position in *put*-type events (CSPos) and at its start position in *pick*-type events (CGPos), but this was not significant (see Drawing 6P (a) and (b) for examples). This suggests that DN may be following perceptual constraints in treating the more stable inanimate entity as the reference object for the Theme, without necessarily processing its directional role as the source or goal of the Theme's movement. In possession change events, where there is no easily identifiable "stable" entity, DN generally drew the Theme equidistantly from the two animate entities, represented as exclusions (see Drawing 6P (c)). This again suggests that he does not reliably identify the directional roles of these entities, i.e. which one corresponds to the Theme's start position and which to its end position.

Drawing 6P:
DN: examples of inconsistency in location of Theme in visual condition drawings, indicating a failure to process the directional roles of the entities

a) Theme at start position:
girl picks flower from vase



b) Theme at end position:
girl puts flower into vase



c) Theme equidistant between start and end position:
girl takes book from boy

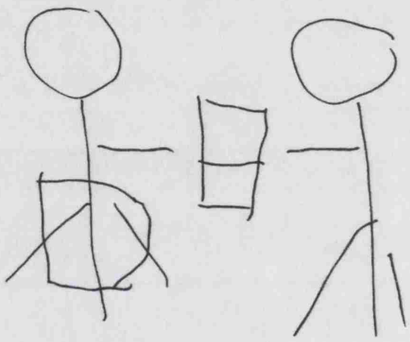
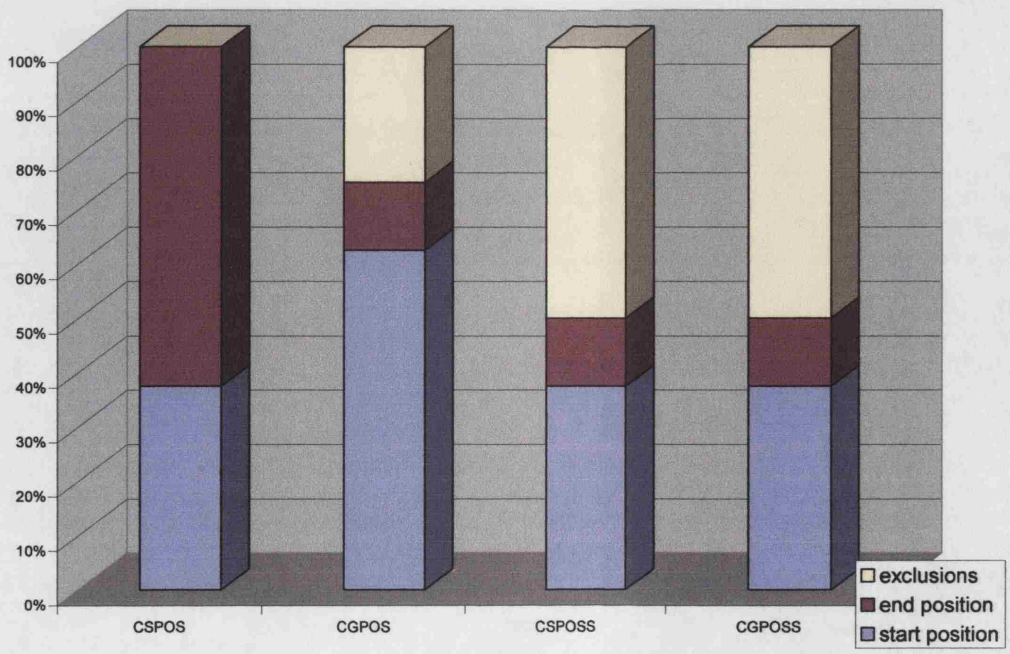


Figure 6.5.3:

Graph showing location of Theme in DN's drawings in the visual condition



The combined evidence from DN's event drawing performance in the visual condition therefore suggests a problem with processing or attending to the causal structure of the events and a problem interpreting directional information. Failure to process the causal structure of the events would predict problems in interpreting the roles of the participant entities and in identifying specific features of the action involved. His limited use of arrows and his failure to include a symbol for money in his drawings of *buy/sell* events provide some support for the latter. Further support comes from his performance on the other non-linguistic event processing assessments.

ii) Evidence from other non-linguistic event processing assessments

DN's score of 47/60 on the Event Perception Test (EPT) was significantly lower than the expected score (Fisher exact, $p < .05$). He made predominantly close semantic errors ($N = 8$), but he also made 3 distant semantic and 2 gross errors. This pattern of performance confirms that he has difficulties interpreting specific features of visual events, in particular those features that enable discrimination between similar events.

On the Role Video DN made four event errors, two on non-reversible scenes and two on reversible scenes. The presence of event errors is consistent with a problem identifying the action taking place in the scene (see PZ above). He only made one role error on a non-reversible scene. This relative absence of role errors can be explained in the same way asas for BP (see Section 6.4. A (ii)), namely that success on the Role Video may be achieved on the basis of information from the process and end state subcomponents of the event, without the need for identification of the Cause entity. Thus this performance does not contradict DN's hypothesized failure to interpret the role of the Cause entity in the event drawing task.

In summary, DN's performance on the visual condition of the event drawing task provided evidence in support of an event conceptualisation source of his difficulties with communicating about events. Problems with processing a number of communicatively-relevant aspects of events were identified, which affects his ability to schematize and structure events into a form suitable for communication in either non-linguistic or linguistic modalities. This will be discussed further in Section C below.

B. Processing of linguistically-encoded events

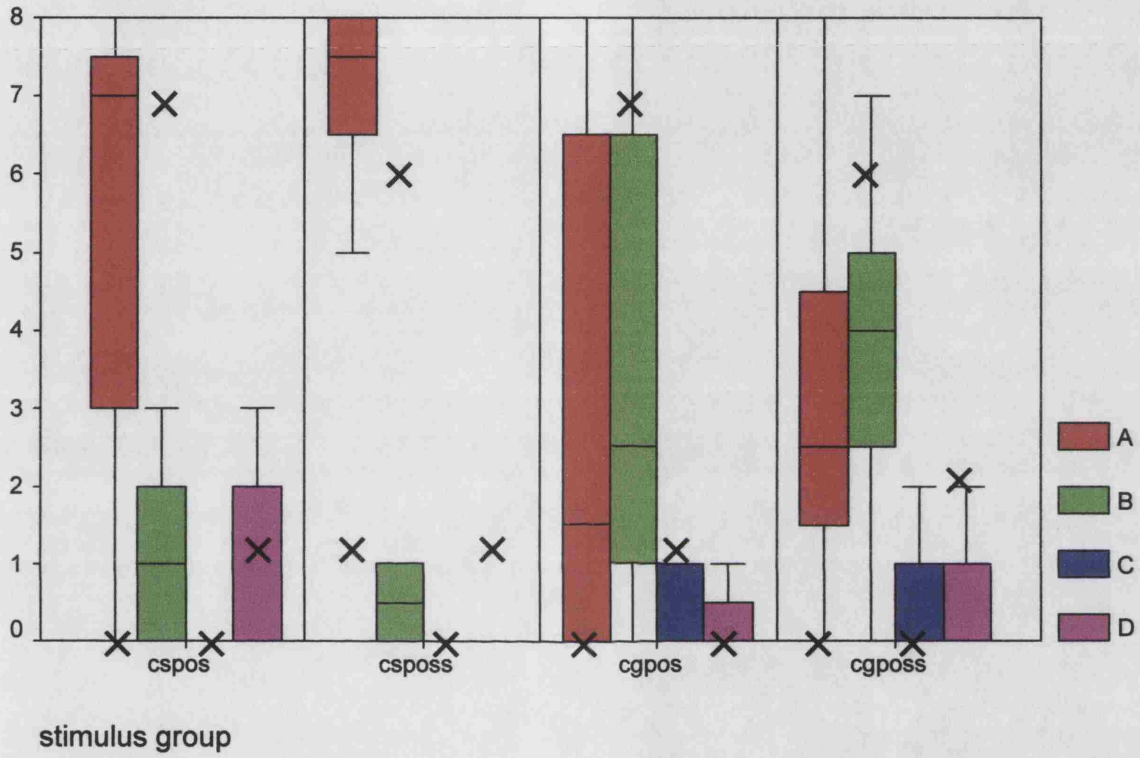
i) Evidence from verbal condition of event drawing task.

DN found this version of the task harder than the visual condition. He requested a total of 22 repetitions, compared with only 4 in the visual condition a difference that was highly significant (χ^2 = 12.46, df 1, p < .0005) (Analysis 1). It was also more than two standard deviations above the control mean for the verbal condition (control mean = 0.417, S.D. = 0.87). Requests for repetition occurred equally on sentences describing position change and possession change events. This suggests a problem with maintaining the information in working memory whilst engaging in further processing.

DN had some difficulties processing the individual noun phrases in the sentences, as shown by his occasional substitution errors (Analysis 2). He drew the wrong Theme on 2 occasions, and the wrong Source/Goal on a further 3. These errors may have been attributable to a mild semantic deficit, since they all involved drawing a semantically related item, e.g. a *table* instead of a *chair*, or a *flower* instead of a *vase*. This would tie in with DN's performance on the PALPA 47, where he scored 31/40 with mainly close semantic errors (see Chapter 4, Section 4.2.5). Alternatively, these errors may have been due to inattention, since they all occurred on items for which no repetitions had been requested, and DN had been noted to rush into a response on several other assessments.

DN showed some ability to retain the order of the noun phrases in the sentences, since he almost always drew the Cause first in both position change and possession change events (Figure 6.5.4, Type A & B responses) (Analysis 6). Whilst this confirms that he has retained the noun phrase in sentence-initial position, it does not tell us whether he has correctly interpreted the thematic role of that noun phrase as Cause/Actor. The combination of evidence from the other analyses indicates that he does not process thematic information in the sentences, either on the basis of general thematic role assignment procedures or by access to the meaning of the verb, including its thematic structure. This prevents him from building up the semantic structure of the events described.

Figure 6.5.4
DN: Verbal condition. Performance on Analysis 6, temporal order of drawing. Graph showing number of each response type produced by DN in the verbal condition stimulus groups compared with control median and range



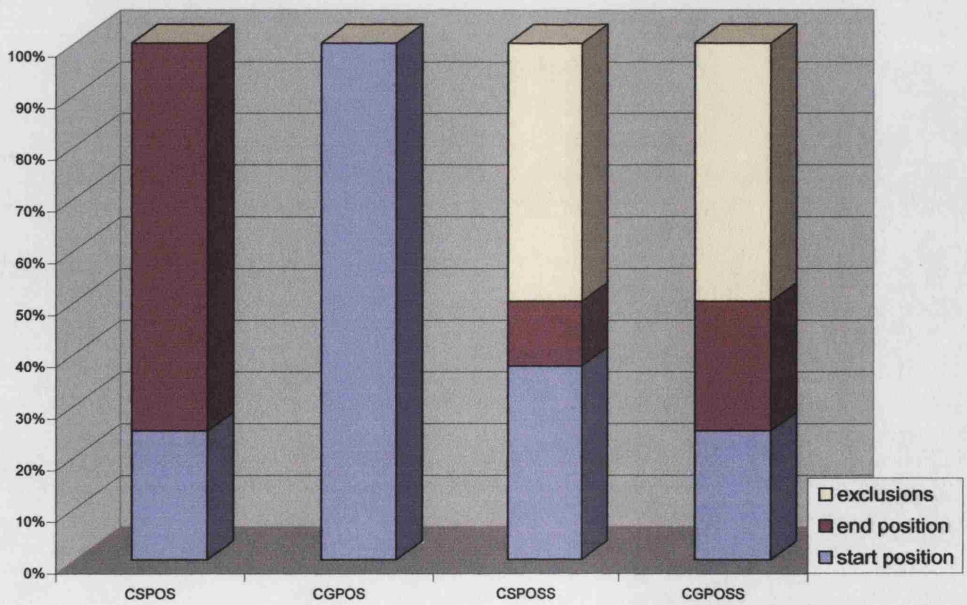
Several aspects of DN's performance suggest that he does not interpret the action-related or directional roles of the noun phrases in the sentences, implicit in the meaning of the verb and the prepositional phrase. Firstly, he almost always drew the Theme last (response Types B & D, Figure 6.5.4). Drawing both the other entities before the Theme suggests that DN treats them both as reference objects against which to ground the Theme, and follows the graphic output constraint of "draw reference object before Theme". This would indicate some understanding that the noun phrases in the sentence are related at least spatially. However it does not necessarily imply intact interpretation of the causal, temporal or directional relationship between the noun phrases implicit in the meaning of the verb. He may, for example, interpret the sentences as describing a state, e.g. "Mary sees the book on the table".

Further indications that DN has failed to interpret temporal and directional information in the sentences come from:

1) his failure to use any graphic strategies such as arrows to indicate the movement and direction of the Theme (Analysis 3). This contrasts with his performance in the visual condition, which argues against a graphic output modality source of this problem.

2) inconsistent location of the Theme in his drawings (Analysis 5). As in the visual condition, DN generally drew the Theme at its end position in *put*-type position change events and at its start position in *pick*-type position change events (Figure 6.5.5, CSPOS and CGPOS), a difference which was significant (Fisher exact, $p < .01$). This suggests that he locates the Theme with the noun phrase that occurs at the end of the sentence, regardless of its directional role. In possession change events, DN usually drew the Theme equidistantly between the two human entities, represented as exclusions in Figure 6.5.5. This suggests that he did not appreciate which of these entities corresponded to the Theme's start position and which to its end position. Examples of inconsistencies in the location of the Theme in DN's drawings are provided in Drawing 6Q overleaf.

Figure 6.5.5.
Location of Theme in DN's drawings in the verbal condition



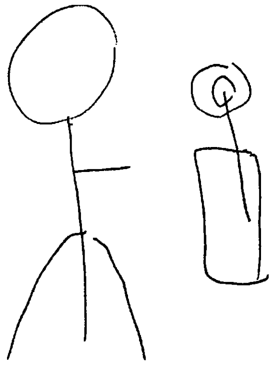
Drawing 6Q
DN: examples of inconsistency in location of Theme in verbal condition drawings, indicating a failure to interpret directional roles of the noun phrases in the sentences

a) Theme with start position:

Bill picks the flower from the vase

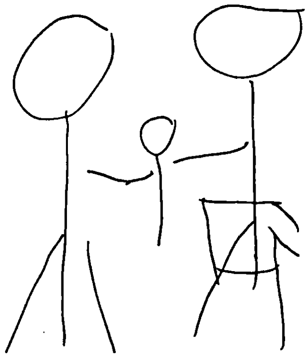
b) Theme with end position

Bill puts the flower in the vase



c) Theme equidistant from start and end positions

Bill gives the flower to Mary

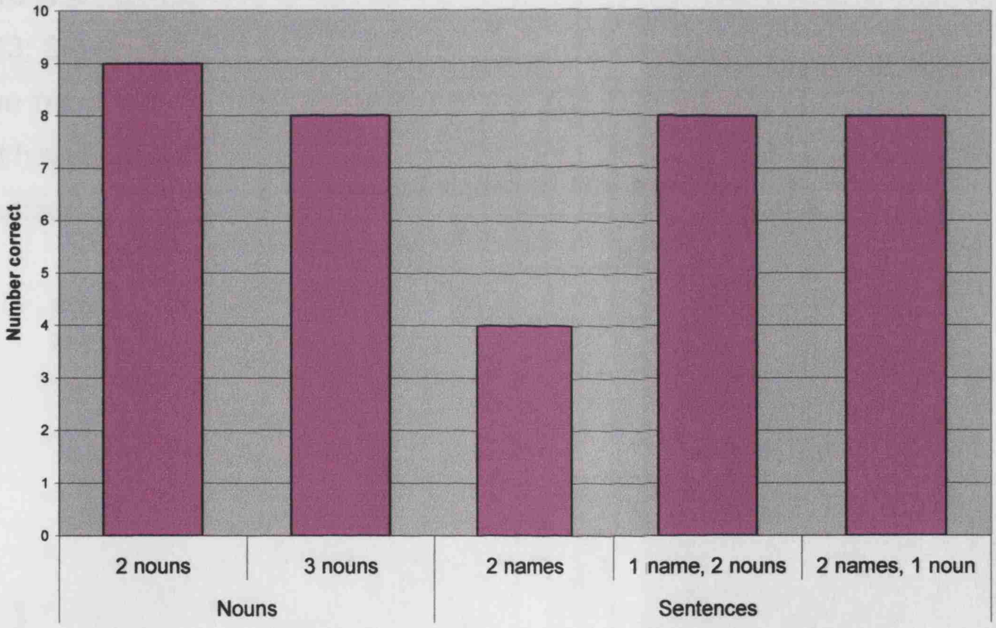


DN's performance on the verbal condition of the event drawing task therefore indicates a semantic source of his problems in interpreting sentences, in the context of relatively good syntactic ability. He fails to build up the semantic structure of the events either on the basis of general mapping procedures, or by accessing the meaning of the verb, including its thematic structure. This is supported by evidence from the other language assessments.

ii) Evidence from other language assessments

DN's good performance on the Noun Pointing Task confirms that his sentence processing difficulties are not attributable to a problem with retaining the order of the noun phrases. His scores were comparable with control performance on all levels except the two-noun sentences where he scored only 4/10 (see Figure 6.5.6). This low score on the two-noun sentences suggests that his ability to retain noun phrase order may be influenced by the semantic content of the noun phrases used. The sentences in this set involve two proper names around a verb. Thus the semantic clues to aid selection of the correct picture are reduced. DN made five sequencing errors on this level, all of which occurred on sentences where the two names referred to people of the same gender, e.g. "Anne sees Mary". Thus DN may only get sufficient information from the name to identify it as "female human". His better performance on the two name, one noun sentences can be attributed to the fact that there was only one sentence in this set that included two proper names of the same gender, and indeed DN made a sequencing error on this item.

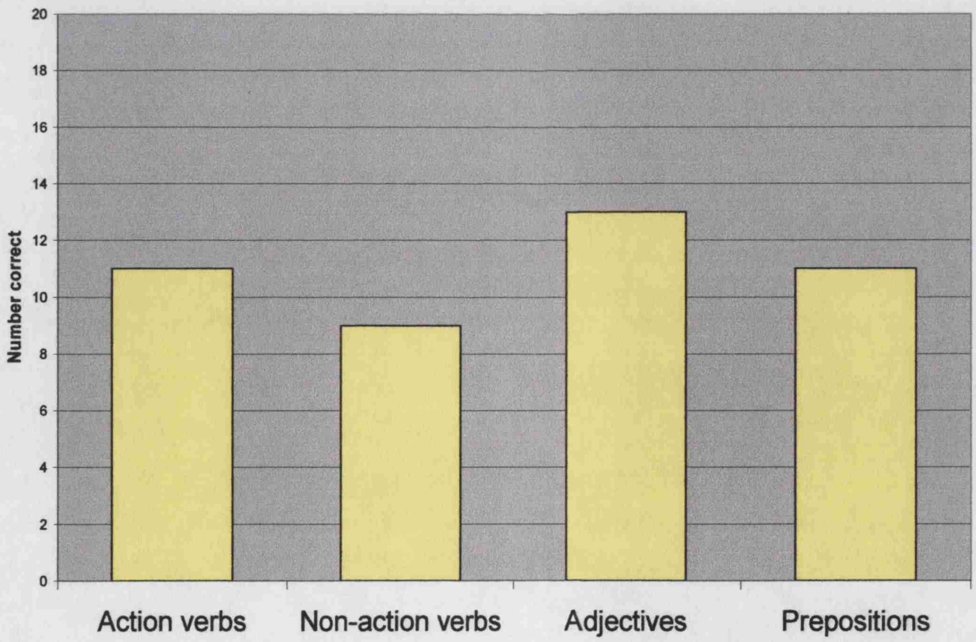
Figure 6.5.6
DN: Scores on different levels of the Noun Pointing Task



This particular difficulty with proper names cannot account for DN's problems interpreting the sentences in the event drawing task. Firstly, he showed a similar pattern of performance on position change sentences and possession change, the former of which only include one proper name. Secondly, the names included in the possession change sentences always referred to two different genders, and DN showed no difficulty differentiating between these genders in his drawings (he always drew *Mary* wearing a skirt).

Likewise, a difficulty with proper names cannot account for his poor performance on the singles version of the Reversible Sentences Comprehension Test. The semantic content of the noun phrases clearly differentiates between the two characters in the corresponding pictures. Thus DN's problems in the RSCT must be related to a difficulty interpreting thematic information in the sentences. His score of 44/80 was at chance and he made roughly equal numbers of errors on all the sentence types (see Figure 6.5.7 overleaf). His low score on the Action verbs set suggests that he is not able to interpret thematic information on the basis of either verb meaning or the application of a general mapping principle that assigns the role of Actor to the first noun phrase in the sentence. Qualitative analysis of DN's performance revealed no differences in his approach to the action verbs set than to the other sentences. He made more errors on incongruous stimuli than on congruous in all sentence sets, suggesting that his performance is adversely affected when there is a conflict between the linguistic input and the picture (Cupples & Inglis 1993; Black & Chiat 2000). DN's performance on the RSCT may therefore have been affected by the interaction of his problems with linguistic processing and his difficulties with processing visual events, as identified in the visual condition of the event drawing task.

Figure 6.5.7
DN: Scores on each sentence set in the RSCT



Evidence that DN has limited access to specific verb meanings comes from his poor performance on the Perspective Video, where there is no requirement to process sentence structure. He scored only 9/18 on this task, which was significantly lower than that of controls (Fisher exact, $p = .001$). He made five distractor errors, one of which occurred on an unbiased scene, and four perspective errors. As discussed with respect to PZ, distractor errors involve selection of a verb label that does not correspond to either of the two possible perspectives on the visual event. Distractor errors on the biased scenes suggest that, even when there are strong visual clues to perspective, DN has difficulty selecting an appropriate verb label to match the event. This suggests that the problem is not restricted to processing perspective information in either the visual scenes or the verb labels, but could indicate more general difficulty with identifying specific visual events and with processing verb meanings. This is consistent with DN's performance in the visual and verbal conditions of the event drawing task. As with the RSCT above, DN's performance in the Perspective Video is influenced by the interaction between his impaired event conceptualisation and his linguistic impairments.

C. Summary and interpretation of DN's performance

DN's performance on the event drawing task provides evidence in support of an event conceptualisation source of his difficulties in communicating about events. He has problems processing certain communicatively-relevant aspects of events, even when the task involves no linguistic encoding (i.e. in the visual condition), which suggests that his problems are related to the schematization of events for the purpose of communication in general. In other words, he has problems at the conceptual preparation stage of communication, which would affect both non-linguistic and linguistic communication, and might therefore contribute to his severe language production deficits. Clearly this is not the only source of deficit, since DN's complete lack of linguistic output is likely to result from the combination of deficits at various stages of production.

Similarities in DN's performance across the visual and verbal conditions provided further indications that there may be a relationship between his problems with event conceptualisation and his language impairment. In both conditions of the task, DN had difficulty processing those aspects of the stimuli relating to the structure of the events. He failed to appreciate the causal structure of the visual events and the related roles of the participant entities, and failed to process thematic information in the sentences, which prevented him from building up the semantic structure of the events described. DN also showed similar problems in interpreting directional information from both visual and linguistic input.

DN showed an increased reliance on perceptual factors in the visual condition of the event drawing task, relying almost exclusively on the perceptual constraint of screen position in determining his choice of perspective and foregrounding. In the verbal condition also, DN relied on the order of the noun phrases in the sentence to determine his foregrounding choices in drawing the events described. However, there was no indication that he had correctly assigned the role of Actor to this noun phrase. It is possible that reduced access to thematic aspects of verb meanings might interact with event conceptualisation by failing to direct attention to the roles of the entities in a visual event (Dipper et al 2005).

DN's performance on the verbal condition of the event drawing task also demonstrates that sentence comprehension relies on more than just intact syntactic processing. DN's syntactic processing was relatively good, yet he still had difficulty interpreting the events described by the sentences. This confirms that access to semantic information and the ability to integrate syntax and semantics are crucial to sentence comprehension.

6.6 DA

A. Processing of visual events

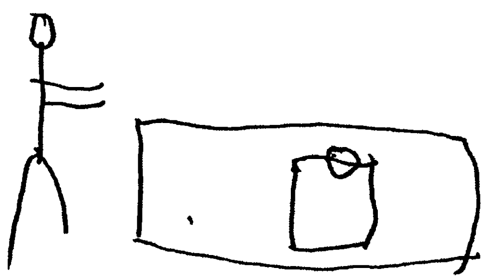
i) Performance on visual condition of event drawing task

DA's performance differed from that of controls in several respects, indicating significant problems with processing visual events for the purpose of communication. He required a total of 41 repetitions over the whole task, which is well outside the control range of 2 -10 and more than two standard deviations above the control mean (control mean = 4.917, S.D. = 2.59) (Analysis 1). Requests for repetition occurred equally across position change and possession change events. This suggests that he has difficulty storing the incoming stimulus in visual memory whilst engaging in further processing and execution.

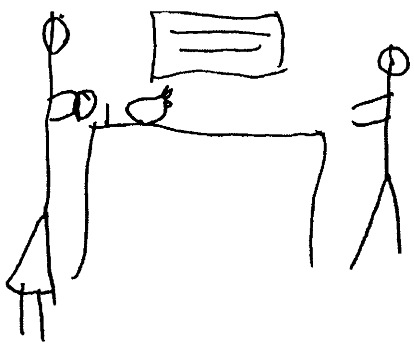
DA had some difficulty identifying the relevant participants in the event, as shown by the occasional inclusion of an additional item that was present in the background of the scene but was not relevant to the main event, such as a radiator (Drawing 6R a) or a picture on the wall (Drawing 6R b) (Analysis 2). Inclusion of irrelevant items indicates that DA does not appreciate how the entities in the scene are related to one another, which implies a problem conceptualizing the scene as an event. This is confirmed by other aspects of DA's performance which suggest that he fails to process the causal and temporal structure of the events.

Drawing 6R.
DA: examples of inclusion of irrelevant entities in DA's drawings in the visual condition, indicating a problem with identifying relevant participants

a) boy throws ball into bucket

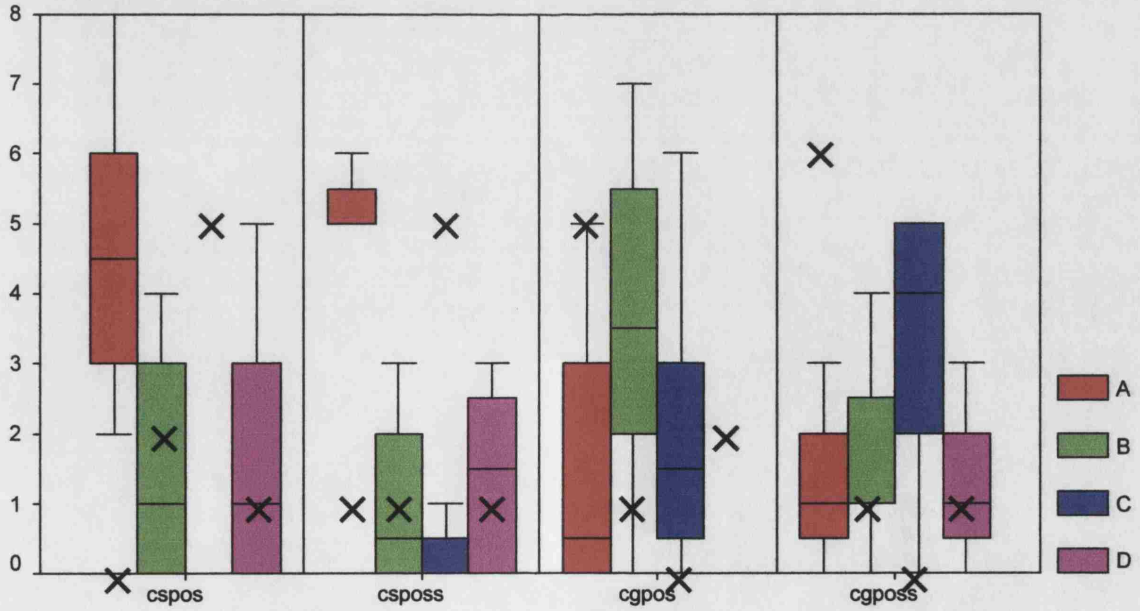


b) girl buys apple from boy



A problem with processing causal structure is shown by DA's failure to direct attention to the triggering Act subcomponent of the event. Unlike the control participants, he did not consistently foreground the Cause entity in his drawings of either position change or possession change events (Analysis 6). This suggests that he does not attend to the role of the Cause as initiator of the event, even when there are strong perceptual and conceptual clues to identify this role. DA's performance suggested that he relied on perceptual factors in his foregrounding choices, and treated the Cause purely as a spatial reference object for the Theme, foregrounding it only when it corresponded to the end position of the Theme's movement, i.e. in *take/pick*-type events (Figure 6.6.1, Type A & B, CGpos & CGposs). In *give/put*-type events, he usually drew the Goal first (Figure 6.6.1, Type C & D, CSpos & CSposs). Analysis confirmed that he was significantly more likely to foreground the entity that corresponded to the end position of the Theme (χ^2= 18.06, df 1, p < .0001). This was consistent over both position change and possession change events and was not affected by the variable of screen position. This pattern suggests that DA focuses on the end state subcomponent of the events.

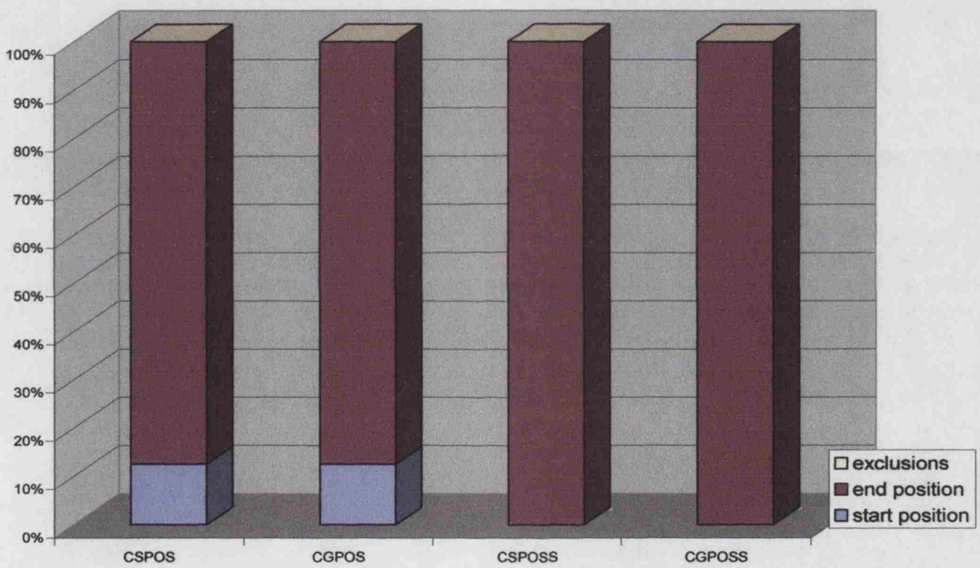
Figure 6.6.1
DA Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by DA (X) in the visual condition stimulus groups compared with control median and range.



GROUP

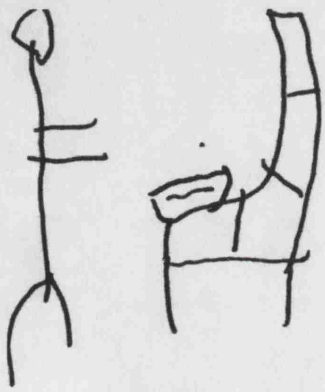
A focus on the end state is supported by DA's consistent location of the Theme at its end position in his drawings of both position change and possession change events (Analysis 5) (see Figure 6.6.2). Examples are provided in Drawing 6S. This differs from the controls, who showed a preference for locating the Theme at its start position, though it is similar to participants PZ and BP above (sections 6.2. and 6.4). DA differs from these two participants in that there is no indication that he has attended to the initiating act or to the process leading up to the end state. DA may simply have been reproducing the locational positions of the entities at the end of the video clip. His drawings resembled locational states, with no indication that an event has occurred.

Figure 6.6.2
DA: Location of the Theme in DA's drawings in the visual condition

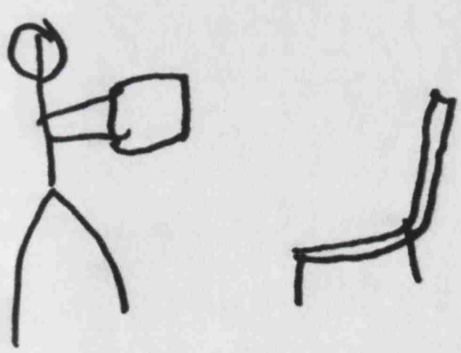


Drawing 6S.
DA: Examples of consistent location of Theme at its end position in visual condition drawings

a) boy puts cushion on chair



b) boy takes cushion off chair

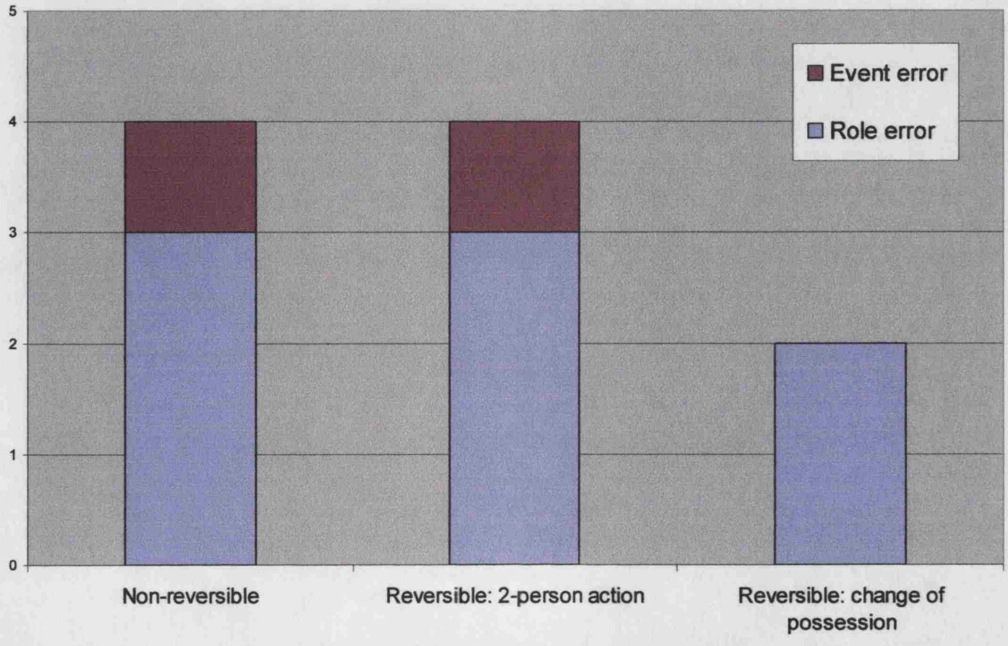


This interpretation would suggest that DA has failed to attend to or process the temporal structure of the scene, i.e. that it involves a change. Support for this interpretation comes from DA's failure to use graphic strategies such as arrows or double-Theme to indicate movement and direction in the scenes (Analysis 3). A failure to process temporal structure would in turn imply difficulties in processing directional information in the stimuli, as well as problems in interpreting role and relational information and identifying the specific action involved. Other aspects of his performance in the visual condition provide support for this. For example, unlike the control participants, he did not include a symbol for money in any of his drawings of *buy/sell* events, suggesting he is not aware of the specific transaction involved here. Problems with role and relational information and with interpreting specific features of visual events are supported by DA's performances on the other assessments of non-linguistic event processing.

ii. Evidence from other non-linguistic event processing assessments

Problems with role and relational information are confirmed by DA's performance on the Role Video. His score of 22/32 was below the control range. He made 8 role errors and 2 event errors. Role errors occurred on all three scene types (see Figure 6.6.3).

Figure 6.6.3
DA: Error analysis on Role Video



Role errors on non-reversible scenes are consistent with DA's hypothesized problem with identifying the participant entities in the event, which indicates a problem in interpreting the relation between the entities (Dipper 1999). The role distractor in non-reversible scenes is an entity that is present in the background of the scene, but does not participate in the event in any way (see Chapter 4, Section 4.3.2).

Role errors on the reversible scenes are consistent with DA's hypothesised problem with interpreting role information in visual events. These errors all occurred on items where selection of the outcome photograph could not be made on the basis of perceptual or locational information at the end of the video scene, but relied instead on an understanding of cause and effect. For example, his errors in the reversible possession change scenes both occurred on *sending* events, where the final scene in the video clip shows one person posting a letter, while the target outcome photograph shows another person, who had not been present in the video scene, reading the letter. His errors on the two person action scenes occurred on *hitting* events and *shooting* events, where once again the outcome photographs did not correspond perceptually to the end of the video scene. This can explain why DA made role errors despite his focus on the end state subcomponent of video scenes in the event drawing task. Unlike BP and DN above, DA had given no indication that he had appreciated the process leading up to that end state. Rather, he had focused purely on the locational positions of the entities at the end of the scene.

The presence of event errors is consistent with a problem identifying the action taking place in the scene (see PZ, Section 6.2 A above). Further evidence of this problem comes from DA's performance on the Event Perception Test (EPT). His score of 43/60 was significantly lower than the expected score of 57 (Fisher exact: $p < 0.005$). He made only one gross error compared with 15 semantic errors, 10 of which were close semantic. The predominance of semantic errors suggests that DA has difficulty retrieving and/or analysing the full semantic information from pictures of events (Marshall et al 1999). This information prevents him from differentiating between similar events, and from categorising visual scenes as exemplars of a particular event type.

In summary, DA's performance in the event drawing task suggests that adopts a narrow temporal perspective on the events he sees, focusing on the end state, rather than the act or process that led up to that state. Thus he fails to identify the roles of the individual entities as participants in an event and fails to attend to the causal or temporal structure of visual scenes. These problems with event conceptualisation have significant effects on DA's ability to communicate these events effectively to others via drawing and may also contribute to his problems in linguistic communication of events. This will be discussed further in Section C.

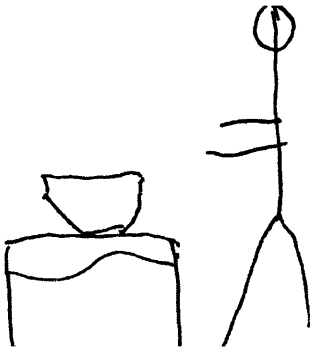
B. Processing of linguistically encoded events

i) Evidence from verbal condition of event drawing task.

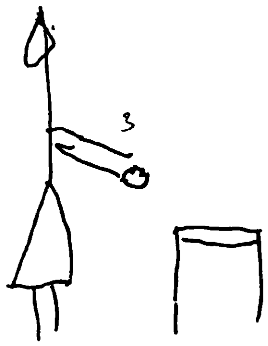
DA's performance on this task indicates significant problems with processing sentences that describe caused change of location events. Several aspects of his performance suggest that he may have difficulty storing and maintaining the incoming linguistic information whilst engaging in further processing and producing graphic output. He required a total of 87 repetitions, which is significantly higher than in the visual condition (χ^2= 16.53, df 1, p < .0001), and far outside the control range of 0 – 3 (control mean = 0.417, S.D. 0,87). Requests for repetition occurred equally across position change and possession change events (Analysis 1). DA also made several errors involving the omission and/or substitution of one of the entities, suggesting a failure to retain or process the individual noun phrases in the sentence. Some of his errors were hard to classify. In Drawing 6T (a) and (b), for example (see over), it is difficult to tell whether he has omitted one of the entities (the flower in drawing (a) and the bowl in drawing (b)), or whether his errors involve substitutions of noun phrases. Examples (c) and (d) are more readily identifiable as substitution errors. As for DN above, these errors might be attributable to a semantic deficit, since DA showed some problems with interpreting single noun semantics as shown by his score of 30/40 in the PALPA 47 (see Chapter 4, Section 4.2.6).

Drawing 6T
Examples of substitution errors in DA's drawings in the verbal condition indicating problems with processing the individual noun phrases

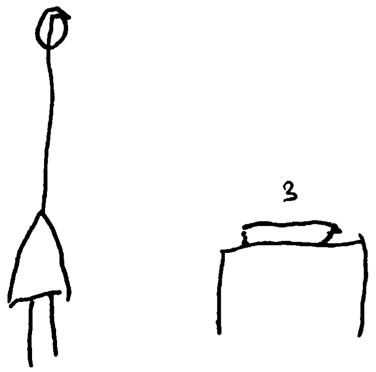
a) Bill picks the flower from the vase



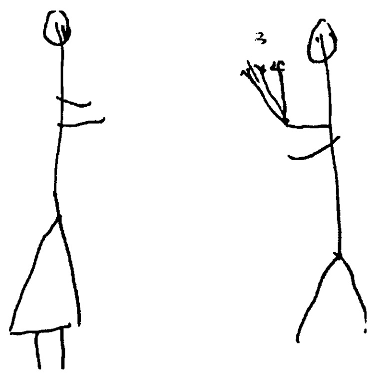
b) Mary takes the apple out of the bowl



c) Mary grabs the cushion off the chair

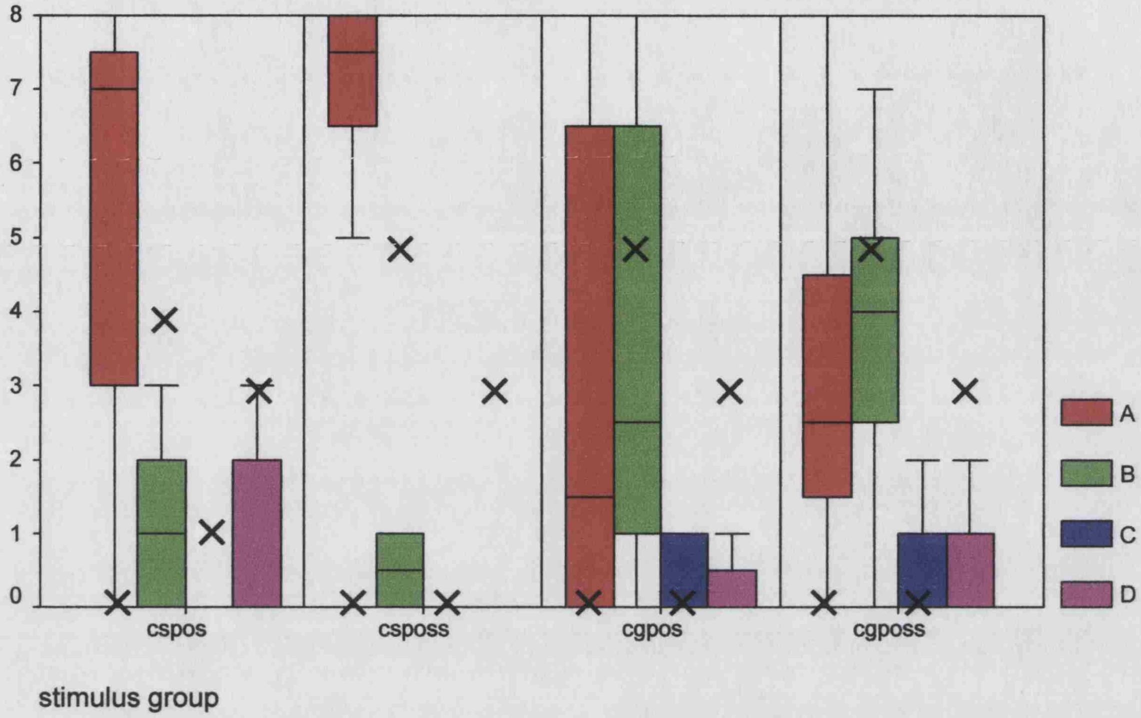


d) Bill takes the box from Mary



In addition to problems processing the individual noun phrases, the temporal order in which DA drew the entities also suggests that he fails to interpret their thematic roles. Unlike the control participants, he did not consistently foreground the Cause entity in either position change or possession change events (Analysis 6). He produced roughly equal numbers of Cause-first (Type B) and Source/Goal-first (Type D) responses in all stimulus groups (see Figure 6.6.4). As discussed in Chapter 5 (Section 5.4), failure to consistently foreground the Cause entity in both position change and possession change events in the verbal condition could be indicative of a problem with interpreting the thematic structure of the event described. It suggests that the role of Cause/Actor has not been assigned to the prominent sentence-initial noun phrase, either on the basis of general mapping procedures or by access to the meaning of the verb.

Figure 6.6.4.
DA Verbal condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by DA (X) in the verbal condition stimulus groups compared with control median and range.

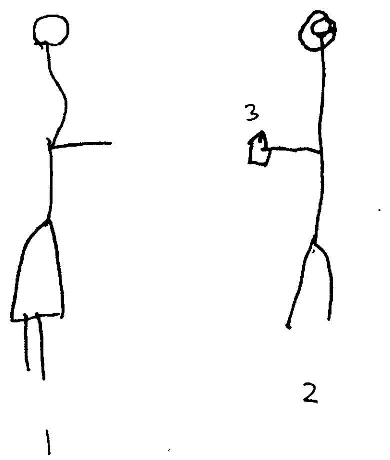


An alternative explanation for DA's failure to consistently foreground the Cause entity might be a problem with retaining the order of the noun phrases in the sentence. However, this interpretation cannot explain why all of DA's Source/Goal first responses occurred on stimuli in which *Bill* had the role of Cause. A problem confined to retaining the order of the noun phrases would predict equal difficulty with sentences like *"Mary grabs the ball from Bill"* and *"Bill grabs the ball from Mary".*

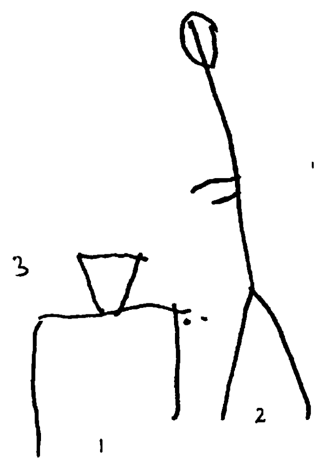
The reason for this becomes clear from a post-hoc analysis of DA's drawings, which revealed that his foregrounding choices were influenced neither by the roles of the noun phrases nor the order in which they occurred in the sentences. Rather, they were influenced almost exclusively by perceptual and graphic factors, namely the spatial positions of entities in the investigator's model during the explanation of the task, in interaction with the graphic output constraint of "start drawing on left of page". In the investigator's model, the entity corresponding to "*Mary*" occurred on the left of the page, while "*Bill*" occurred on the right. Although this model was removed from sight before the start of the task, DA nevertheless appeared to base his drawings on it. He always drew the entity representing *Mary* on the left of the page and the entity representing *Bill* on the right of the page, in both position change and possession change events. The graphic constraint of "start drawing on the left of the page" resulted in his drawing *Mary* first and *Bill* second regardless of their role in the event or the order of the corresponding noun phrases in the sentence. This can be seen in the examples in Drawing 6U below. In example (a) he drew *Mary* first and on the left, even though she does not have the role of Cause and the corresponding noun phrase occurs at the end of the sentence. In example (b) he drew the table first and on the left, followed by *Bill* on the right, despite *Bill* having the role of Cause and appearing in sentence-initial position.

Drawing 6U.
Examples showing DA's consistent positioning of Mary on the left of the page and Bill on the right. (Numbers added by the investigator to indicate the order in which the entities were drawn.)

a) Bill grabs the ball from Mary



b) Bill lifts the box off the table

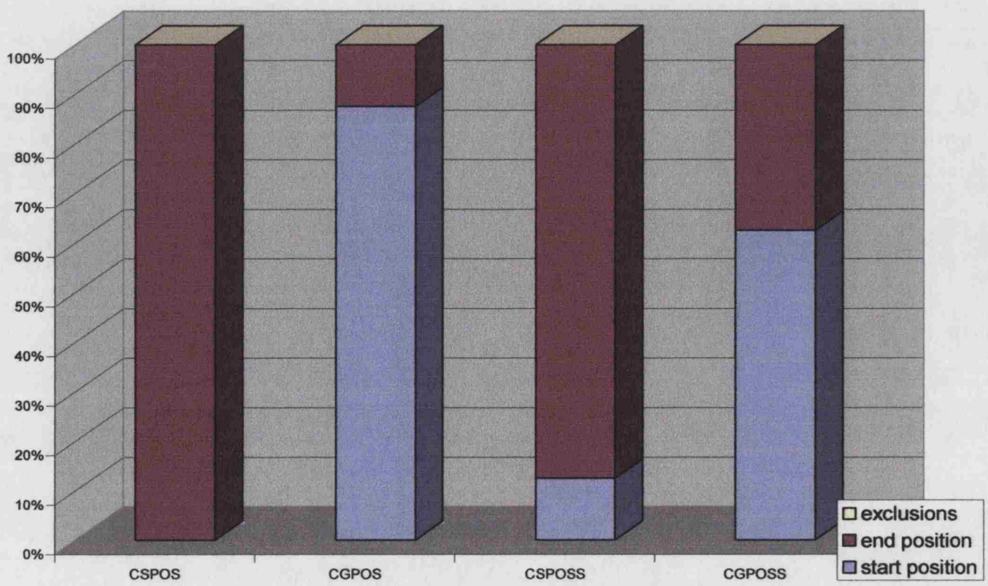


Thus the only source of linguistic information that appears to affect DA's drawing performance is the meaning of the individual noun phrases. This suggests that he does not process the syntactic structure of the sentence nor its meaning, indicating a failure to access the verb's subcategorisation frame and its semantic representation, including thematic information.

Several other aspects of DA's performance on the event drawing task indicate a problem with accessing the meaning of the verb and the thematic structure of the sentence. Firstly, unlike control participants, he did not use any graphic strategies such as arrows or double-Theme to indicate the initiating action or the Theme's movement and direction (Analysis 3). Secondly, DA almost always drew the Theme last (response Types B & D, Figure 6.6.4). As discussed for DN above, drawing both the other entities before the Theme suggests that he may treat them both as reference objects against which to ground the Theme. This indicates that he has some understanding that the noun phrases in the sentence are related, but he appears to interpret this relationship as a static spatial one, rather than a causal or temporal one.

Thirdly, DA did not show any consistency in the location of the Theme in his drawings (Analysis 5), suggesting a problem with interpreting directional information implicit in verb and prepositional meaning (see PZ and DN above). DA was significantly more likely to draw the Theme at its start position in *take/pick*-type events and at its end position in *give/put*-type events, in both position change and possession change events ($\chi^2 = 12.96$, $p < .0001$) (see Figure 6.6.5 overleaf). This suggests that he located the Theme with the entity that corresponds to the final noun phrase in the sentence, regardless of its directional role.

Figure 6.6.5.
Location of Theme in DA's drawings in the verbal condition



Finally, DA did not indicate appreciation of specific differences implicit in the verb's meaning. For example, unlike control participants, he did not include a symbol for money in his drawings of *buy/sell* events. This mirrors his performance in the visual condition of the task, where a problem with interpreting specific features of events was hypothesized.

As with DN above, the hypothesised sentence processing deficit in DA's case is a failure to build up the semantic structure of the sentence, either on basis of general procedures or by access to verb meaning, including thematic role information. Although he appears to have some understanding of the meanings of the individual noun phrases, he shows no ability to integrate this with syntactic structure or thematic information.

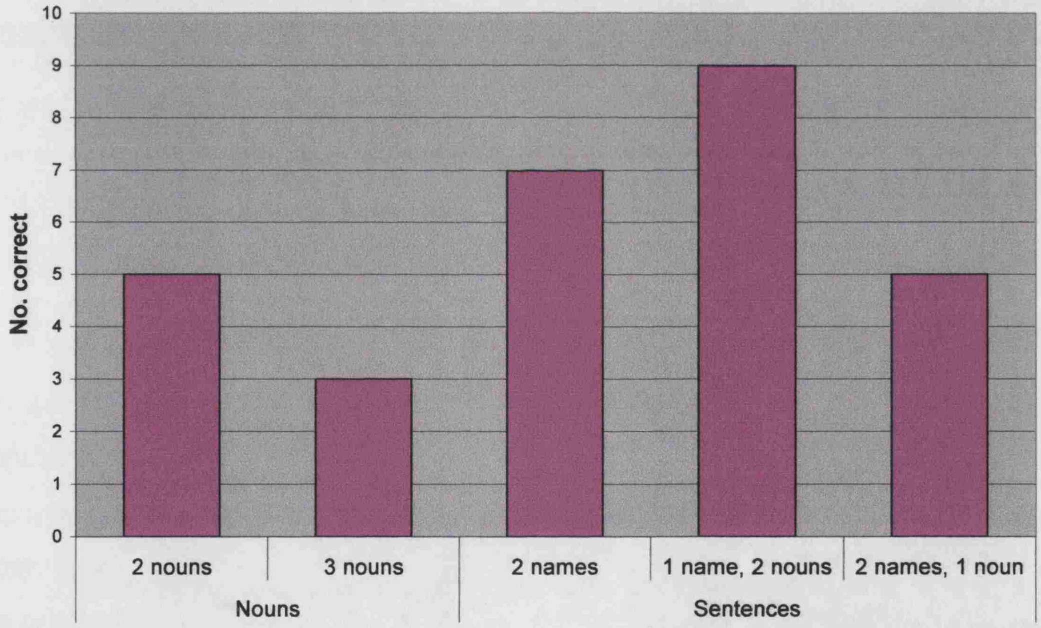
ii. Evidence from other language assessments

DA's performance in the Noun Pointing task (NPT) argues against a problem with retaining noun order as a source of DA's difficulties with processing sentences. His ability to retain nouns and their order was, in fact, aided by their inclusion in a sentence. His performance on the sentences was significantly better than on the noun lists, even when the sentences required more words to be remembered (Fisher exact, $p < .05$). His scores on the different levels of the task are shown in Figure 6.6.6 (overleaf). Scores were comparable to those of controls both on the two-name sentences and on the sentences including one proper name and two nouns. This indicates that the DA may be sensitive to the syntactic structure of sentences, but does not imply that he has understood their meaning.

DA's performance dropped on sentences involving two proper names and one noun. All DA's errors on this set occurred on sentences containing a complement as the final prepositional phrase, e.g. *John sent a flower to Mary,* as opposed to sentences where the final prepositional phrase is an adjunct, e.g. *John hit Bill with a bat.* Complement and adjunct phrases make a different semantic contribution to the sentence. Complement phrases are semantically bound to the verb and express core participants in the event. Adjunct phrases, on the other hand, add further details about the situation, in this case by specifying the instrument, but they are not participants in the event. The 'complement sentences' are similar in terms of argument structure to the possession change sentences in the event drawing task, i.e. they involve the thematic roles of Actor, Theme, Goal. DA's errors on these sentences in the NPT all involved the transposition of the final two nouns, confirming that he can retain at least the first-heard noun even in these sentences. His failure to consistently foreground the Cause entity in the equivalent sentences in the event drawing task cannot therefore be attributed to a problem remembering the content of the corresponding sentence-initial noun phrase. This supports the hypothesis that his failure to foreground the Cause in the verbal condition of the event drawing task is related to a problem in interpreting thematic role information in the sentences.

Figure 6.6.6

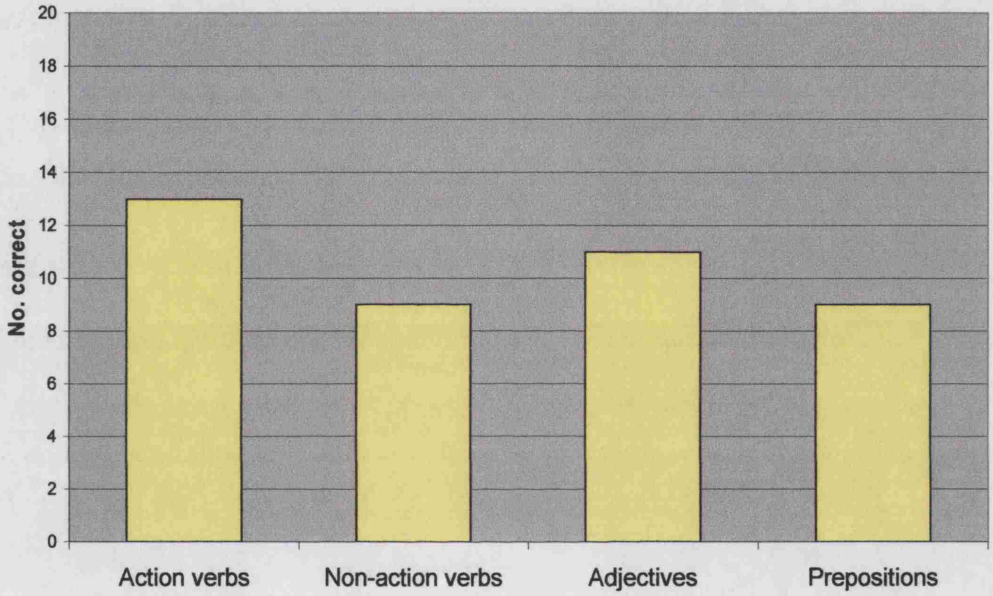
DA: Scores on each level of Noun Pointing Task



Additional evidence in support of a problem with interpreting thematic information in sentences comes from DA's poor performance on the RSCT. Intact processing of these sentences cannot be achieved solely on the basis of the meaning of the noun phrases and their order, but also requires the ability to assign thematic roles to the noun phrases in the sentence. DA's performance suggests that he was unable to do this, either on the basis of general mapping principles, or by accessing the meaning of the verbs and predicates. He scored only 42/80 and his scores were at chance on all the sentence sets, including the action verbs set (Figure 6.6.7). He made slightly more incongruous errors than congruous on all sentence sets. DA may have been further disadvantaged on the RSCT due to the interaction between his problems with processing visual events, identified in the visual condition of the event drawing task, and his linguistic processing difficulties.

Figure 6.6.7

DA: scores on each sentence set on RSCT



A similar interaction could account for DA's performance on the Perspective Video, which also involves conceptual processing of visual events and access to verb meanings. Although his score of 14/18 was not significantly worse than controls, his four errors were all perspective errors. As discussed for JT above, a predominance of perspective errors is consistent with a problem identifying the perspective of visual events, or a problem with interpreting perspective information in the meaning of the verb, or a combination of these problems. The final interpretation is most likely in DA's case and provides further support for a problem accessing specific aspects of verb meanings.

In summary, DA's performances on these language assessments confirm that his problems with sentence processing occur primarily at the semantic level and in integrating syntactic and semantic information.

C. Summary and interpretation of DA's performance

DA's performance on the event drawing task points to significant problems with processing the structure of events from both visual and linguistic input. In both conditions, DA showed a reliance on perceptual and graphic constraints in determining his approach to the task and there were indications that he had failed to process the stimuli as depicting or describing events. In the visual condition, he focused on the end state subcomponent of the scenes, with no indication that he had processed the act or process leading up to that state. In the verbal condition, likewise, DA's drawings resembled locational states and indicated no appreciation of the semantic structure of the sentences or the meaning of the verb. Similarities in performance across the two conditions suggest that DA's problems with communicating about events are not restricted to the linguistic modality. This therefore argues for a problem at the conceptual preparation level, which affects the schematization of events for the purpose of communication in general, suggesting that these problems might underlie DA's linguistic output difficulties, at least in part.

DA's reliance on perceptual and graphic constraints in both the visual and the verbal conditions also suggests an interaction between his language impairments and his event conceptualisation difficulties, due to the reduced availability of linguistic sources of constraint. Even in the verbal condition, DA made little use of linguistic sources of information, other than the meanings of the individual noun phrases, confirming his severely reduced access to linguistic meaning as a constraint on event conceptualisation.

6.7 JIK

A. Processing of visual events

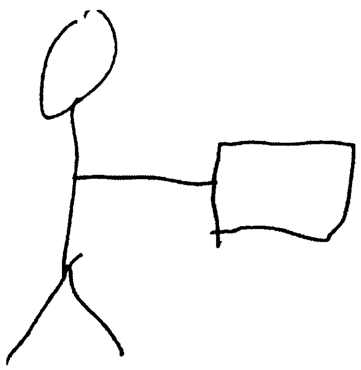
i) Performance on visual condition of event drawing task

JIK's performance on this task was similar to that of DA (section 6.6) in many respects, and a similar interpretation is put forward, i.e. that he fails to process the causal and temporal structure of the scenes, focusing instead on the end state. JIK required a total of 48 repetitions over the whole task, which is much higher than the control range of 2 -10 and more than two standard deviations above the control mean (control mean = 4.917, S.D. = 2.59) (Analysis 1). Requests for repetition occurred equally across position change and possession change events. This suggests that JIK has difficulty storing or maintaining the incoming visual information in visual memory whilst engaging in further processing and producing the graphic output.

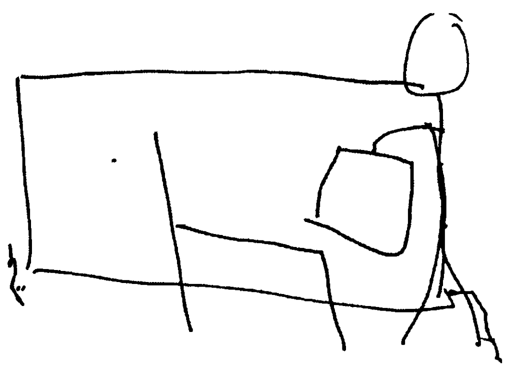
Like DA, JIK also had some difficulty identifying the relevant participants in the events. On three occasions, he omitted the Source from his drawing (see Drawing 6V a), and on two occasions he included a background item which had not been part of the event (Drawing 6V b) (Analysis 2). This indicates a failure to appreciate the event that relates the entities in the scene to one another.

Drawing 6V:
Examples of omissions and addition of entities in JIK's drawings in the visual condition, indicating a failure to identify the relevant participant entities

a) boy lifts box off table

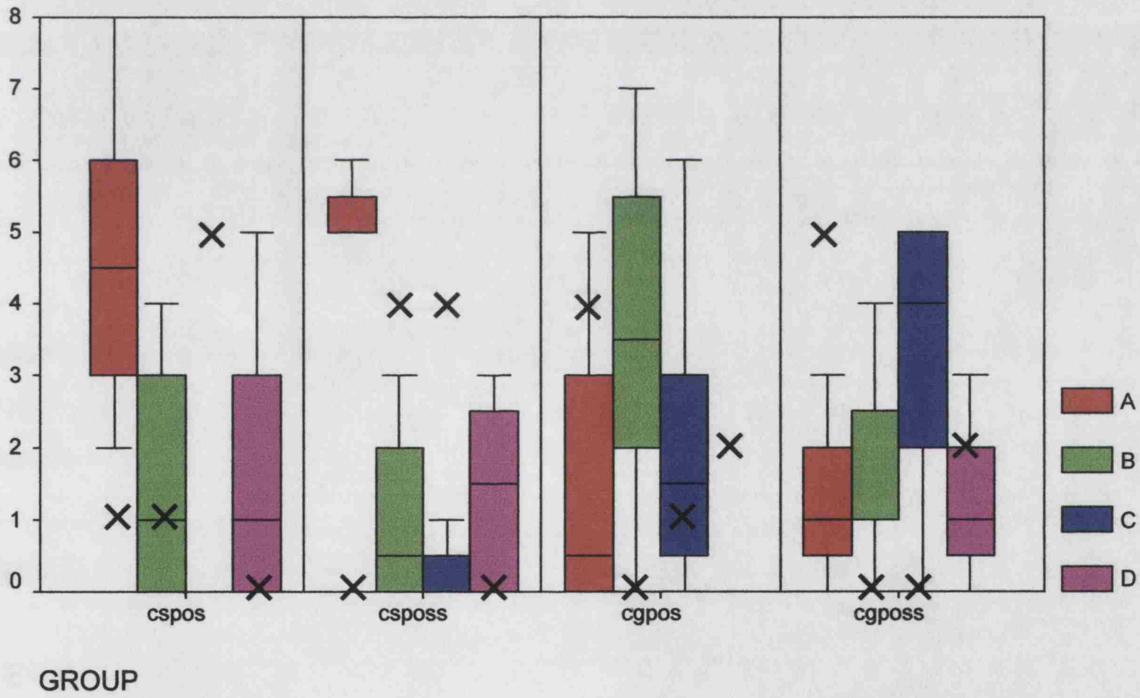


b) boy picks case off chair



JIK's drawing performance gave no indication that he had processed the causal or temporal structure of the events. He did not consistently foreground the Cause entity in his drawings, in either position change or possession change events (Analysis 6), suggesting that he fails to attend to its role as initiator of the event. His foregrounding choices differed from those of controls in all stimulus groups (see Figure 6.7.1) and suggested a reliance on perceptual factors, namely the interaction of screen position and end position of the Theme. He was significantly more likely to draw the entity on the left of the screen first (χ^2 = 12.07, df 1, p = .001) and he was significantly more likely to draw the entity corresponding to the end position of the Theme first (χ^2 = 4.74, df 1, p < .05).

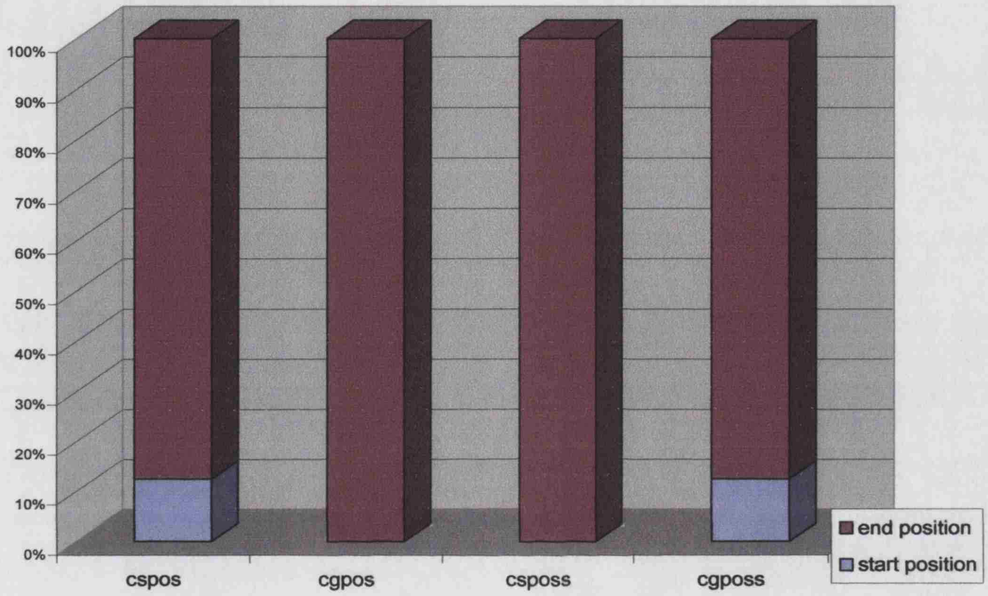
Figure 6.7.1
JIK Visual condition: Performance on Analysis 6, temporal order of drawing. Graph showing the number of each response type produced by JIK (X) in the visual condition stimulus groups compared with control median and range.



JIK's performance also provided no evidence that he had processed the temporal structure of the scenes. Firstly, he did not use any arrows or other graphic strategies to indicate action, movement or direction (Analysis 3). Secondly, like DA above, he consistently located the Theme at its end position in the scenes, both in position change and possession change events (see

Figure 6.7.2) (Analysis 5). This indicates a focus on the end-state subcomponent of the event, with nothing to mark out the initiating act or process leading up to that state. Whilst this performance indicates he has some appreciation of locational relations between the entities the end of the scenes, it does not of itself imply intact processing of directional information, since this is contingent on being able to process temporal structure.

Figure 6.7.2.
JIK: Position of Theme in visual condition



Failure to process the causal and temporal structure of the events implies a problem with processing the roles of the participants and with identifying the specific action involved. This is supported by JIK's failure to include a symbol for money in his drawings of *buy/sell* events, suggesting that he had not appreciated or indicated the specific transaction involved.

ii) Evidence from non-linguistic event processing assessments

A problem with identifying the specific action in visual scenes is confirmed by JIK's performance on the Event Perception test. His score of 41/60 was significantly worse than that of controls (Fisher exact, $p < .0005$). All of his errors were semantic errors: 12 close semantic and 7 distant semantic. This error pattern suggests that he has problems with analyzing specific semantic features of the pictured scene that would enable it to be categorized as an example of a particular event type. These features include information relating to aspects of the event such as manner or direction.

However, JIK's good performance on the Role Video appears to contradict the hypothesis that he has problems interpreting the roles of participants in visual events, in particular the role of the Cause. His score of 28/32 was within the normal range on this version of the test. However, all his errors were role errors and they occurred on reversible scenes in which the outcome photograph did not match the scene at the end of the video clip, and could not be selected on the basis of locational information. Thus, as discussed for DA above, JIK may have been basing his selection of outcome photograph on the locational information at the end of the video scene, which is consistent with his focus on the end state subcomponent of the events in the visual condition of the event drawing task.

In summary, JIK's performance in the visual condition of the event drawing task suggests that, like DA above, he adopts a narrow temporal perspective on events, focusing on the end state, rather than the act or process leading up to that state. This suggests that he has severe problems in schematizing events for the purpose of communication, since he fails to process many communicatively-relevant aspects of the events, even when no linguistic communication is involved.

B. Processing of linguistically encoded events

i) Evidence from verbal condition of event drawing task

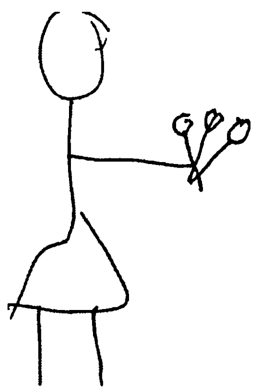
JIK's performance on this task indicates severe difficulty with understanding events that are described in language. Even over two sessions, he only managed to complete half of the task (16 items in total). As with BP above, his difficulties with the verbal condition cannot be attributed to problems with producing the drawings, since similar events and entities were used in the visual condition, which he completed in just one session.

JIK had significant problems maintaining the incoming information in working memory whilst engaging in further processing and production of graphic output. He required a total of 41 repetitions on the 16 items he attempted, which is significantly higher than the control mean for the whole test (control mean = 0.417, S.D. = 0.87). Requests for repetition occurred equally across position change and possession change sentences (Analysis 1). JIK also had difficulty retaining or processing the noun phrases in the sentences, as shown by the high number of omission and substitution errors in his drawings. He included all three entities in only three of his sixteen drawings. He omitted the Cause twice (Drawing 6W a), and the Source/Goal eleven times (Drawing 6W b) & c). He drew the wrong Theme 5 times (Drawing 6W c) and the wrong Cause twice.

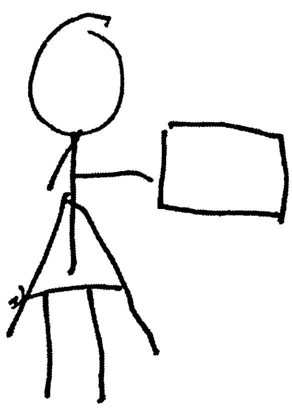
Drawing 6W.
Examples of omission and substitution errors in JIK's drawings in the verbal condition indicating failure to process the individual noun phrases.

a) Omission of Cause:
{Mary} puts the book on the table

b) Omission of Goal:
Mary gives the flower to {Bill}



b) Omission of Source, wrong Theme:
Mary takes the apple out of {the bowl}



Frequent omission of the Source/Goal entity suggests that JIK may have particular difficulty processing or retaining the end of the sentence, since this entity corresponds with the noun phrase that occurs in sentence-final position. This would prevent him from building up the syntactic structure of the sentence, and also from appreciating the semantic structure of the event. This is supported by evidence from other aspects of JIK's performance which provides no indication that he has interpreted the meaning of the sentence, including thematic information.

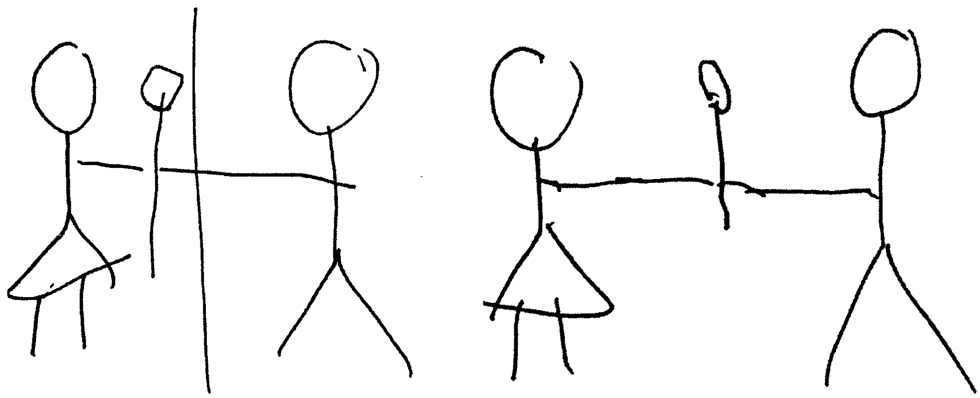
Firstly, although he generally followed the order of the initial two noun phrases in his drawings, in that he drew the Cause first and the Theme second (11/16 times, Analysis 6), his approach to the task indicated that he was not processing the roles of these noun phrases or the relationship between them. Rather he appeared to treat the input stimulus simply as a series of independent nouns phrases, and seemed unaware that an event had been described. On first hearing the sentence, he usually responded by drawing the entity that corresponded to the first noun phrase. He then requested a repetition before drawing the Theme, and a further repetition on the three occasions in which all three entities were included.

Furthermore, like DA above, JIK appeared to be influenced by the investigator's explanatory model, although this had been removed from sight prior to the start of the task. This was particularly apparent on the three drawings where he did include the three main entities, all of them possession change events. In these drawings JIK always drew *Mary* on the left of the page, represented the Theme as a flower and sometimes even added a line through the middle of the drawings which had been present in the model (see Drawing 6X overleaf). This reliance on perceptual information in the verbal condition indicates that linguistic sources of information are reduced. JIK fails to interpret the meaning of the sentence or the causal and directional roles of the noun phrases implicit in the semantic representation of the verb.

Drawing 6X.
Example of JIK's copy of investigator's model drawing in response to sentences describing possession change events

a) Bill passes the box to Mary

b) Mary sells the book to Bill



As in the visual condition, JIK's drawing resembled locational *holding* states rather than events, with nothing to mark out the Cause entity as agentive or to indicate the movement of the Theme. He made no use of any graphic strategies, such as arrows or double-Theme (Analysis 3). Although he generally located the Theme with the Cause entity, there was no indication that he had interpreted the initiating or directional role of the corresponding noun phrase. Rather, JIK may simply have been treating the Cause as a spatial reference object for the Theme, on the basis of real world knowledge and graphic constraints.

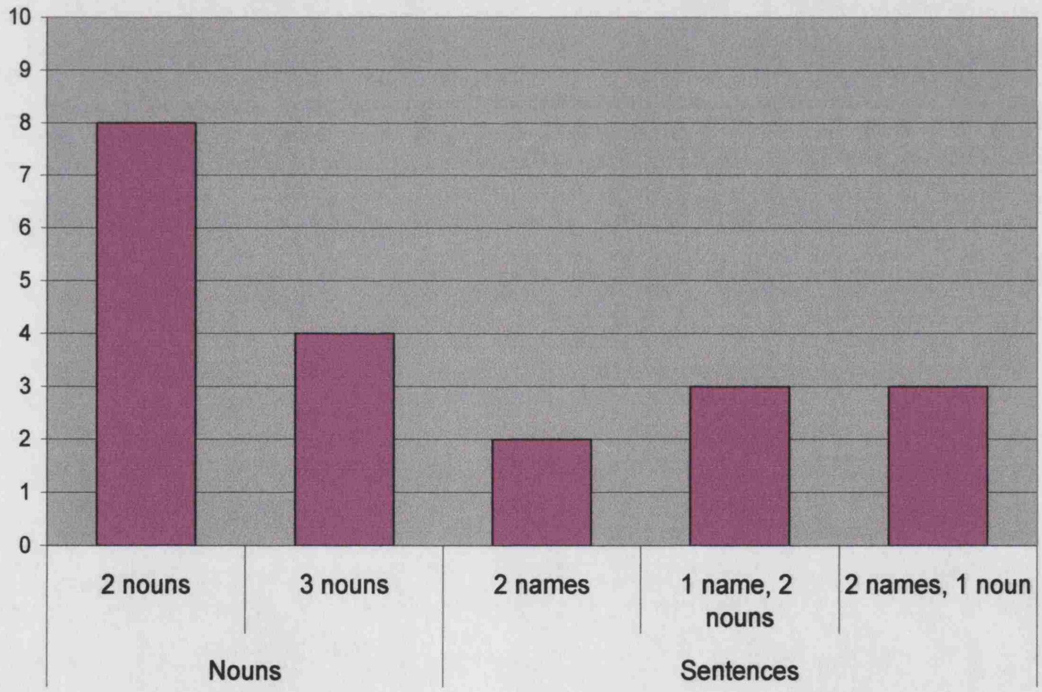
In summary, JIK's performance in the verbal condition of the event drawing task indicates a failure to build up the syntactic and semantic structure of the sentences. He shows little appreciation that the sentences describe an event, basing his drawings on the meanings of the initial two noun phrases and perceptual and graphic constraints. He fails to access any information from the verb, either its subcategorisation frame or its semantic representation. He also fails to process the end of the sentence.

ii) Evidence from other language assessments.

Problems with retaining noun phrases, particularly those at the ends of sentences, are confirmed by JIK's performance on the Noun pointing task. His total score of 20/50 was significantly lower than that of controls (Fisher exact test $p < 0.0001$). Figure 6.7.3 shows a breakdown of his scores on the different levels of the task. His score was comparable with controls only in the two-noun lists. His performance dropped when the number of nouns was increased to three, suggesting difficulty retaining more than two nouns in auditory memory even when they do not occur within a sentence. However, his performance on sentences was significantly worse than on noun-lists (Fisher exact, $p < .005$), confirming that he is not helped by the structure or meanings of the sentences.

Figure 6.7.3.

JIK: Scores on each level of Noun Pointing Task



JIK made both lexical and sequencing errors on all levels of the task, confirming that he has difficulty retaining the nouns themselves, not just the order in which they occurred. However, sequencing errors significantly outnumbered lexical errors in the sentences ($\chi^2 = 10.4$, $p = .005$), which suggests that including the words in a sentence frame may have a detrimental effect on his ability to retain their order. The majority of his errors on the three noun lists and three noun sentences occurred on the final two nouns (18/22 times), while his ability to retain the first noun was relatively intact (26/30 times). This confirms his difficulty with processing and retaining the ends of sentences, which was evident in his event drawing performance.

Failure to maintain the linear order of the noun phrases in a sentence would predict difficulties in all sentence sets in the Reversible Sentences Comprehension Test, since noun order is one of the main clues to thematic information in reversible sentences. However, JIK's poor performance on this test suggests that this is not the only source of deficit here, and argues for an additional problem with interpreting the semantic information from the sentences and/or matching this to the information from the pictures. He was unable to complete the singles version of the RSCT, requesting that the test be terminated after only 20 items from a possible 80. On these 20 items, his score was at chance (10/20) and he made errors on all the sentence types. On several occasions he indicated that he was simply guessing the response.

JIK agreed to be further tested on the "Who is...?" version of the RSCT[19] where the position of only one noun phrase must be remembered. There was no improvement in JIK's performance on this version. He scored only 3/10 on the action verbs, and only 2/10 on the non-action verbs. Poor performance on the action verbs set in particular confirms that JIK is unable to interpret thematic information in sentences, either by applying general mapping procedures or by accessing the meaning of the verb.

An additional source of difficulty for JIK on the RSCT could be related to his problems with visual event processing, as demonstrated by his performance in the visual condition of the event drawing task. He may not have been able to process the particular action or event occurring in the pictures. Thus his problems with this test could be exacerbated due to the interaction between his visual event conceptualisation difficulties and his language processing problems.

[19] See Section 6.1 of this chapter for description of the "Who is ...?" version of the RSCT

A similar effect is apparent in his performance on the Perspective Video, where his difficulty accessing the meanings of verbs interacts with his problems with processing visual events. He scored only 10/18 on this task, which was significantly worse than controls (Fisher exact, $p < .005$). He made five perspective errors, and three distractor errors, two of which occurred on unbiased scenes. The presence of both perspective and distractor errors indicates that his problems are not restricted to interpreting perspective information in either visual events or verb meanings, but also include other aspects of meaning (see PZ above). JIK's poor performance on the Perspective Video cannot be accounted for by difficulties with syntactic processing or auditory memory, since it involves only a single written verb label.

In summary, JIK's performances on the other language assessments confirm that his problems with sentence processing are the result of a combination of syntactic level and semantic level deficits.

C. Summary and interpretation of JIK's performance

As with DN and DA above (Sections 6.5 and 6.6), JIK's complete absence of linguistic output had hitherto effectively prevented a detailed examination of his ability to process events specifically for the purpose of communication. The evidence from the event drawing task confirmed a significant problem with several aspects of event conceptualisation that are crucial to their communication in both non-linguistic and linguistic output modalities.

Comparison across the visual and verbal conditions indicates that JIK's output difficulties are not restricted to linguistic communication, since he showed a similar pattern of deficit when no linguistic processing was required, i.e. in the visual condition. This argues strongly for an underlying problem at the conceptual preparation level which may also contribute to his problems in describing events linguistically. In both the visual and verbal conditions, his drawing performance suggested that he had failed to interpret the stimulus as an event. He failed to process the causal and temporal structure of the visual scenes, which undermined his ability to process other communicatively relevant aspects such as the nature of the action, the direction of movement and the roles of the participant entities. In the verbal condition, he failed to process any aspects of the sentence other than the meanings of the individual noun phrases. Thus he failed to build up the semantic structure of the event being described.

Similarities across the two conditions suggest an interaction between JIK's event conceptualisation problems and his language impairments. Like DA above, he relied on perceptual information exclusively in the visual condition, i.e. the locational information at the end of the scene. In the verbal condition also, he relied to some extent on perceptual information from the investigator's model to guide his drawing performance. This suggests that linguistic sources of information are not available to JIK as a means of constraint, either in interpretation of sentence meaning or in directing attention to relevant features in a visual event.

The interaction between JIK's problems with visual event processing and his severe linguistic impairments also disadvantages JIK on assessments that require concurrent analysis or comparison between visual and linguistic input, as shown by his failure to complete any assessments that required sentence to picture matching, e.g. the RSCT and the TROG. The verbal condition of the event drawing task does not require concurrent processing of visual and verbal stimuli, but it does require the ability to form a conceptual representation of a linguistically described event and to 'translate' this into a visual representation. This might explain why JIK had such difficulty with the verbal condition of the task.

A failure to understand the task instructions can be rejected as possible source of JIK's severe difficulty with the verbal condition of the event drawing task. The investigator's spoken explanation was accompanied by non-verbal information and modelling of the task and JIK had successfully understood similar instructions when completing the visual condition some two weeks previously.

Chapter 7
SUMMARY AND GENERAL DISCUSSION

The research presented in this thesis revealed a number of findings that can contribute to our understanding of the relationship between event conceptualisation and language impairment in severe aphasia. This chapter will summarise the main findings of the individual performances on the event drawing task and draw comparisons between the participants. The first part (Section 7.1) will focus on the theoretical implications of the findings, with particular reference to the claims and questions raised in the literature review in Chapters 2 and 3. This will be followed by a discussion of the clinical implications of the findings with respect to both assessment and remediation (Section 7.2). Finally, implications for future research will be considered.

7.1 Event conceptualisation and language impairment

The results of the current investigation provide additional information about a level of processing that is evident in several models of language production (Garrett 1980, 1992; Levelt 1989; Levelt et al 1999), but has received relatively less attention in the aphasia literature (Dean & Black, in press). As discussed in Chapters 1 and 2, event conceptualisation for the purpose of communication involves processes of “thinking for communication”, which operate at the conceptual preparation level of message construction. It was hypothesised that difficulties at the conceptual preparation level reflect problems with ‘paring down’ complex conceptual information into a schematic structure suitable for communication. Certain aspects of events were identified in Chapter 2 as relevant to their communication irrespective of output modality. These aspects relate to the structure of the events, for example the roles of the participant entities and the temporal and causal relations between them. A problem related to schematisation would be likely to affect these aspects of event conceptualisation and their communication in both linguistic and non-linguistic communication of events.

Other aspects of events can be identified from observation of the event without needing access to the relations between the participant entities, for example specific action-related features that would allow one to distinguish between similar events such as *throw* and *drop.* These aspects of events were hypothesised to be particularly relevant to linguistic communication, since they determine selection of a verb label. However, the absence of a graphic equivalent to a verb label may make these aspects of events less relevant to graphic communication.

In other words, a similar, though not identical, conceptual preparation level is thought to underpin "thinking for speaking" and "thinking for drawing" (Lyon 1995; Loncke et al 1996). Many aspects of event conceptualisation for communication may be common to both these modalities, and indeed to communication in general, but particular aspects may be "language-specific".

The evidence from the event drawing task provides support for this hypothesis, since all the participants with aphasia, bar two, showed problems with the graphic communication of events in the visual condition of the event drawing task. Thus, even when no language is involved, these five individuals demonstrated difficulties with processing certain communicatively-relevant aspects of events, suggesting problems with the schematisation of events for the purpose of communication in general. This finding therefore provides strong support for the claim made by previous researchers that event conceptualisation problems can underlie some aphasic individuals' difficulties with communicating about events, both linguistically and non-linguistically (Marshall et al 1993, 1999; Dipper 1999; Black & Chiat 2000; Dipper et al 2005).

The current study both supports and extends the findings of previous research in this area. Detailed, theoretically motivated analysis of the graphic communication of events by both control participants and the individuals with aphasia provided additional information about the specific processes involved in 'paring down' complex perceptual and conceptual information into a form suitable for communication. It also provided hitherto unavailable information about the effects of impaired event conceptualisation on message construction and communication. This is particularly relevant in view of the paucity, and in some cases, total absence of linguistic output of these seven individuals, which provides few, or no clues to their underlying abilities in this area of processing. Comparisons between participants and across modalities highlight a number of associations and dissociations in performance, which have several implications.

Firstly, they provide support for the suggestion that that event conceptualisation for communication should not be considered as unitary. Rather, it is internally complex and requires the ability to process a number of different aspects of events, which may be multiply or differentially impaired in aphasia (Marshall et al 1993; Dipper 1999; Dean & Black, in press). The event drawing task provided detailed information about specific aspects of intact and impaired event conceptualisation for each individual. The results of the visual condition, in particular, indicated that participants' performance varied in a principled way across the different aspects of processing targeted by the different analyses. This will be discussed further in section 7.1.1 below.

Secondly, comparisons between and within participants across the two modalities provide some evidence in support of a reciprocal relationship between event conceptualisation problems and language impairment. The suggestion here is that reduced access to the meanings and forms available in one's language might affect the process of conceptual preparation itself, by reducing the influence of linguistically-mediated constraints on attention (Black & Chiat 2000; Dipper et al 2005). The current findings indicate a correlation between the nature and extent of individuals' language impairments and their ability to conceptualise events from visual stimuli. Specifically, there appeared to be an increased reliance on perceptual aspects of the stimuli when language is least available as a source of constraint on attention. This will be discussed further in section 7.1.2.

Finally, dissociations between participants provide further evidence that similar surface symptoms can have different underlying causes (Byng et al 1994; Berndt, Mitchum & Haendiges 1996; Berndt et al 1997b; Black & Chiat 2003b). The participants were selected primarily on the basis of similarities in their linguistic output (i.e. severely restricted linguistic output, with limited verb and sentence production). They also all showed difficulties processing sentences. Variations in performance between participants on the visual and verbal conditions of the event drawing task demonstrated that these broadly similar symptoms could arise from a number of sources. The implications of these findings for sentence processing in particular are discussed in section 7.1.3.

7.1.1 Performance on the visual condition of the event drawing task

The event drawing task analyses provided evidence about individual participants' ability to process a number of different aspects of caused change of location events identified as relevant to their effective communication (see Chapter 2, Section 2.5). This is summarised in Table 7.1 below. A tick indicates evidence from the event drawing task that this aspect of the events had been processed. A cross indicates evidence of failure to process this aspect of the events.

Table 7.1 Summary of individual participants' ability to process different aspects of visually-presented caused change of location events

	JOK	PZ	JT	BP	DN	DA	JIK
1. Identify participant entities	✓	✓	✓	✓	✓	X	X
2. Process causal structure & action-related roles	✓	✓	X	X	X	X	X
3. Process temporal structure i.e. change	✓	✓	✓	✓	✓	X	X
4. Process directionality & directional roles	✓	✓	✓	✓	X	X	X
5. Process perspective information	✓	✓	X	X	X	X	X
6. Process specific action-related features	✓	X	X	X	X	X	X

As discussed in Chapter 2, aspects 1 to 4 in Table 7.1 are hypothesised to be relevant to the communication of events in general. A problem with any or all of these aspects of event processing should therefore result in similar difficulties in communicating effectively about the events in both non-linguistic and linguistic modalities. Aspects 5 and 6 are more specific to the linguistic output modality, and a problem restricted to this aspect of event processing might selectively affect linguistic communication, with fewer consequences on graphic communication. Comparisons between the participants demonstrate that this was indeed the case.

Only two participants, JOK and PZ, were reliably able to process all communication-general aspects of the events. Their performance in the visual condition of the event drawing task was similar to that of control participants in almost all respects. This suggests that their difficulties with communicating about events are specific to the linguistic output modality and are not attributable to a general problem with the schematisation of events for the purpose of communication.

PZ showed evidence of a failure to process specific action-related features of visual events, such as the manner of the action. Whilst this did not significantly affect her drawing performance, it was hypothesised to be a possible underlying source of her language production deficits, in particular her specific and severe verb retrieval deficits, since these features of an event are those that are crucial for verb selection (see Chapter 6, Section 6.2 for detailed discussion of PZ's performance).

In contrast to JOK and PZ, the remaining five participants all showed some difficulty in processing one or more communication-general aspects of the events, which affected their ability to communicate effectively about the events even when no language was involved. This supports an event conceptualisation source of these participants' output deficits, specifically, a problem at the conceptual preparation level of message construction, affecting the schematisation of events for the purpose of communication in general.

Patterns of association and dissociation between these five participants provide more specific information about the extent and nature of their event conceptualisation difficulties, and give some indication of the effects of these difficulties on the communication of events.

Although there was variation amongst these five participants, they were similar in one respect, which differentiated them all from JOK and PZ: they all failed to process the causal structure of the events and the action-related roles of the participant entities. This was hypothesised on the basis of their failure to present the events from the perspective of the Cause entity, even when there were strong conceptual clues to agentivity, as in the position change events. This suggests that they had failed to identify the crucial role of the Cause entity as initiator of the event, which in turn indicates a failure to focus on the initiating act subcomponent of the event, and to integrate this with the subsequent process of change and resultant end state. Thus a problem with processing the causal structure of the events suggests that these participants were not focusing on the same aspects of visual scenes as controls, which is consistent with a hypothesis of impaired event processing (Dean & Black, in press). It also confirms that these participants' problems were related to the 'paring down' or schematisation process required to integrate complex perceptual information into a single 'event schema'. However, variations in the performance of these five participants indicate that the schematisation process itself involves a number of separable aspects of processing, which may interact with one another to affect conceptualisation of the whole event.

The performances of DA and JIK suggest that a failure to process temporal structure may have implications for other aspects of event processing. This is to be expected since the presence of change is what distinguishes events from non-events (Black & Chiat 2003a). Failure to appreciate that a change has taken place in a scene would necessarily imply a problem in recognising that an event has occurred. This would in turn predict problems with identifying the relevant participants, since identifying who or what is involved in an event is clearly contingent on the ability to recognise the situation as an event, rather than a state (Dipper 1999). DA and JIK both had problems with both these aspects of event processing, whilst JT, BP and DN did not.

A problem with temporal structure would also predict problems with appreciating directionality in the scenes. Identifying the beginning and end point of any movement by necessity requires awareness that a change has taken place. DA and JIK's performance confirms that failure to process temporal structure co-occurs with a problem with appreciating directionality. However, DN's performance suggests that these two aspects of event processing can be separately impaired. Although DN was able to appreciate that a change had occurred, he was unable to identify the beginning and end point of that change. This dissociation suggests that, while intact processing of temporal structure may be a necessary condition for intact processing of directionality, it is not a *sufficient* one. The remaining two participants, JT and BP, were able to process both temporal structure and directionality.

Failure to appreciate change in a visual scene also implies a failure to process the action that initiated that change. Thus the ability to process the causal structure of caused change of location events is contingent on the ability to process their temporal structure. DA and JIK had problems with both these aspects of event processing. Their drawings in the visual condition resembled the end state of the scenes, with no indication of the process of change leading up to that state (see Chapter 6, sections 6.6 A and 6.7 A). However, as JT, BP and DN's performance shows, a problem with processing the causal structure of these types of events can occur in the context of intact processing of their temporal structure. These three participants all showed some appreciation that a process of change had taken place, but they failed to focus on the act that triggered this process (see Chapter 6, sections 6.3 A, 6.4 A and 6.5 A). This difference between DA and JIK on the one hand, and JT, BP and DN on the other, indicates that the ability to process causal structure and temporal structure are linked but separable aspects of event processing. Whilst the former is contingent on the latter, the latter does not guarantee or predict the former. This is to be expected, since, although all events involve change, they do not all involve *caused* change.

The performance of the five participants discussed above also suggests that problems in processing communication-general aspects of events may affect the ability to process more language-specific aspects. All five demonstrated problems with processing specific action-related features of the events like the manner of the action. JT and BP's performance, in particular, suggests that even a single difficulty with processing the causal structure of the events can affect these aspects of event processing. This is perhaps unsurprising, since the action in the event drawing task scenes was carried out by the Cause entity, whose role as initiator of the action in the event was not identified by these participants. However, as PZ's performance shows (see above), problems with processing specific action-related features of events can occur in the context of intact processing of other communicatively-relevant aspects of events. This suggests that intact processing of communication-general aspects of events does not guarantee intact ability to process language-specific features, but that these aspects of events can be separably impaired.

The evidence reviewed in this section therefore confirms that event conceptualisation for communication is internally complex, involving a number of separate aspects of event processing. As discussed in Chapter 2, the idea that events are componential and can be parsed into a number of separable aspects is accepted in many theoretical accounts of event conceptualisation and event structure perception (Jackendoff 1983; Talmy 1996, 2000; Zacks & Tversky 2001). Event conceptualisation involves the decomposition and segmentation of perceptual information into parts and re-integration of these parts to form a conceptual whole, referred to in this thesis as schematisation or 'paring down'. When processing an event, a person's attention may be guided by conceptual expectations, prior experience, or perceptual characteristics of the event. Intention to communicate about an event also guides attention to specific communicatively-relevant aspects of the events. The current investigation provides a more detailed specification of these communicatively-relevant aspects of event processing and how they interact with one another and with communication.

The conceptual preparation processes underlying both linguistic and graphic communication remain underspecified in articulated models of communication. For example, Loncke et al (1996) present an elaboration of Levelt's (1993) 'blueprint of the speaker', to incorporate both linguistic and non-linguistic modalities and their interactions. In this model, linguistic and non-linguistic modalities share a common 'conceptualizer' and 'message generator'. Production of a communicative utterance is considered to be driven by "modality-free structuring strategies". However, Loncke et al provide no information about what these strategies may consist of or involve, or how the 'conceptualizer' level interacts with subsequent levels of message formulation.

Dissociations between and within the participants with aphasia on the visual condition of the event drawing task confirm the findings of previous research indicating that different aspects of event processing may be separably or multiply impaired, with different consequences for event communication. The performances of JT, BP, DN, DA and JIK, in particular, provide clear evidence of problems at the conceptual preparation level, involving the schematisation of events for communication along the lines identified in the literature review in Chapter 2. These difficulties were shown to affect graphic communication in similar ways to linguistic communication, e.g. adoption of an unusual focus on the event, failure to communicate the roles of the entities and the causal and/or temporal relations between them.

Thus the event drawing task revealed hitherto unavailable information about a possible additional source of difficulty at the very earliest stages of production for these individuals, i.e. a problem with "thinking for communication", which might also underlie their problems with describing events linguistically, at least in part. This finding highlights the need to consider problems with structuring conceptualisation from visual input as a possible source of production difficulty for some people with severe aphasia. The claim here is not that these individuals have a general event processing problem, as suggested by previous researchers (Marshall et al 1993; Byng et al 1994), since this would predict difficulties with everyday activities, action planning etc, which none of the current participants displayed. Rather, the problem is specific to the conceptualisation of events *for the purpose of communication*, linguistic or otherwise. Neither is it claimed that a problem with event conceptualisation is the only source of language production deficit for these individuals. Problems with other aspects of language production undoubtedly play a contributory role. As JOK's performance showed, these problems can disrupt linguistic communication even if the conceptual preparation level is intact.

A problem related to the graphic output modality itself, i.e. the planning and execution of drawings, can also be ruled out for the participants in the current study. The selection process ensured that they had no problems with visual recognition or with motor execution of drawings, despite using their non-preferred hand. This factor was considered in the design of the study, particularly in regard to the comparison between participants with aphasia and controls. There is some evidence to suggest that the drawing performance of aphasic people and controls is not measurably different in quality or clarity with altered hand use (Rumble & Whurr 1998). Furthermore, since all the participants with aphasia had been using their non-preferred hand for over a year, the evidence from the between-participant comparisons is meaningful and methodologically viable.

7.1.2 Comparisons across the visual and verbal conditions of the event drawing task

As discussed in Chapter 2, the conceptualisation of events for the purpose of communication involves the complex interaction between bottom-up perceptual and top-down conceptual constraints. Evidence suggested that, when the influence of top-down constraints was reduced, there was an increased reliance on perceptual factors for both aphasic and non-aphasic individuals (Hartsuiker & Kolk 1998; see Chapter 2, Section 2.4). This was confirmed by the results of the control study in the current investigation, where there was an increased reliance on perceptual factors in the possession change events, where conceptual clues to agentivity were reduced (see Chapter 5, Section 5.3).

The possibility was also raised that, for people with aphasia, reduced access to the meanings and forms available in language would further reduce the influence of top-down, linguistically-mediated constraints during the process of conceptual preparation for the purpose of communication (Black & Chiat 2000; Dipper et al, in press). If, as hypothesised, certain aspects of conceptual preparation are common to both language and *communicative* drawing, then this would predict an increased reliance on bottom-up perceptual factors in both linguistic and graphic communication when language is least available as a source of constraint (see Chapter 3, Sections 3.2 and 3.3)

Comparisons across the visual and verbal conditions of the event drawing task provide some support for this hypothesis, since they suggest that there is a degree of correlation between the nature and severity of the participants' language impairment and their ability to process visual events for the purpose of communication. Specifically, the findings suggest that participants whose access to thematic aspects of linguistic meaning was most impaired showed an increased reliance on stimulus-related perceptual factors in the visual condition of the task. In other words, they relied more on surface visual characteristics of the video clip of the event to be drawn, such as the positions of the entities on the screen or the direction of the movement.

In order to make comparisons across the two conditions more accessible, the ability of the individual participants to process certain aspects of syntactic and semantic information from the input sentences in the verbal condition of the event drawing task is summarised in Table 7.2. A tick indicates intact processing, whilst a cross indicates that the particular aspect of processing is impaired in some way, although degrees of impairment are not distinguished and some participants may have partial processing in that domain.

Table 7.2 Summary of individual participants' ability to process aspects of syntactic and semantic information from input sentences in the verbal condition of the event drawing task

		JOK	PZ	JT	BP	DN	DA	JIK
	Retain individual NPs	X	✓	✓	X	X	X	X
Syntactic level	Keep linear order of NPs	X	✓	X	X	✓	✓	X
	Build initial syntactic structure	✓	✓	✓	X	✓	X	X
	Access syntax of words, including verb	✓	✓	✓	X	✓	X	X
Semantic level	Build initial semantic structure (general mapping procedures)	✓	✓	✓	X	X	X	X
	Access thematic aspects of verb meanings	✓	✓	X	X	X	X	X
	Access 'core' aspects of verb meaning	✓	X	X	X	X	X	X
	Access directional information in PP	✓	X	X	X	X	X	X

Four participants, BP, DN, DA and JIK, had severe problems with all aspects of semantic level processing. They were unable to access thematic information, either on the basis of general mapping procedures, or by accessing the meaning of the verb. JT showed some ability to apply general mapping procedures in thematic role interpretation, but her access to verb-specific thematic information was reduced. Thematic aspects of meaning provide information about how entities participate in roles in the event described by the sentence. These aspects of meaning are therefore relevant to the building of event structure. Notably, these five participants also showed similar problems with processing the structure of the visual events, in particular their causal structure, in the visual condition (see Table 7.1).

Furthermore, these participants all showed an increased reliance on perceptual factors in their graphic communication of visual events. JT, BP, DN and JIK all showed an increased reliance on screen position in comparison to controls in both position change and possession change events. They were more likely to draw the entity on the left of the screen first, regardless of its role in the event. For DN this was the only significant factor. JT was also influenced by the factor of 'start position of Theme', tending to draw this entity first. BP was also influenced by the perceptual factor of the relative stability of the entities. DA and JIK were more likely to foreground the Theme's end position, in keeping with their focus on the end state subcomponent of the scenes (see section 7.1.1 above). These two participants also relied on perceptual factors in the verbal condition of the event drawing task, since they tended to reproduce the investigator's model drawing, suggesting that linguistic sources of meaning were not available to them (see Chapter 6, sections 6.6 B and 6.7B).

All five of these individuals also had difficulty with processing 'core' aspects of meaning such as directionality and manner. This was also a source of difficulty for PZ, but, unlike the other participants, her access to thematic aspects of meaning was hypothesised to be intact. PZ's performance in the visual condition of the event drawing task correlates with her linguistic abilities. She was able to process the structure of visual events, but showed difficulties with processing specific features of the stimuli, such as the manner of the action, which correspond to those aspects encoded in the 'core' meaning of the verb. PZ did not show an increased reliance on perceptual factors in comparison to control participants in the visual condition of the event drawing task.

JOK is the only participant for whom intact semantic processing was hypothesised. JOK had no problems with any aspect of visual event conceptualisation, and in fact showed less reliance on perceptual factors than the control participants.

The above evidence highlights a correlation between language impairment and event conceptualisation. However, it is important to be clear about the precise claims that are being made here, particularly with regard to the causal connection between these two deficits. These are summarised below:

a) Problems with event conceptualisation may be an underlying source of some aphasic individuals' problems with communicating about events, both in and outside of language. This is supported by evidence from the visual condition showing that problems with specific aspects of event processing result in similar patterns of performance in graphic and linguistic communication of events.

b) Reduced access to aspects of linguistic meaning do not *cause* problems with event conceptualisation, but can interact with these problems to result in conceptualisations not optimally structured for communication. It is this interaction between impaired event processing mechanisms and impaired language that creates what Black & Chiat (2000) call a "spiral of impairment" in language production (see also Dipper 1999; Dipper et al, 2005).

This interpretation has implications for models of language production, since it suggests that the interaction between message construction and the linguistic system is bi-directional and makes use of both feed-back and feed-forward mechanisms (Dean & Black, in press). By comparing performance across two different input modalities, the event drawing task provided some additional evidence in support of a reciprocal relationship between language impairment and event conceptualisation.

7.1.3 Implications of the verbal condition for sentence processing

The performance of the participants on the verbal condition of the event drawing task also provides some information about the sentence comprehension abilities of these individuals. As in the visual condition, comparison between participants reveals associations and dissociations that have both theoretical and clinical significance (see Table 7.2 above for summary of individual performances).

Most importantly, the findings support the claim that the conceptualisation of events from linguistic description requires the integration of a number of different sources of information, in particular syntactic and semantic information (see Chapter 2, section 2.2). The results therefore challenge purely syntactic accounts of sentence processing impairments in non-fluent aphasia (Grodzinksy 1986, Just & Carpenter 1992, Thompson 2003) and provide support for accounts that highlight a semantic source of impairment and/or a problem with the integration of syntactic and semantic information, for example the different variants of the "mapping hypothesis" discussed in Chapter 3 (Schwartz et al 1980, 1985; Byng 1988; Nickels et al 1991; Byng et al 1994; Marshall 1995, 1997; Haendiges et al 1996; Berndt et al 1997b).

All the participants except JOK had some impairment at the semantic level of processing. Furthermore, participants PZ and DN, who demonstrated *intact* syntactic processing, nevertheless had difficulties interpreting the sentences. In PZ's case, her problems with sentence interpretation were attributed to a failure to access 'core' aspects of verb meaning, which affected her ability to conceptualise the precise nature of the action occurring in the event (see Chapter 6, section 6.2 B). DN, in contrast, had more severe problems at the semantic level, including a failure to access thematic aspects of verb meaning, and a problem with integrating syntax with semantics (see Chapter 6, section 6.5 B). This resulted in a failure to build up the semantic structure of the events described and to interpret the roles of the participants, either on the basis of verb-specific thematic information or general mapping procedures.

The remaining four participants, JT, BP, DA and JIK, all had problems with both syntactic and semantic aspects of sentence processing, although the exact nature of these problems varied (see Table 7.2. above). All these participants had significant difficulties interpreting the sentences in the event drawing task. In the case of BP and JIK, their severe syntactic level problems interacted with their difficulties at the semantic level to result in conceptualisations and graphic representations that failed to include all the participants in the event and failed to reproduce the situational focus of the verb. (Chapter 6, sections 6.4 B and 6.7 B). JT and DA, whose syntactic deficits were less severe, did include all relevant participants, but did not fully appreciate their roles in the events as a result of reduced access to verb-specific thematic information (see Chapter 6, Sections 6.3 B and 6.6 B).

In contrast to the other six participants, JOK showed intact semantic level processing. The only hypothesised deficit in JOK's case was a problem with maintaining the content of the noun phrases in registration with the structure of the sentence. This single deficit was shown to affect his ability to form a precise conceptualisation of the event being described by certain sentences, i.e. reversible sentences which rely primarily on the order of the noun phrases around the verb for the interpretation of role information. However, his good performance on the non-reversible position change sentences demonstrates that the availability of semantic/pragmatic information can compensate for his problems in maintaining phrasal order (see Chapter 6, Section 6.1B for detailed discussion). This once again demonstrates how the integration of semantic and syntactic information can assist in the interpretation of many sentences. JOK's drawing performance also argues against an argument structure complexity account of his sentence processing deficits (Thompson et al 1997), which would predict that sentences containing verbs with a similar number of arguments should cause equal difficulties.

The findings from the verbal condition of the event drawing task therefore confirm that neither intact syntactic processing (PZ and DN), nor intact semantic processing (JOK) are sufficient guarantees of success in the interpretation of all sentences. Successful sentence processing requires the ability to integrate these two sources of information. Dissociations between the participants in the verbal condition support the claim that there is no unitary explanation for sentence comprehension failure in people with non-fluent aphasia, and that multiple factors in combination may be responsible for a person's deficit (Berndt et al 1996, 1997a, Berndt & Mitchum 1997, Black & Chiat 2000). The findings of the event drawing task help disentangle some of these components, and both support and extend some of the differentiations already present in the aphasia literature (see Chapter 3).

The event drawing task can therefore complement other assessment procedures already available, by enabling more specific hypotheses to be drawn about individuals' event conceptualisation problems and their language impairments and the interactions between the two. This will be discussed further in the following section.

7.2 Clinical implications

This thesis was motivated primarily by a clinical concern for the support of people with severe aphasia. As discussed in Chapter 1, Speech and Language Therapists may experience difficulties in identifying the underlying competencies of these individuals due, in part, to the paucity of their linguistic output. Consequently, intervention may be based on limited or inaccurate interpretation of their problems. Detailed analysis of the ability to conceptualise and communicate about events amongst these seven individuals revealed a range of competencies and difficulties. This has several implications for the assessment and remediation of severe aphasia.

7.2.1 Implications for assessment

The current research highlights the need to consider event conceptualisation problems as a possible area of difficulty for people with aphasia. The event drawing task was motivated by a review of the literature on event conceptualisation and the analyses were selected to target specific aspects of event processing identified as necessary for their communication. Evidence from previous research suggested that these aspects are separable and can be selectively impaired in aphasia. Assessments of event processing should therefore aim to investigate a number of different aspects of event processing in order to gain an overall view of an individual's abilities and to identify impairments in one or more of these processes (Dipper 1999).

As demonstrated in Section 7.1.1 above, this aim was achieved and surpassed by the event drawing task, which provided specific information about both impaired *and intact* aspects of events processing for each individual participant. This suggests that the event drawing task can be a useful clinical tool in the investigation of event conceptualisation in aphasia, since it can complement tasks already available that target specific aspects of event processing, for example the Event Perception Test (Marshall et al 1999), the Role Video (Marshall et al 1993) and the Perspective Video (Dipper 1999).

The event drawing task can also supplement the information gained from such assessments, since it also provides information about the consequences of any event processing impairments on the communication of events. This is because, unlike these other tests, the event drawing task does not focus only on input, but rather deals specifically with the processing of events for output. The event drawing task provided information that assisted in the interpretation of both success and failure on these tests, which was not available from the tests alone.

In the case of the Role Video, in particular, the information gained from the event drawing task resulted in a re-consideration of requirements for successful performance of this test. Specifically, the performances of participants BP and DN suggested that success on the Role Video could be achieved without the need to identify the roles of all the participants in the scenes, in particular the Cause/Actor role. On the event drawing task, these two participants failed to process the causal structure of the events and to identify the related role of the Cause entity. However, they performed well on the Role Video, making few role errors. It was therefore hypothesized that intact performance on the Role Video could be achieved on the basis of processing the outcome, or end state, of the event and the process of change leading to that state (see Chapter 6, sections 6.4 A and 6.5 A). However, DA and JIK's performances suggested that focusing on the end state alone, without attending to or appreciating the process leading up to that state, would not result in success on the Role Video. This is because on certain stimuli the outcome photographs do not correspond perceptually to the end of the video scene. For example, in a *hitting* event, the video shows one person punching another, followed by the "victim" putting his hand up to his face. Both people are standing throughout the scene. The target outcome photograph shows the "victim" sitting on a bench with an eye-patch on. Both DA and JIK made errors on these scenes (see Chapter 6, sections 6.6A and 6.7A). Thus the evidence from the event drawing task suggests that performance on the Role Video could be affected by the focus one takes on a visual event. However, further investigation with a large number of individuals with aphasia would be required to confirm this.

Comparison of BP and DN's performance with that of two other participants, JOK and PZ, highlights the fact that similar performances on tasks can sometimes mask communicatively-relevant differences in participants' abilities to process specific aspects of visual events. All four participants performed well on the Role Video. However, BP and DN's good performance was achieved in the absence of the ability to process the causal structure of the events, while JOK and PZ *were* able to process causal structure.

This point is even more strongly illustrated by performance on the Event Perception Test (EPT). All the participants except JOK had difficulties with the EPT, producing both gross errors and semantic errors, a pattern of performance which is difficult to interpret (Marshall et al 1999). However, the evidence from the event drawing task indicated that nature of these difficulties varied between individuals. As discussed in Section 7.1.1 above, PZ's problems were confined to interpreting the specific action in the scene, while the other participants all had problems related to the schematisation of visual events. Thus the event drawing task enabled more specific hypotheses to be formed about possible sources of failure on the EPT, which have implications for the interpretation of individual impairments and for remediation planning.

The above findings highlight the importance of having a clear understanding of the processing that is required for individual tasks, even those where no language is involved. Event processing difficulties will manifest in all communicative tasks that require the conceptualisation of events from pictures or video scenes (Dipper 1999). This includes comprehension tasks that involve the matching of linguistic and visual information. This is particularly relevant considering the prevalence of such tasks in the aphasia clinician's repertoire.

The interaction of event conceptualisation difficulties and language impairments may impact negatively on the performance of such tasks, particularly in situations where there is a conflict between visual and linguistic input (Cupples & Inglis 1993; Black & Chiat 2000). This might have affected the performance of some of the current participants on assessments like the Perspective Video (Dipper 1999) and the Reversible Sentences Comprehension Test (RSCT) (Byng & Black 1999), making interpretation of performance on such tasks more difficult. Evidence from the verbal condition of the event drawing task resulted in more specific hypotheses about the sources of individual participants' difficulties with sentence comprehension, which assisted in the interpretation of performance on these tests.

For example, in the RSCT, all the participants made roughly equal numbers of errors on all sentence sets. This pattern of performance is hard to interpret, and may have a number of underlying causes which are not distinguishable from the RSCT alone. In some cases, the evidence from the event drawing task permitted differentiation between a semantic and a syntactic source of deficit. For example, JOK's performance on the event drawing task confirmed that access to semantic information remained intact, and that his difficulties with understanding reversible sentences were attributable to a problem with maintaining the linear order of the noun phrases in the sentences (see Chapter 6, section 6.1.B). In contrast, PZ's event drawing performance indicated that her syntactic abilities were relatively intact, but that access to the specific meanings of verbs was impaired, which affected all sentences, not just reversible ones (see Chapter 6, Section 6.2 B). For both these participants, the evidence from the event drawing task encouraged a more detailed analysis of their performance on the RSCT. In JOK's case, this involved comparison across two versions of the test, and in PZ's, a qualitative analysis of her performance, both of which revealed confirmatory evidence for the hypothesized deficits. The current study therefore highlights the importance of looking at qualitative as well as quantitative aspects of performance, which can also yield clinically relevant information.

One qualitative finding from the event drawing task that has direct relevance to assessment in aphasia is the fact that the majority of the participants with aphasia required significantly more repetitions of the stimuli in *both* the visual and the verbal conditions in comparison to the controls. PZ and DN were the only two participants whose requests for repetition in the visual condition were within the control range. The remaining five participants' requests for repetitions fell more than two standard deviations outside the control range in the visual condition. This was true even of JOK, whose conceptualisation of visual events was hypothesized to be intact. Increased repetitions in the verbal condition are predictable, in view of these individuals' severe language impairments. However, increased repetitions in the visual condition confirm that they had significant difficulties in retaining the information in the scenes whilst engaging in further processing. This is rarely taken into account in either assessment or therapy in aphasia, despite the increased prevalence of video-based material. Repetitions of verbal stimuli are common, but increased processing time and/or repetitions of visual stimuli are rarer. The event drawing task suggests that this simple adjustment to the way tests and tasks are administered might have significant implications for performance.

The event drawing task has one further advantage over other assessment tools, namely, it does not constrain individuals to choose among experimenter-generated alternatives. This permits individuals more freedom to show their own interpretation of the event they witness or the sentence they hear. This provides a better indication of the particular focus or perspective adopted by an individual, which is highly relevant to an investigation of event conceptualisation. However, one problem with this 'unconstrained' approach is the difficulty in comparing observed performance to a specified level of expected chance, because it is hard to know how many possible alternatives a given individual might consider (Cupples & Inglis 1993, Berndt et al 1996). The current investigation sought to overcome this problem by comparing the performance of the participants with aphasia with those of matched controls, following a detailed and theoretically-motivated qualitative analysis of control performance (Chapter 5). Ideally, the control study should be extended to include a larger number of people, thus providing more robust evidence for 'normal' event-drawing performance. This level of analysis, however, was appropriate to this preliminary investigation of event drawing.

In the context of clinical realities, the time taken both to administer the event drawing task and to analyse the results might reduce its clinical applicability. The findings of the current investigation suggested that certain analyses were more significant than others in providing information about the event conceptualisation abilities of the participants with aphasia. The three key analyses in the current study proved to be the temporal order of drawing, which provided clues about focus and interpretation of event structure and roles, and the use (or non-use) of graphic strategies, such as arrows and consistent spatial location of the Theme, to indicate temporal and directional aspects of the stimuli. It may therefore be possible to adapt the task to reduce the time taken for analysis of performance.

Another possible limitation of the event drawing task is that the demands of the drawing output modality may themselves restrict its use amongst people with aphasia, some of whom may have concurrent visual, planning or execution problems resulting from brain damage (Gainotti & Tiacci 1970; Gasparrini, Shealy & Walters 1980; Kirk & Kertesz 1989). As discussed above, this can be ruled out for the participants in the current study, who were selected on the basis of intact visual processing and good motor execution skills.

Overall, the advantages of the event drawing task as a means of providing more detailed insights into the event conceptualisation abilities of people with severe aphasia outweigh the disadvantages at this stage of its development. The evidence from the event drawing task contributes to a fuller understanding of the processes involved in the conceptualisation of events for the purpose of communication and the consequences of impairments to specific aspects of processing. This information both complements and supplements evidence from other assessments by enabling more specific hypotheses to be drawn about impaired and intact aspects of processing, both in terms of event conceptualisation and language.

The findings confirm that within-participant comparison across different tasks, including non-linguistic tasks, should be an important feature of clinical assessment (Cupples & Inglis 1993, Byng et al 1994, Berndt et al 1996, Dipper 1999, Marshall et al 1999, Black 2003). Between-participant comparisons also highlighted differences in individuals' underlying processing abilities, which cut across both classification and severity. For example, JT's performance bore some similarities to that of BP, both in terms of visual event conceptualisation and in terms of language comprehension, yet they received different classifications of Conduction aphasia and Broca's aphasia on the WAB. Likewise, JOK and PZ achieved similar aphasia quotients on the WAB as DA, DN and JIK. However, their event conceptualisation and sentence processing skills were found to be significantly better than these other three participants. The findings of the current investigation confirm that traditional symptom or syndrome-based approaches to the investigation of aphasia may be less informative, both clinically and theoretically, than a series of detailed case studies (Berndt et al 1997a), further undermining the *"myth of homogeneity of performance among clinically defined groups"* (Berndt et al 1996, p 300).

7.2.2 Implications for remediation.

The findings of the current study provide support for the claim that event conceptualisation itself may be an appropriate target for therapy for some people with aphasia (Marshall et al 1993, 1999; Dipper 1999). The aim of such therapy would be to facilitate conscious awareness of how events are structured, in order to organize and constrain conceptualisation in such a way as to facilitate communication. This is similar to some of the 'mapping therapies' discussed in Chapter 3, which have indeed been described as "exercises in thinking for speaking" (Black & Chiat 2000). The following thoughts on intervention are not proposed as a replacement for existing strategies, but may be explored as a means of complementing current therapies and extending them to the non-linguistic domain.

By enabling more specific hypotheses to be formed about intact and impaired aspects of processing for each individual, the event drawing task can contribute to planning appropriately targeted therapy, both in terms of deciding on the focus of therapy and the selection of appropriate tasks and materials.

For example, for individuals like DA and JIK, it may be more effective to target therapy initially at increasing their appreciation of change in visual scenes, in order to improve their ability to process the temporal structure of the events. This could be done by contrasting scenes in which no change occurred, such as locational states, with scenes which involved movement (see Byng et al 1994 and Dipper 1999 for similar tasks). Attention could be drawn to the relevant entities participating in the movement and to their positions at both the start and the end of the events. Other contrasts could gradually be introduced, such as variations in nature of the change and in direction. In later stages of therapy, contrasts between caused and uncaused change could be introduced.

For individuals like JT, BP and DN, a therapy programme focusing on increasing their appreciation of causal interactions and the roles of the various participants in these interactions might prove fruitful. This could then be developed to include tasks that focus on the specific nature of the action occurring. This type of programme is similar to that developed for AER by Byng et al (1994).

For PZ, therapy could commence at the level of contrasting specific actions, since her only difficulty with visual event conceptualisation was related to processing specific features of the action. She may therefore benefit from a programme that aims to improve her awareness of the precise nature of the action in visual events and to focus on differences between perceptually and conceptually similar events. The relationship between these events and the verbs used to describe them could also be targeted, which should have a positive effect on both comprehension and verb retrieval. Similar programmes have been used with some success with other individuals with aphasia (Marshall et al 1993, 1996; Randrup-Jensen 2000).

As well as providing indications about suitable tasks for therapy, the findings of the event drawing task have implications for the selection or development of appropriate therapy materials. In particular, the increased reliance of some participants on perceptual aspects of the stimuli should be taken into account. In initial stages of therapy, care should be taken to ensure that perceptual and conceptual factors act in congruence. For example, entities whose role in the event needs to be emphasized could be made more salient, for example by ensuring that they occur on the left of the scene (Flores d'Arcais 1975; Sridhar 1988; Chaterjee et al 1995a, 1995b). Scenes that restrict perspective options, such as those in which a prominent animate entity acts on an inanimate, would also be more appropriate to initial stages of therapy (Hartsuiker & Kolk 1998; Black & Chiat 2000). In later stages of therapy, the congruence of perceptual and conceptual factors could be gradually reduced by varying the position of the human entity, or by introducing a second animate participant.

Therapeutic procedures and tasks have to be tailored to the individual, but they must also be based on an appreciation of the specific characteristics of the medium of drawing as a communicative tool. Clinicians routinely "encourage" drawing as a means of compensating for or augmenting severely limited linguistic communication. The findings of the current research, in particular the control study, provide hitherto unavailable information about the graphic communication of events which are relevant to planning therapy using drawing as the output modality. The aim of such therapy would be the conventionalization of graphic representation as a means of communicating about events (Bauer & Kaiser 1995). Regularities in patterns of performance of the control participants suggest that drawing itself could be used as a means of structuring event conceptualisation for communication.

The consistent use of certain graphic strategies could be promoted as a way to direct attention to specific aspects of events that were causing particular problems for the participants with aphasia. For example, DA and JIK could be encouraged to use arrows to indicate movement and direction, which were shown to be effective in control participants' drawings. The use of consistent temporal order of drawing as a means of foregrounding relevant participants could also be employed, which was also a feature of control participant performance. For example, JT and BP and DN could be encouraged to draw the initiator of the event first, in order to highlight that the event is to be interpreted from that participant's perspective. This could then be linked with foregrounding in linguistic communication, as a means of establishing links between roles of participants in events and positions in sentence structure. Improvements in linguistic communication are unlikely for these participants, in view of their additional severe language production deficits. However, there may be some effect on their ability to understand linguistic descriptions of events, and in communicating about events using drawing, which would be of significant functional benefit.

Specific graphic strategies such as the above have been used successfully in drawing therapy studies to improve the communicative effectiveness of individuals' drawings of events (Sacchett et al 1999; Sacchett and Lindsay, in press). The evidence from the current investigation provides a theoretical justification for promoting these strategies in drawing therapy. The goal of such therapy is improved mutual understanding between two interactants, and the communicative effectiveness of drawing therefore relies to a large extent on the interpretive skills of the aphasic individuals' communication partner, which could also be a target for therapy (see Sacchett 2002). Communication partners could be trained in the use of specific interpretive techniques which would contribute to the overall communicative effectiveness of the exchange, for example the use of selectively targeted questions prior to the initiation of drawing, and during production of the drawing itself, to facilitate the process of structuring conceptualisation for communication and to clarify any aspects of the event that remained unclear. In this way the communication partner acts as a specialist listener, to help refocus and adjust the exchange to make it more effective (Black & Chiat 2003a).

In a real-life communicative situation, the communication partner would also be able to utilize clues from the process of drawing that might assist in interpretation of roles and relations within the event, in particular the use of consistent strategies. A good example of this occurred during one session with DA, which was observed by one of his regular communication partners. Her attention had been distracted during the presentation of one of the video clips, but on observing DA's drawing below, she correctly identified the event as *"The girl put the vase on the table",* commenting that she had been able to do so because she knew, from his previous drawings, that the vase must have ended up on the table. Thus she had quickly become familiar with his strategy of consistently locating the Theme at its end position.

The functional benefits of improving communicative drawing for the participants in this study and their communication partners are undeniable, particularly since, for these participants, improvements in language production are unlikely. Even without any therapy, the ability of all the participants in this study to communicate events using drawing exceeded their ability to describe those events verbally or in writing, suggesting that drawing may be an appropriate target for intervention.

7.3 Implications for future research

The main contribution of the current study has been to increase our understanding of the processes involved in "thinking for communication" and how these might be impaired in severe aphasia, through the development of novel procedures and exploratory analyses. The results confirm that problems at the conceptual preparation stage of message formulation, involving the schematization and structuring of events, can underlie the event communication difficulties of some individuals with severe aphasia, in both non-linguistic and linguistic output modalities. The results also shed light on the interaction between event conceptualisation and language impairment, providing some evidence in support of the claim that there may be a reciprocal relationship between the two. The findings have both theoretical and clinical relevance, particularly as regards remediation planning.

In terms of future directions, two lines of research present themselves. Firstly, in order to further increase our understanding of the relationship between event conceptualisation, event communication and language impairment, systematic investigations of the graphic communication of different kinds of events under different stimulus conditions could be undertaken, involving people with and without aphasia. Of particular interest would be:

a) A systematic study which compares graphic event communication, by both aphasic and non-aphasic individuals, across events that vary in terms of the number and nature of the participants involved, and the roles of and relations between these participants. For example, scenes in which the number and nature of the participants remained constant, but which varied in terms of the nature of the relationship between these participants, could be compared (e.g. a girl pointing to a boy vs. a girl hitting a boy vs. a girl chasing a boy). Differences in drawing performance across these events would indicate that the nature of the participants and the action affect the ease with which events can be communicated (Black & Chiat 2003b). Careful consideration would need to be given to the development of any stimuli, to ensure that other perceptual factors were controlled for.

b) A study investigating the ability of different individuals to communicate 'self-generated' events, in the absence of a visual or linguistic stimulus (e.g. a "What happens next?" task). This is highly relevant to the development of effective communicative drawing, and would therefore have implications for remediation planning (Sacchett et al 1999). However, there may be problems in analysing the data produced by such an investigation, due to difficulties in determining the precise target event. These difficulties would not be insurmountable and could be addressed through the use of qualitative analyses of performance, such as those used in the current study.

c) A cross-linguistic study, where the forms and structures of the participants' natural languages direct attention to different aspects of events. This would provide some evidence about the relationship between graphic and linguistic event communication. If similar patterns of graphic performance emerge amongst speakers from different language communities, this might suggest that there is an intrinsic "graphic" system of organisation (Soto 1997; Gershkoff-Stowe & Goldin-Meadow 2002). If different patterns of graphic performance emerge that parallel differences between the spoken languages, this would provide strong evidence for shared aspects of conceptual preparation for graphic and linguistic communication.

Another line of research would be a systematic investigation of the hypothesis that drawing therapy itself may improve event conceptualisation, by promoting more structured representations of events and consistent strategies for their communication. If this were the case, improvements might be expected not only in graphic event communication, but also in comprehension of linguistically described events. Such an investigation is best suited to a single case or case series approach, involving individually tailored therapy programmes targeting specific aspects of event conceptualisation and communication identified as problematic for each individual. This would require a detailed investigation of language and event processing abilities pre and post-therapy, along the lines of that described in the current study, with the aim of identifying any improvements in performance that could be directly attributable to the therapy process. Such an investigation would yield information of direct relevance to clinical practice.

7.4 Concluding remarks

The investigation described in this thesis represents a preliminary step towards increased understanding of event conceptualisation and event communication in severe aphasia. It encourages clinicians and researchers to routinely consider the interaction between conceptualisation and language and its effect on communication, and provides novel tools for investigating this interaction. Of crucial importance is the fact that the current study has direct implications for improving functional communication in severe aphasia. The findings suggest theoretically motivated and specific ways in which drawing can be used both to improve event conceptualisation and to increase communicative effectiveness.

Much of our communication, in particular our social communication, involves talking about events, e.g. things that have happened, what we have been doing, who did what to whom. Thus improving individuals' ability to conceptualise and communicate about events would have significant effects on their ability to participate in interactions and to reveal their competence. Drawing can therefore act as what Kagan refers to as a "communication ramp", removing some of the barriers to communication and participation, which is the ultimate goal of any intervention with people with aphasia (Kagan & Gailey 1993; Simmons-Mackie & Damico 1995; Pound, Parr, Lindsay & Woolf 2000; Sacchett 2002; Sacchett & Lindsay, in press). This is particularly relevant in view of the severe limitations in both spoken and written output of the participants in the current study. The potential of drawing as a means of allowing these individuals to let other people know something of their ideas, knowledge, thoughts and understanding cannot be underestimated.

This is well-illustrated by the case of GJ, reported by Sacchett et al (1999), who was discussed briefly in Chapter 1 (section 1.3). GJ was six years post-onset at the start of this therapy, and in that time his output had consisted solely of one repetitive phrase. On witnessing GJ's drawing of a complex transactional event, produced towards the end of the therapy period (Figure 1.1), his wife burst into tears, commenting:

> *"I didn't know he still had it inside him. I didn't know he knew so much".*

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APPENDICES

APPENDIX A

INFORMATION LEAFLET FOR PROSPECTIVE PARTICIPANTS WITH APHASIA

CONFIDENTIAL

An investigation of the relationship between conceptualisation and non-linguistic communication: evidence from drawing production in severe aphasia

Carol Sacchett, Research Speech & Language Therapist
Department of Human Communication Science, University College London
Chandler House, 2 Wakefield Street, London WC1N 1PF
Tel: 020 7679 4252

Drawing Research

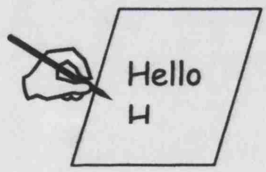
Thank you for agreeing to take part in this research project.

This leaflet gives you **more information** about what it will involve.

About the research

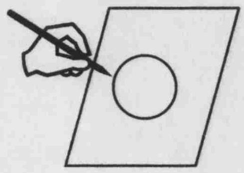
When talking is hard, people with aphasia can use other ways to get their message across. For example:

Writing



Gesture

Drawing



I am interested in **drawing**.

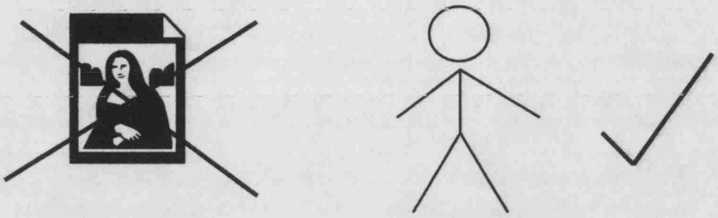
Drawing can be a useful way to get our thoughts across.

APPENDIX A (contd.) INFORMATION LEAFLET FOR PROSPECTIVE PARTICIPANTS WITH APHASIA

I have done some research into this already. I found that:

- **some people get messages across easily**
- **some people find it hard**.

It did not matter how good the drawings were.



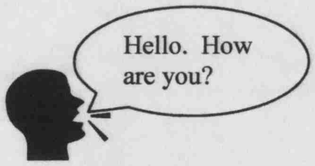
Too good Good enough

Other things were more important, like:

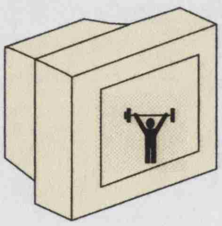
- **choosing the right things to put in** the drawing
- **putting them in the right places.**

I want to see if there are **things that help** people get their message across using drawing.

Some of the things I will be looking at are:
- Understanding language



- Understanding things that we see happening



Finding these things out will **help people with aphasia** and their friends and family to communicate better.

It will help Speech and Language Therapists to **plan the right kind of therapy** for people with aphasia.

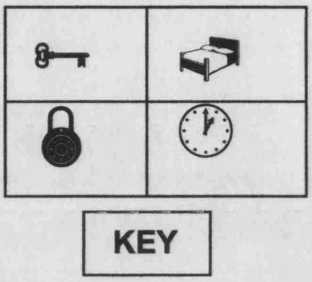
APPENDIX A (contd.) INFORMATION LEAFLET FOR PROSPECTIVE PARTICIPANTS WITH APHASIA

What happens next?

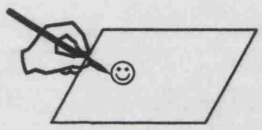
You will do some **more detailed assessments**.

Some of them will be the same as ones you have done before in your Speech & Language Therapy.

They will look at your **understanding** of **language**



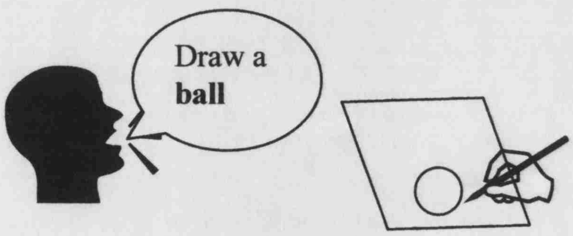
There will also be a **new assessment**.
This looks at your **drawing**.



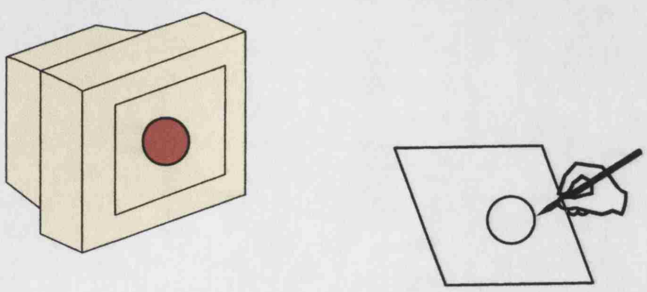
The drawing assessment

You will have to **draw some things that happen.**

Sometimes I will tell you what to draw.



Sometimes you will see a picture or video clip.



APPENDIX A (contd.) INFORMATION LEAFLET FOR PROSPECTIVE PARTICIPANTS WITH APHASIA

Where and when?

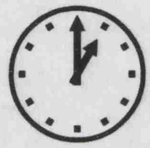
You won't do all the assessments in one go.

We will spread them over **a few weeks**.

We will need about **10 sessions** in all.

	Wk 1	Wk 2	Wk 3
M	x	x	
T		x	x
W	x		x
Th		x	
F	x		x

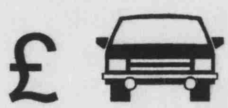
Each session will take about **one hour.**



I can come to **your home** if this is easier.

Or you can **choose somewhere else** if you prefer.

If I see you somewhere else, I will pay your **petrol money or taxi fare**.



APPENDIX A (contd.) INFORMATION LEAFLET FOR PROSPECTIVE PARTICIPANTS WITH APHASIA

Things to remember:

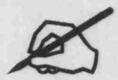
This is a **research** study. I am only doing assessments, **NOT therapy**.

ASSESSMENTS ✓ ~~THERAPY~~

You don't have to be good at drawing.

You don't have to be able to use your usual hand

LEFT ✓



RIGHT ×

You **don't have to take part** if you don't want to.

NO THANKS!

You may withdraw at any time without having to give a reason.

STOP! NO MORE!

Your decision will not affect the rest of your Speech & Language Therapy in any way.

I will contact you again in a few days' time.
You can tell me if you want to take part.

If you DO want to take part, please read and sign the **CONSENT FORM**

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by the Joint UCL/UCLH Committees on the Ethics of Human research.

PLEASE KEEP THIS LEAFLET

APPENDIX B

CONSENT FORM FOR PARTICIPANTS WITH APHASIA

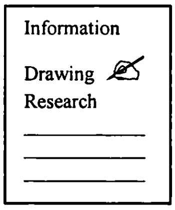
CONFIDENTIAL

An investigation of the relationship between conceptualisation and non-linguistic communication: evidence from drawing production in severe aphasia

Carol Sacchett, Research Speech & Language Therapist
Department of Human Communication Science, University College London

Drawing Research

I have read the information sheet about this study.



YES ✓ NO X

I have asked questions about the study. ?

YES ✓ NO X

The answers to my questions were good enough.

YES ✓ NO X

I understand that I can withdraw from this study:

- at any time
- without giving a reason
- without affecting my future care.

STOP

YES ✓ NO X

I agree to take part in this study YES NO

Signed .... Date ....

Print name ....

Signature of investigator ....

APPENDIX C

INFORMATION SHEET FOR PROSPECTIVE CONTROL PARTICIPANTS

CONFIDENTIAL

An investigation of the relationship between conceptualisation and non-linguistic communication: evidence from drawing production in severe aphasia

Carol Sacchett, Research Speech & Language Therapist
Department of Human Communication Science, University College London
Chandler House, 2 Wakefield Street, London WC1N 1PF
Tel: 020 7679 4252

Volunteers are needed to help with a research project investigating the use of drawing to communicate. When people lose the ability to speak or write following a stroke ("aphasia") they are often encouraged to use other means of communication, such as gestures or drawing, to get their messages across. Some people arre able to do this quite well, but others are not. This does not seem to be linked to how "good" the drawings are.

This study aims to work out what is required in order to get certain kinds of message across using drawing. I will be studying the drawings produced by a small number of people who have difficulty speaking or writing to see if there are are any particular skills required. I also want to compare their drawings to drawings produced by people who do not have any problems with speaking or writing, to see if there are any similarities or differences.

This research will help people with aphasia. It will enable Speech & Language Therapists working with them to understand what the requirements are for being able to use drawing as a means of communication. This will help them plan appropriate therapy.

What would it involve?

You would have to draw a number of things that happen ("events"). Some of these will be described to you verbally; on other occasions you will see pictures or video clips; and sometimes you will have to draw "from your head".
The whole thing should take no more than 2 hours, and does not have to be completed in one session. I can come to your home if that is more convenient, or you can suggest somewhere else. Travel expenses will be covered.

You do not have to take part in this study if you do not want to. If you decide to take part, you may withdraw at any time without having to give a reason.
If you would like to participate please contact me on the above.
Please keep this leaflet.

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by the Joint UCL/UCLH Committees on the Ethics of Human research.

APPENDIX D

CONSENT FORM FOR CONTROL PARTICIPANTS

CONFIDENTIAL

An investigation of the relationship between conceptualisation and non-linguistic communication: evidence from drawing production in severe aphasia

Carol Sacchett, Research Speech & Language Therapist
Department of Human Communication Science, University College London
Chandler House, 2 Wakefield Street, London WC1n 1PF
Tel: 020 7679 4252

CONSENT FORM

I have read the information sheet about this study.	YES	NO
I have had an opportunity to ask questions and discuss the study.	YES	NO
I have received satisfactory answers to your questions.	YES	NO
I have received enough information about this study.	YES	NO
I understand that I can withdraw from this study: *at any time *without giving a reason.	YES	NO
I agree to being video-recorded.	YES	NO
I agree to take part in this study.	YES	NO

Signed .... Date ....

Print name here ....

Signature of investigator .... Date....................

APPENDIX E

FULL LIST OF STIMULI USED IN SCREENING ASSESSMENT

A. ASSESSMENT OF PICTURE COMPREHENSION

1 Match objects to pictures

Object	*Pictures*
cup	glass, bowl, cup
knife	spoon, fork, knife
pencil	pencil, book, comb
comb	brush, comb, mirror
ball	ball, book, lightbulb
book	pencil, book, newspaper
scissors	knife, pencil, scissors
glasses	mirror, glasses, comb
fork	fork, knife, spoon

2 Odd-one-out

pen, pencil, <u>scissors</u>

<u>cup,</u> beer mug, wine glass

matches, lighter, <u>candle</u>

ambulance, police car, <u>taxi</u>

radio, record player, <u>telephone</u>

spoon, ladle, <u>knife</u>

brush, comb, <u>mirror</u>

shoe, sock, <u>glove</u>

orange, lemon, <u>apple</u>

sheep, cow, <u>lion</u>

APPENDIX E (contd.) FULL LIST OF STIMULI USED IN SCREENING ASSESSMENT

B. ASSESSMENT OF DRAWING ABILITY

1 *Draw familiar objects to command*

Practice items: ball, spoon

Test items:

Cup	Fork	House	Table	Umbrella
Pencil	Clock	Flower	Book	Key

2 *Complete the category*

orange, apple . . . .

shirt, jacket . . . .

cat, rabbit ....

bed, wardrobe . . . .

spoon, fork . . . .

hammer, screwdriver ....

hat, scarf ....

sandal, boot ....

cup, wineglass ....

rake, hoe ....

APPENDIX E (contd.) FULL LIST OF STIMULI USED IN SCREENING ASSESSMENT

3. GENERATIVE DRAWING ASSESSMENT (Sacchett et al 1999)

Target	Stimulus Photo
Practice items:	
a) Hairbrush	Woman with messy hair looking in mirror
b) Umbrella	Man looking up at sky, hand outstretched, on rainy day
c) Scissors	Man holding end of string used to tie a parcel
1. Saw	Man holding plank of wood supported by chair
2. Iron	Man with creased shirt on ironing board
3. Razor	Man at washbasin, face covered in shaving foam
4. Rake	Man standing in middle of lawn covered in leaves
5. Padlock	Woman chaining bike to railings, holding ends of chain
6. Lightbulb	Woman holding empty lightbulb socket, reaching out
7. Basket/trolley	Man in supermarket, arms loaded with shopping
8. Icecream	Boy standing beside ice-cream van, offering money
9. Baby	Woman with empty pushchair reaching into car
10. Towel	Woman in shower reaching out
11. Hammer	Woman holding nail against wall and holding hand out
12. Lawnmower	Woman standing in middle of uncut lawn, looking around
13. Dog/cat	Woman placing full bowl of pet food onto floor
14. Ambulance	Couple looking at person covered in blood lying on ground
15. Needle/thread	Woman holding button and cardigan with missing button
16. Plaster	Man holding bleeding finger over washbasin
17. Train	People standing on station platform
18. Sellotape/string	Man wrapping up parcel
19. Plug	Woman holding screwdriver and wire flex of hairdryer
20. Spoon	Woman with cup of tea and sugar bowl
21. Bus	Woman standing at bus stop
22. Clothes peg	Woman holding shirt on washing line, reaching down
23. Pen/pencil	Woman with blank sheet of paper opening pencil case
24. TV	Man pointing remote control
25. Tablets	Woman with headache looking in medicine cabinet
26. Corkscrew	Woman with unopened wine bottle and empty glass
27. Axe	Man standing next to log on chopping block
28. Brush/broom	Woman and child looking at cereal spilt on floor
29.Toothbrush	Woman standing near washbasin holding toothpaste
30. Letters	Postman with sack next to open pillar box

APPENDIX F

INDIVIDUAL PERFORMANCES ON PRELIMINARY LANGUAGE ASSESSMENTS

A. WESTERN APHASIA BATTERY (Kertesz 1982)

Participant	Aphasia Quotient	Breakdown	
JOK	17.2	Fluency:	0
		Comprehension:	8.2
		Repetition:	0.6
		Naming:	0.1
PZ	14.8	Fluency:	0
		Comprehension:	7.4
		Repetition:	0
		Naming:	0
JT	47.6	Fluency:	8
		Comprehension:	8.6
		Repetition:	3.9
		Naming:	3.3
BP	40	Fluency:	4
		Comprehension:	7
		Repetition:	3.8
		Naming:	5.2
DN	16.1	Fluency:	0
		Comprehension:	8.05
		Repetition:	0
		Naming:	0
DA	11.9	Fluency:	0
		Comprehension:	5.95
		Repetition:	0
		Naming:	0
JIK	14.2	Fluency:	0
		Comprehension:	7.1
		Repetition:	0
		Naming:	0

APPENDIX F (contd.) INDIVIDUAL PERFORMANCES ON PRELIMINARY LANGUAGE ASSESSMENTS

B. OBJECT and ACTION NAMING BATTERY (Druks & Masterson 2000)

Participant	Object Score	Action score
JOK	44/50	18/50
PZ	36/50	1/10
JT	15/50	8/50
BP	23/50	11/50
DN	0/50	0/50
DA	0/50	0/50
JIK	0/50	0/50

Error analysis

	Object				Action				
	S	Ph/Gr	Neol	NR	S	Ph/Gr	Neol	NR	Noun
JOK	3	6	0	0	3	3	0	5	22
PZ	8	7	0	1	0	2	0	41	6
BP	16	2	0	9	6	0	1	11	22
JT	2	4	32	0	3	3	37	0	5

Key to errors
S = Semantic; Ph/Gr = Phonemic/graphemic; Neol = Neologism
NR = No response; Noun = pictured or stem noun named (Actions only)

C. TEST FOR RECEPTION OF GRAMMAR (TROG) (Bishop 1982)

Participant	Score	Error breakdown
JOK	62/80	Lexical: 2 Syntactic: 16
PZ	49/80	Lexical: 8 Syntactic: 23
JT	62/80	Lexical: 2 Syntactic: 16
BP	45/80	Lexical: 11 Syntactic: 24
DN	52/80	Lexical: 10 Syntactic: 18
DA	46/80	Lexical: 13 Syntactic: 21
JIK	35/64	Lexical: 15 Syntactic: 14

APPENDIX F (contd.) INDIVIDUAL PERFORMANCES ON PRELIMINARY LANGUAGE ASSESSMENTS

D. PALPA 47: Spoken word to picture match (Kay, Lesser & Coltheart 1992).

Participant	Score	Error breakdown
JOK	38/40	Close semantic 2
PZ	37/40	Close semantic 2 Visual 1
JT	37/40	Close semantic 3
BP	36/40	Close semantic 4
DN	31/40	Close semantic 7 Distant semantic 1 Unrelated 1
JIK	37/40	Close semantic 1 Distant semantic 2
DA	30/40	Close semantic 8 Distant semantic 2

APPENDIX G

TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant JOK: Object names (written)

Target	Response	Prompt	Response after prompt
Tie	Tie		
Candle	Candle		
Stamp	Stamp		
Tongue	Tongue		
Cow	Cow		
Bone	Bone		
Umbrella	Umbrall		
Dog	Dog		
Collar	Confer, cover, con		
Hammock	Wommock	"starts with 'h'"	Hammak
Spoon	Spoon		
Strawberry	Sweet, pie	Phonemic	Strawberry
Belt	Belt		
Gate	Gate		
Road	Lane		
Tree	Tree		
Letter	Letter		
Banana	Bannen, bonnan		
Bed	Bed		
Shoe	Shoe		
Drum	Drum		
Cherry	Cheery		
Conductor	Ticket		
Shower	Shower		
Ball	Ball		
Curtain	Curtain		
Nun	Nun		
King	King		
Hospital	Hospital		
Pram	Pram		
Circle	Circle		
Roots	Root		
Piano	Piano		
Lion	Lion		
Eye	Eye		
Picture	Picture		
Tractor	Tractor		
Fruit	Fruit		
Fork	Fork		
Heart	Heart		
Butterfly	Butterfly		
Box	Box		
Knot	Knot		
Table	Table		
Bridge	Bridge		
Cigar	Ciger		
Angel	Angel		
Chair	Chair		
Whistle	Whistle		
elephant	elephant		

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant JOK: Action names (written)

Target	Response	Prompt	Response after prompt
Crawling	Crawl		
Folding	[draws picture of folded paper]		
Driving	Drive		
Weighing	Weight		
Drinking	Drink		
Roaring	Roe, Reo, Roer		
Swimming	Swim		
Snowing	Snowing		
Biting	Bite		
Diving	N/R		
Eating	Food		
Stopping	Help	"What's he doing?"	Stop
Floating	Bottled		
Yawning	Awk, Yawn		
Dreaming	Dream		
Raking	Rubbish		
Juggling	Juggle		
Skating	N/R		
Playing	Toy	"What's he doing?"	Bruild Tra
Kicking	Football	"What's he doing?"	Baller
Sliding	slide		
Lighting	lighter		
Knocking	knock		
Tickling	tickler		
Leaning	wall	"What's he doing?"	build, arm
Watching	watch		
Begging	arm	"What's he doing?"	thank
Crying	cry		
Pinching	N/R		
Painting	painter		
Sinking	sink		
Tying	shoes	"What's he doing?"	trum, tie
Walking	walk		
Kneeling	kneel		
Blowing	blow		
Running	running		
Skipping	skip		
Smoking	smoke		
Praying	pray		
Sewing	sewing		
Dancing	dancing		
Catching	tennis	"What's he doing?"	catch
Building	building		
Melting	hot	"What's happening?"	frozen
Riding	side, ride		
Combing	combing		
Shooting	gun	"What's happening?"	blast
Posting	Post box was letter		
Waving	bye bye	"What's he doing?"	exch e
Pushing	arm	"What's he doing?"	pushing

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant PZ: Object names (written)

Target	Response	Prompt	Response after prompt
Tie	tie		
Candle	Candle		
Stamp	Postage stamp		
Tongue	N/R	Phonemic	Tongue
Cow	Cow		
Bone	Bone		
Umbrella	Umberrela		
Dog	Dog		
Collar	Shirt		
Hammock	hammerk		
Spoon	spoon		
Strawberry	strawnberry		
Belt	Tie		
Gate	hall		
Road	highway		
Tree	Tree		
Letter	letter		
Banana	banana		
Bed	N/R	"You sleep in it"	Bed
Shoe	shore		
Drum	Drum		
Cherry	Cherry		
Conductor	Conductor		
Shower	N/R		
Ball	Football		
Curtain	Curtain		
Nun	King		
King	Nan		
Hospital	Royal Surrey		
Pram	Pram		
Circle	Moon		
Roots	Roots		
Piano	Pioate, pioto, piorto		
Lion	Lion		
Eye	Eye		
Picture	Palm, sun, brite		
Tractor	Tractor		
Fruit	Fruits		
Fork	Fork		
Heart	Health, heaty		
Butterfly	buttersfield		
Box	box		
Knot	Tie, tieghs		
Table	Table		
Bridge	bridge		
Cigar	Cigar		
Angel	Angel		
Chair	Chair		
Whistle	Whiskey		
elephant	N/R		

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant PZ: Action names (written)

(NB Test abandoned at participant's request after 10 items)

Target	Response	Prompt	Response after prompt
Crawling	N/R		
Folding	paper	"What's he doing?"	hanger
Driving	drive		
Weighing	weigh		
Drinking	mug		
Roaring	Loin [possibly target lion]		
Swimming	ha		
Snowing	snow		
Biting	Bruit, brute		
Diving	swiggers		

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant JT: Object names (spoken)

Target	Response	Prompt	After prompt
Tie	/faɪm/		
Candle	/fæmb bəbəl/		
Stamp	/fɪkʃən/ on a /su:bə/ (gestures licking and sticking)		
Tongue	/fæm/		
Cow	cow		
Bone	/fu:t tʃu:z su:n tu:n/		
Umbrella	umbrella		
Dog	/kɔ:g kɔ:d/	Ph	dog
Collar	collar /lə lələ/		
Hammock	/kɔ: lælɪks/		
Spoon	/ku:n/		
Strawberry	/swɔ: bʌri/		
Belt	/bʌntʃʊ/		
Gate	/g k leɪt/ /kem bleɪ/		
Road	road		
Tree	tree		
Letter	letter		
Banana	/lɛtʃətə/		
Bed	/sutʃə/ and a comb	Sem	bed
Shoe	slipper		
Drum	/krim kru:mbə bʌmbəbə/		
Cherry	/krip kri:p kri:pə/		
Conductor	/kəspəs/ (gestures music)		
Shower	/wɒ baɪ hə bɒs bʌs ba:s/		
Ball	ball		
Curtain	/kɜɪ kɔ:kənən/		
Nun	/sku:lɪ lu:li/		
King	/skwi:z skwizɪnən/		
Hospital	bædjə	Sem	hospital
Pram	pram		
Circle	/kreɪm/		
Roots	/hɛsnjɛdɪn/		
Piano	/sp pænliən kənliən/		
Lion	/kləʊzɪz/		
Eye	eye		
Picture	/mæmæmæs sə sə pʊtʃə/		
Tractor	/kræktə/		
Fruit	/kru:p/		
Fork	soup		
Heart	/su:zæn hædrə hænənən hʌtʃ/		
Butterfly	/kri:mbʌs/		
Box	/kri:m du: ən bəsəsə/		
Knot	/kri:m kri: ʌm has bʌs/		
Table	/krambɪs/		
Bridge	/su:zəs bɪs bɪs/		
Cigar	(gestures smoking)		
Angel	lovely		
Chair	chair		
Whistle	whisper		
elephant	elephant		

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant JT: Action names (spoken)

Target	Response	Prompt	After prompt
Crawling	/krʊ:lɪn/		
Folding	/ənələləvən/		
Driving	/tʃɛz/ (gestures steering wheel)		/graɪvɪn/
Weighing	/tʒə/ doing (unintelligible jargon)		
Drinking	/kri:m/		
Roaring	scream		
Swimming	/tʃ tʃ tʃu:z ən ə bʌs/		
Snowing	/kləʊvɪn/		
Biting	a bite		
Diving	a /kəʊv/ and a /dəʊv/		
Eating	biscuit	“What's he doing?”	eating
Stopping	/kəsə ku: kəmləɪ/ (gestures hand up)		
Floating	/ʌv (...) ənd/		
Yawning	/swu: su:tɪn/		
Dreaming	/stri:m/ and a /bas/		
Raking	/bri:mɪn/ the leaves		
Juggling	/tʃu:z/ (gestures juggling)		
Skating	/tʃu:zɪn ʃu:zin ə bas/		
Playing	/swu: smu:ðɪn a smu:z/		
Kicking	shooting a tree		
Sliding	/skru:m kru:m/ /kæmbəliŋ/ down		
Lighting	lighting candle		
Knocking	/kə kɔ:fɪnɪn/ (gestures knocking)		
Tickling	she's got a /kʊnwɪn/ and a /gaɪs/		
Leaning	/klævəlɪn/ on a /bɒs/		
Watching	come a /si:vɪn/		
Begging	he's /kʊ/ /spɛə bəbəbə kam/		
Crying	/skri:din/ and a boy		
Pinching	(gestures pinching) /bʌst/		
Painting	/dʌs bɒs/ and ɪ guess		
Sinking	half		
Tying	choosing a /nɒs/		
Walking	/wɔ:tʃin/		
Kneeling	well... (unintelligible) ... kneeling		
Blowing	/kri:m/ and a leaf and a leaf /skri:m/		
Running	(unintelligible jargon)		
Skipping	come /kʌmbhav/ have school		
Smoking	(unintelligible jargon)		
Praying	(unintelligible jargon)		
Sewing	/əs kri:mɪn wəlɪn lə/		
Dancing	/dʒʌntʃɪn/		
Catching	/kɔ əlɪn/ a ball		
Building	he wall ... he /ma:l/ (unintelligible)		
Melting	/sku:l/ (unintelligible)		
Riding	/krɛɪsɪs/ and up		
Combing	/kɪpʊ/ lovely having /skɒn/		
Shooting	gun	“what's he doing?”	shooting
Posting	choosing a ..		
Waving	(unintelligible jargon)		
Pushing	calling		

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant BP: Object names (Spoken)

Target	Response	Prompt	After prompt
Tie	tie		
Candle	candle		
Stamp	stamp		
Tongue	no	Ph cue	tongue
Cow	(writes C) udder, no	Ph cue	cow
Bone	bone		
Umbrella	A brollie		
Dog	dog		
Collar	Tie, no	Ph cue	Collie, collar
Hammock	no	Ph cue	hammock
Spoon	spoon		
Strawberry	(writes S)	Ph cue	strawberries
Belt	belt		
Gate	Oh smart! gate		
Road	Winding …..path, no		
Tree	(writes T) …. Good grief! (writes tre)		
Letter	Lick maybe? …. stick		
Banana	banana		
Bed	bed		
Shoe	shoes		
Drum	drum		
Cherry	(writes chea) no	Ph cue	cherries
Conductor	Em…/hɒskɪs/ orchestra	"Who's he?"	/fɪsəm fəmlɪn/
Shower	No	Ph cue	shower
Ball	ball		
Curtain	Hang in …..screen	"it's on a window"	curtain
Nun	Good grief! (writes M) no	Ph cue	nun
King	orb	"who is he?"	coronation
Hospital	hospital		
Pram	baby	Ph cue	pram
Circle	ball	"what shape?"	I don't know
Roots	spines	"underground"	I don't know
Piano	piano		
Lion	lion		
Eye	eye		
Picture	picture		
Tractor	(draws furrow) furrow		
Fruit	Banana, pear	Ph cue	fruit
Fork	knife	"are you sure?"	fork
Heart	heart		
Butterfly	butterfly		
Box	carton		
Knot	rope	"tied in a…"	bow
Table	(writes tr) no… door, no		
Bridge	arc		
Cigar	Fag, no	Ph cue	Cigarette, no
Angel	Good grief! I don't know … harp?		
Chair	chair		
Whistle	(gestures blowing whistle)	Ph cue	whistle
elephant	(Writes e) oh dear	Ph cue	/elefitz/

APPENDIX G (contd.) TRANSCRIPTS OF OBJECT AND ACTION NAMING BATTERY RESPONSES

Participant BP: Action names (spoken)

Target	Response	Prompt	After prompt
Crawling	Baby	What's he doing?	Falling down
Folding	Don't know		
Driving	Car ....driving		
Weighing	No ...		
Drinking	A cup...tea...drinking. Hooray!		
Roaring	lion	What's he doing?	eating
Swimming	no	What's he doing?	swimming
Snowing	snowman		
Biting	Leg ... Ow!		
Diving	no		
Eating	Supper. Biscuits..Eating. Hooray!		
Stopping	bobby	What's he doing?	Stop!
Floating	Away .... cork		
Yawning	(gestures yawning) Yawn		
Dreaming	riding		
Raking	leaves	What's he doing?	Bag. holding
Juggling	carrying		
Skating	ice		
Playing	baby	What's he doing?	No I don't know
Kicking	Ball	What's he doing?	Carrying. Football goal
Sliding	slide		
Lighting	Candle... burning		
Knocking	door	What's he doing?	"Come in!"
Tickling	ho, ho, ho ...		
Leaning	no		
Watching	television	What's he doing?	watching
Begging	"Please!"	What's he doing?	holding
Crying	crying		
Pinching	(gestures pinching) No		
Painting	painting		
Sinking	/taɪtɪk tanɪk/ [aiming for Titanic]		
Tying	shoe	What's he doing?	lacing
Walking	(gestures with fingers) walking		
Kneeling	I don't know		
Blowing	(gestures blowing) blowing		
Running	running		
Skipping	(gestures turning rope)	What's he doing?	skipping
Smoking	Oh bad! (coughs) .... smoking		
Praying	Ha! No ... no		
Sewing	Darning (sewing machine noise)		
Dancing	(hums tune) no	What's he doing?	dancing
Catching	Ball	What's he doing?	carrying
Building	Trowel	What's he doing?	(gestures plumb-line)
Melting	Ho ho ho! /sufedz/	what's happening?	away
Riding	the horse ... Carrying	What's he doing?	
Combing	comb		
Shooting	bang	What doing?	(draws bullet)
Posting	letter	What doing?	powering
Waving	Bye bye ... waving		
Pushing	No. carrying the ...		

APPENDIX H

FULL LIST OF STIMULI FOR THE EVENT PERCEPTION TEST (Marshall, Chiat & Pring 1999)

Stimulus	Target	Distractor	Type
E1 Slicing orange	Slicing apple	Eating bread	
E2 Paint dripping	Bucket dripping	Filling bucket	
E3 Spray car	Spray flowers	Filling bucket	

1	Peeling apple	Peeling potato	Eating bread	G
2	Burning trousers	Burning newspaper	Cutting bread	DS
3	Throwing ball	Throwing pram	Passing baton	CS
4	Opening tin	Opening car boot	Carrying chair	G
5	Giving boat	Giving present	Lending book	CS
6	Pushing car	Pushing wheelbarrow	Washing window	G
7	Singing	Singing	Playing (music)	CS
8	Dropping newspaper	Dropping boat	Burning trousers	G
9	Pouring water	Pouring milk	Breaking window	G
10	Opening window	Opening car boot	Closing door	CS
11	Giving boat	Giving picture	Opening door	G
12	Car rolling	Stone rolling	Cake burning	G
13	Pulling pram	Pulling horse	Pushing barrow	CS
14	Washing trousers	Washing car	Drying hair	DS
15	Throwing bone	Throwing pram	Pushing pram	DS
16	Pouring (bucket)	Pouring (jug)	Paint dripping	CS
17	Pulling horse	Pulling rope	Feeding dog	G
18	Peeling potato	Peeling orange	Mashing banana	CS
19	Spattering chair	Man spattered	Spraying garden	CS
20	Burning wheelbarrow	Burning paper	Pushing car	G
21	Chasing horse	Chasing girl	Leading man	DS
22	Car falling	Stone falling	Ball rolling	DS
23	Painting table	Painting wall	Polishing car	CS
24	Eating dinner	Eating apple	Feeding dog	DS
25	Pouring milk	Pouring water	Spraying car	DS
26	Opening box	Opening window	Cutting trousers	DS
27	Pushing pram	Pushing car	Pulling rope	CS
28	Ball rolling	Car rolling	Top spinning	CS
29	Covering car	Covering wheelbarrow	Washing trousers	G
30	Dropping boat	Dropping glass	Chest sinking	CS
31	Woman singing	Man singing	Women talking	DS
32	Woman reading	Man reading	Man writing	CS
33	Glass breaking	Chair breaking	Carrying box	G
34	Throwing ball	Throwing bone	Opening door	G
35	Eating banana	Eating bread	Drinking tea	CS
36	Giving picture	Giving present	Showing neck	DS

APPENDIX H (contd.) FULL LIST OF STIMULI FOR THE EVENT PERCEPTION TEST

Stimulus		Target	Distractor	Type
37	Pushing wheelbarrow	Pushing pram	Throwing pram	DS
38	Stone rolling	Ball rolling	Car falling	DS
39	Boy singing	Woman singing	Opening tin	G
40	Man reading	Woman reading	Burning trousers	G
41	Breaking window	Breaking glass	Opening box	CS
42	Eating apple	Eating banana	Cutting bread	G
43	Pulling rope	Pulling pram	Loading lorry	DS
44	Covering chicken	Covering wheelbarrow	Filling bucket	CS
45	Washing window	Washing trousers	Ironing shirt	CS
46	Dropping glass	Dropping newspaper	Scattering	DS
47	Reading to boy	Woman reading	Giving present	DS
48	Breaking chair	Breaking window	Sawing wood	DS
49	Washing car	Washing window	Pushing pram	G
50	Painting chair	Painting table	Breaking window	G
51	Kite falling	Plane falling	Rocket rising	CS
52	Chasing man	Chasing dog	Following man	CS
53	Cake burning	Car burning	Chop cooking	CS
54	Car spattering man	Spattering wall	Bucket dripping	DS
55	Covering car	Covering chicken	Loading lorry	DS
56	Painting wall	Painting chair	Paint dripping	DS
57	Car falling	Kite falling	Cake burning	G
58	Chasing dog	Chasing girl	Giving present	G
59	Spattering wall	Spattering chair	Sawing wood	G
60	Peeling apple	Peeling orange	Cutting bread	DS

APPENDIX J

FULL LIST OF STIMULI FOR THE ROLE VIDEO (Marshall, Pring & Chiat 1993)

A) Non-reversible events			
VIDEO SCENE	PHOTOGRAPHS		
	Target	Role distractor	Event distractor
1. Hammer smashing cup	Broken cup	Broken plate	Full cup
2. Cutting apple in half	Cut apple	Cut orange	Peeled apple
3. Man washing plate	Clean plate	Clean saucepan	Broken plate
4. Woman covering chair	Covered chair	Covered table	Overturned chair
5. Woman burning newspaper	Burnt newspaper	Burnt box	Torn newspaper
6. Man sawing wood	Sawn wood	Sawn chair leg	Broken wood
7. Filling bucket	Full bucket	Full glass	Broken bucket
8. Man ironing shirt	Ironed shirt	Ironed trousers	Crumpled shirt
9. Mashing banana	Mashed banana	Mashed avocado	Sliced banana
10. Woman putting boxes into car	Boxes in car boot	Empty car boot	Boxes on trolley
11. Woman opening window	Open window	Open door	Closed window
12. Woman folding newspaper	Folded newspaper	Folded trousers	Torn newspaper
13. Slicing apple	Sliced apple	Sliced bread	Cored apple
14. Woman closing suitcase	Closed suitcase	Closed box	Packed suitcase
15. Peeling potato	Peeled potato	Peeled apple	Sliced potato
16. Man polishing spoon	Polished spoon	Polished fork	Bent spoon

APPENDIX J (contd.) FULL LIST OF STIMULI FOR THE ROLE VIDEO

B) Reversible events: 1 – 8 People acting on people; 9 - 16 Change of possession			
VIDEO SCENE	PHOTOGRAPHS		
	Target	Role distractor	Event distractor
1. Man shoots woman	Woman lying on ground	Man lying on ground	Woman doing up coat
2. Woman shoots man	Man lying on ground	Woman lying on ground	Man doing up coat
3. Man splashes woman	Woman with wet hair	Man with wet hair	Woman with eye patch
4. Woman splashes man	Man with wet hair	Woman with wet hair	Man with eye patch
5. Man trips woman	Woman on ground	Man on ground	Woman doing up coat
6. Woman trips man	Man on ground	Woman on ground	Man doing up coat
7. Man punches woman	Woman with eye patch	Man with eye patch	Woman with wet hair
8. Woman punches man	Man with eye patch	Woman with eye patch	Man with wet hair
9. Man throws ball to woman	Woman holding ball	Man holding ball	Woman holding letter
10. Woman throws ball to man	Man holding ball	Woman holding ball	Man holding letter
11. Man sells camera to woman	Woman holding camera	Man holding camera	Woman holding letter
12. Woman sells camera to man	Man holding camera	Woman holding camera	Man holding letter
13. Man gives flowers to woman	Woman holding flowers	Man holding flowers	Woman holding camera
14. Woman gives flowers to man	Man holding flowers	Woman holding flowers	Man holding camera
15. Man sends letter to woman	Woman holding letter	Man holding letter	Woman holding flowers
16. Woman sends letter to man	Man holding letter	Woman holding letter	Man holding flowers

APPENDIX K

FULL LIST OF STIMULI FOR THE NOUN POINTING TASK

Stimulus		*Pictures*			
Two nouns list	vase, chair	CHAIR	VASE	MUG	
	flower, book	BOOK	BUCKET	FLOWER	
	ball, table	BALL	CASE	TABLE	
	cushion, apple	BOX	APPLE	CUSHION	
	flower, chair	FLOWER	CHAIR	BUCKET	
	box, chair	HAMMER	CHAIR	BOX	
	Mary, book	FLOWER	MARY	BOOK	
	case, John	CASE	APPLE	JOHN	
	chair, Anne	ANNE	CHAIR	BILL	
	John, vase	VASE	MARY	JOHN	
Three nouns list	flower, apple, ball	APPLE	BALL	FLOWER	CASE
	vase, table, mug	VASE	BOX	TABLE	MUG
	chair, ball, cushion	CASE	CHAIR	CUSHION	BALL
	table, book, apple	BOOK	APPLE	VASE	TABLE
	box, flower, case	BOX	CASE	BUCKET	FLOWER
	table, Mary, flower	MARY	MUG	TABLE	FLOWER
	Bill, chair, box	BOX	BILL	CHAIR	APPLE
	Anne, case, John	JOHN	CASE	BUCKET	ANNE
	Bill, Mary, flower	BOOK	FLOWER	BILL	MARY
	Anne, mug, Bill	MUG	ANNE	BOOK	BILL
<u>Two names sentence</u>	Anne saw Mary	MARY	BILL	ANNE	
	John saw Bill	ANNE	JOHN	BILL	
	Bill hit Anne	BILL	ANNE	MARY	
	John hit Bill	JOHN	MARY	BILL	
	Anne knew Mary	MARY	ANNE	JOHN	
	John knew Anne	BILL	ANNE	JOHN	
	Mary called Anne	ANNE	BILL	MARY	
	Mary called John	JOHN	MARY	ANNE	
	Anne kissed John	MARY	JOHN	ANNE	
	Bill kissed Anne	BILL	ANNE	MARY	

APPENDIX K (contd.) FULL LIST OF STIMULI FOR THE NOUN POINTING TASK

	Stimulus	*Pictures*			
One name, two nouns sentence	Mary cut the apple with a knife	MARY	APPLE	SCISSORS	KNIFE
	John hit the ball with a bat	BAT	BALL	JOHN	HAMMER
	Bill signed the book with a pen	PEN	LETTER	BILL	BOOK
	Mary wiped the vase with a sponge	TISSUE	MARY	SPONGE	VASE
	Bill broke the chair with a hammer	BILL	HAMMER	BAT	CHAIR
	Anne cut the box with scissors	BOX	SCISSORS	ANNE	BOOK
	Bill hit the table with a hammer	MUG	BILL	TABLE	HAMMER
	Anne wrote a letter with a pen	LETTER	PENCIL	PEN	ANNE
	John wiped the table with a tissue	JOHN	TISSUE	TABLE	VASE
	Mary broke the vase with a bat	MUG	VASE	MARY	BAT
Two names, one noun sentence	John hit Bill with a bat	BILL	BAT	JOHN	HAMMER
	Anne showed the book to John	JOHN	ANNE	BOOK	BALL
	Mary poked John with a pencil	MARY	SCISSORS	JOHN	PENCIL
	John sent a flower to Anne	FLOWER	BOOK	ANNE	JOHN
	Mary hit John with a cushion	BAT	CUSHION	MARY	JOHN
	Bill offered an apple to Mary	BILL	APPLE	FLOWER	MARY
	Bill soaked Mary with a sponge	BUCKET	MARY	SPONGE	BILL
	Bill brought a cushion for Anne	CUSHION	ANNE	BILL	CHAIR
	Mary stabbed Bill with a knife	KNIFE	SCISSORS	MARY	BILL
	Mary borrowed a bucket from John	HAMMER	MARY	JOHN	BUCKET

APPENDIX L

FULL LIST OF STIMULI FOR THE REVERSIBLE SENTENCES COMPREHENSION TEST: Singles Version
(Byng & Black 1999)

Action verbs	Non-action verbs
The clown scolds the astronaut	The clown dreads the astronaut
The astronaut photographs the clown	The dancer surprises the cook
The cook protects the dancer	The vicar delights the sailor
The swimmer expels the workman	The sailor notices the vicar
The judge weighs the pilot	The nun astonishes the queen
The queen splashes the nun	The pilot impresses the judge
The judge grabs the pilot	The workman shocks the swimmer
The swimmer helps the workman	The nun sees the queen
The sailor washes the vicar	The swimmer hears the workman
The nun finds the queen	The pilot admires the judge
Adjectives	**Locatives**
The boxer is sad about the cowboy	The bag is inside the shoe
The dancer is sorry for the cook	The box is in the bucket
The pilot is pleasant to the judge	The rug is over the newspaper
The swimmer is cruel to the workman	The man is after the cow
The vicar is polite to the sailor	The chair is on the box
The queen is fond of the nun	The box is under the umbrella
The cook is rude to the dancer	The plane is above the cloud
The boxer is nasty to the cowboy	The bee is below the flower
The swimmer is friendly to the workman	The vase is under the television
The nun is shy of the queen	The boy is behind the bed

APPENDIX M

FULL LIST OF STIMULI FOR THE PERSPECTIVE VIDEO (Dipper 1999)

Training scenes

1. push/fall – unbiased
2. push/fall – biased to push
3. push/fall – biased to fall
4. borrow/lend – unbiased
5. borrow/lend – biased to borrow
6. borrow/lend – biased to lend

Experimental scenes

	Target	Verb labels		
1	PUSH PULL	PUSH	LIFT	PULL
2	PUSH	PULL	PUSH	LIFT
3	PULL	PUSH	LIFT	PULL
4	TAKE GIVE	TAKE	FEED	GIVE
5	GIVE	TAKE	GIVE	FEED
6	TAKE	EAT	GIVE	TAKE
7	POUR FILL	BREAK	POUR	FILL
8	POUR	SPILL	FILL	POUR
9	FILL	POUR	FILL	BREAK
10	SELL BUY	SELL	WRITE	BUY
11	SELL	SELL	WRITE	BUY
12	BUY	SELL	BUY	STEAL
13	CARRY RIDE	CARRY	RIDE	DROP
14	CARRY	DROP	CARRY	RIDE
15	RIDE	CARRY	RIDE	HIT
16	CHASE FLEE	CHASE	KICK	FLEE
17	CHASE	CHASE	FLEE	KICK
18	FLEE	FLEE	KICK	CHASE

APPENDIX N

FULL LIST OF STIMULI FOR THE EXPERIMENTAL EVENT DRAWING TASK

A. VISUAL CONDITION

Event type	Screen position	Cause-role	
		Put-type (Cause = Source)	*Pick*-type (Cause = Goal)
Position change	Cause on left	Girl puts book on table	Boy lifts box off table
		Girl throws ball into box	Girl takes ball out of box
		Boy puts box on chair	Boy takes cushion off chair
		Boy throws ball into bucket	Girl picks apple from bowl
	Source/ Goal on left	Girl puts vase on table	Girl lifts vase off table
		Boy drops ball into box	Boy takes book out of box
		Boy puts cup on table	Boy takes case from chair
		Girl drops flower into bucket	Girl picks flower from vase
		Give-type (Cause = Source)	*Take*-type (Cause = Goal)
Possession change	Cause on left	Boy gives vase to girl	Boy takes apple from girl
		Girl gives flower to boy	Girl takes book from boy
		Girl throws ball to boy	Boy grabs cushion from girl
		Boy sells book to girl	Girl buys apple from boy
	Source/ Goal on left	Girl gives cup to boy	Girl takes flower from boy
		Boy gives cup to girl	Boy takes box from girl
		Boy throws ball to girl	Girl grabs case from boy
		Girl sells apple to boy	Boy buys book from girl

APPENDIX N (contd.) FULL LIST OF STIMULI FOR THE EXPERIMENTAL EVENT DRAWING TASK

B. VERBAL CONDITION

Event type	Cause-role	
	***Put*-type (Cause = Source)**	***Pick*-type (Cause = Goal)**
Position change	Bill drops the ball into the box	Bill takes the ball out of the box
	Mary drops the apple into the bowl	Mary takes the apple out of the bowl
	Mary places the vase onto the table	Mary lifts the vase off the table
	Bill places the box onto the chair	Bill lifts the box off the chair
	Bill puts the flower into the vase	Bill picks the flower from the vase
	Mary puts the book on the table	Mary picks the book off the table
	Bill throws the cushion onto the chair	Bill grabs the cushion off the chair
	Mary throws the ball into the bucket	Mary grabs the ball from the bucket
	***Give*-type (Cause = Source)**	***Take*-type (Cause = Goal)**
Possession change	Bill sells the book to Mary	Bill buys the book from Mary
	Mary sells the book to Bill	Mary buys the book from Bill
	Mary gives the flower to Bill	Mary takes the flower from Bill
	Bill gives the flower to Mary	Bill takes the flower from Mary
	Bill throws the ball to Mary	Bill grabs the ball from Mary
	Mary throws the ball to Bill	Mary grabs the ball from Bill
	Bill passes the box to Mary	Bill takes the box from Mary
	Mary passes the box to Bill	Mary takes the box from Bill

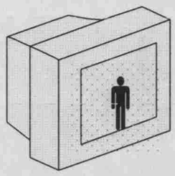
APPENDIX P

EVENT DRAWING TASK INSTRUCTIONS FOR PARTICIPANTS WITH APHASIA

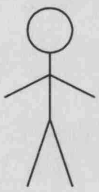
A. VISUAL CONDITION

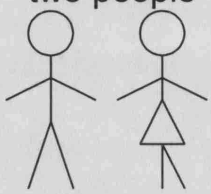
What do I have to do?

You will see a short video scene



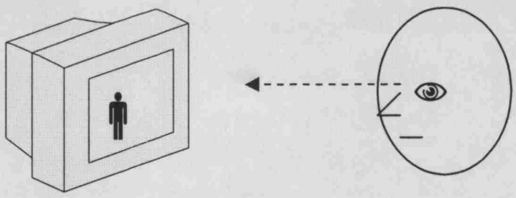
There may be one person OR two people



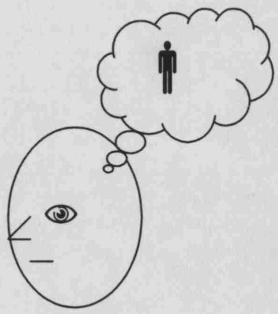


You have to:

- Watch the scene



- Try to remember what happens.

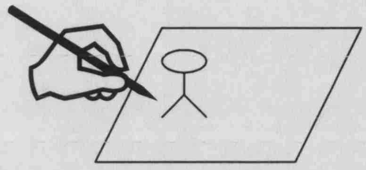


- If you can't remember, you can see it again

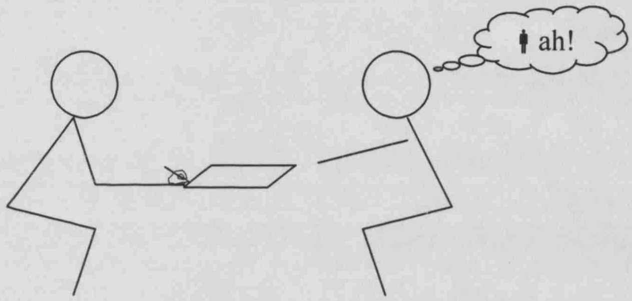
Appendix P (contd.) EVENT DRAWING TASK INSTRUCTIONS FOR PARTICIPANTS WITH APHASIA (visual condition)

Then you have to:

- **Draw** the **main thing** that happens

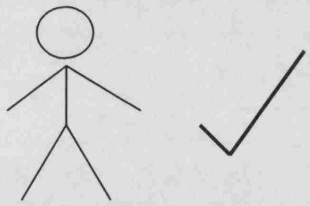


- Pretend you are trying to **get this across to somebody else**.



YOU DON'T HAVE TO DO A "GOOD" DRAWING

Too good



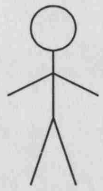
Good enough

Try to draw only the MAIN thing that happens.
You don't have to put in any details.

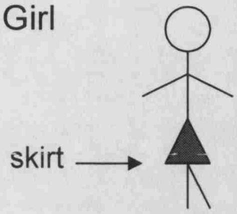
Appendix P (contd.) EVENT DRAWING TASK INSTRUCTIONS FOR PARTICIPANTS WITH APHASIA (visual condition)

For people, draw stick figures, e.g.

Boy



Girl



You can use arrows → ←

And other symbols e.g. **£**

But not words ~~BOOK~~

APPENDIX P (contd.)

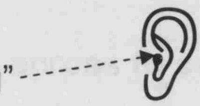
EVENT DRAWING TASK INSTRUCTIONS FOR PARTICIPANTS WITH APHASIA

B. VERBAL CONDITION

<u>What do I have to do?</u>

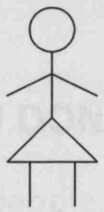
You will hear a short sentence

"Mary is reading"

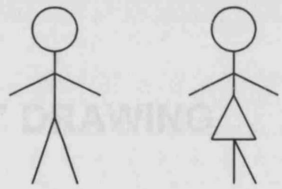


You may hear **one person's name** OR **two people's names**

MARY



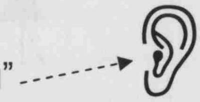
BILL **MARY**



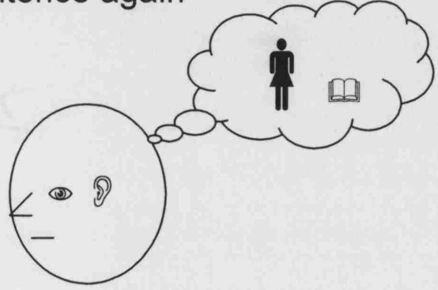
You have to:

- Listen carefully to the sentence

"Mary is reading"



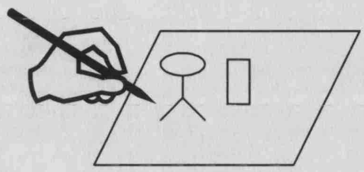
- Try to understand the sentence and remember what happens
- You can ask to hear the sentence again



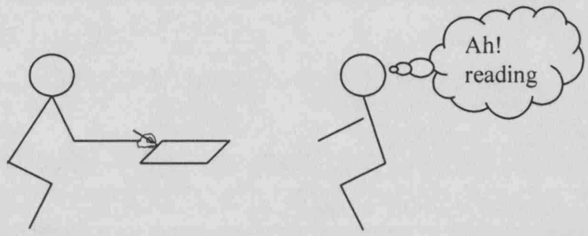
Appendix P (contd.) EVENT DRAWING TASK INSTRUCTIONS FOR PARTICIPANTS WITH APHASIA (verbal condition)

Then you have to:

- Draw the **main thing** that happens in the sentence



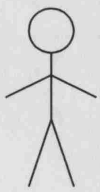
- Pretend you are trying to **get this across to somebody else**.



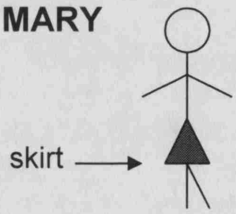
YOU DON'T HAVE TO DO A "GOOD" DRAWING

For people, draw stick figures, e.g.

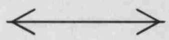
BILL



MARY



You can use arrows



and other symbols e.g.

£

But not words ~~BOOK~~

APPENDIX Q

EVENT DRAWING TASK INSTRUCTIONS FOR CONTROL PARTICIPANTS

A. INSTRUCTIONS FOR VISUAL CONDITION

What do I have to do?

You will see a short video scene involving one or two people and something happening.

You have to:

- Watch the scene and try to remember what happens. You may ask for repetitions if you can't remember it the first time.
- Draw the **main thing** that happens in the scene, ***as if you were trying to get it across to somebody else.***
- **YOU DON'T HAVE TO DO A "GOOD" DRAWING.** The quality of the drawing is not the important thing.
- Try to include only the main things that are relevant to getting the message across. You don't need to put in unnecessary detail.

For people, draw stick figures, e.g.

You can use arrows and other symbols, e.g. £, but no written words.

APPENDIX Q (contd.)

EVENT DRAWING TASK INSTRUCTIONS FOR CONTROL PARTICIPANTS

B. INSTRUCTIONS FOR VERBAL CONDITION

What do I have to do?

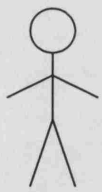
You will hear a short sentence describing an event involving one or two people.

You have to:

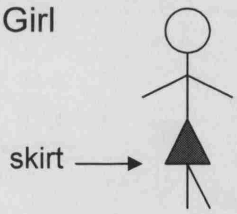
- Listen to the sentence and try to remember what happens. You may ask for repetitions if you can't remember it the first time.
- Draw the **main thing** that happens in the sentence, ***as if you were trying to get it across to somebody else.***
- **YOU DON'T HAVE TO DO A "GOOD" DRAWING.** The quality of the drawing is not the important thing.
- Try to include only the main things that are relevant to getting the message across. You don't need to put in unnecessary detail.

For people, draw stick figures, e.g.

Boy



Girl



You can use arrows and other symbols, e.g. £, but no written words.

APPENDIX R

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

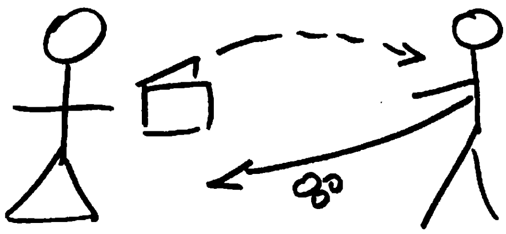
(Drawings are reduced to approximately half their original size)

EXAMPLE 1. Control participants' drawings showing inclusion of money symbol and double-arrow strategy in *buy/sell* events

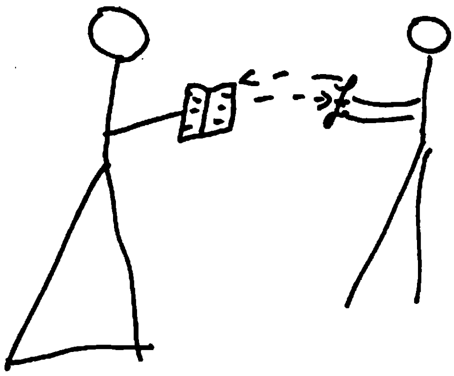
A. Verbal condition

Stimulus sentence: Mary sells the book to Bill

AS

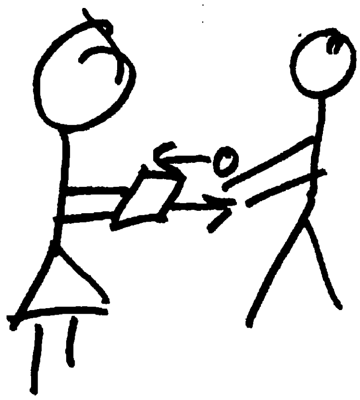


HS



HH

JA



APPENDIX R (contd.)

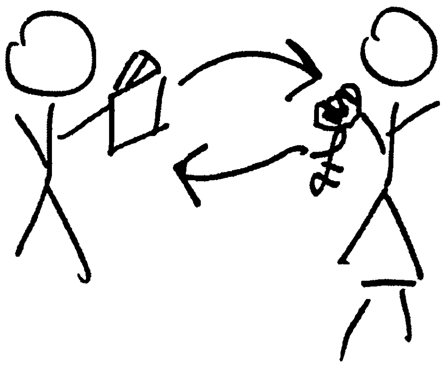
EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 1(continued). Control participants' drawings showing inclusion of money symbol and double-arrow strategy in *buy/sell* events

B. Visual condition

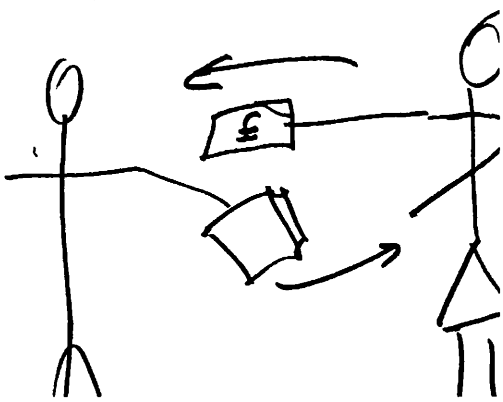
Stimulus event: Girl buys book from boy

HH

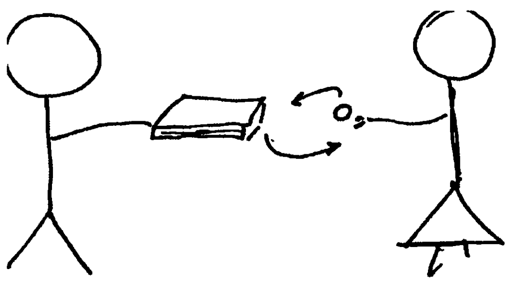


JA

MW



RS



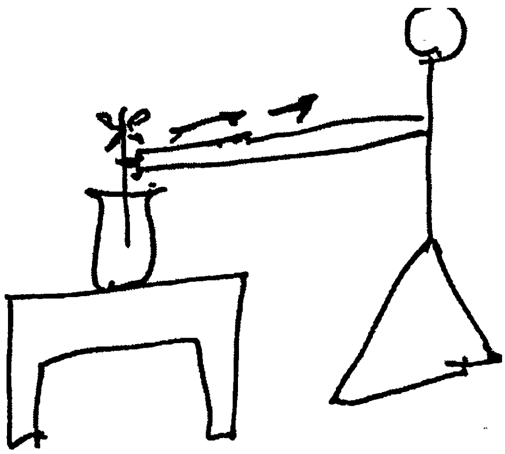
APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

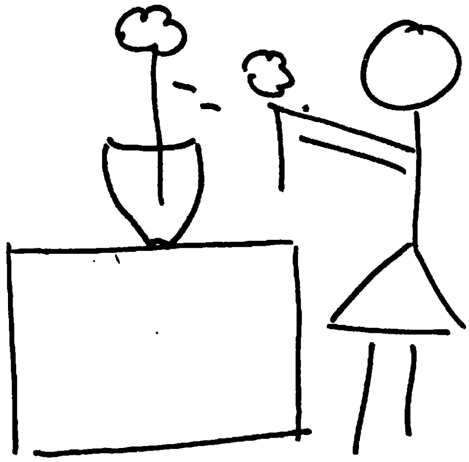
EXAMPLE 2: Inclusion of a table as support for the Source/Goal entity in visual position change events

Stimulus event: Girl takes flower out of vase

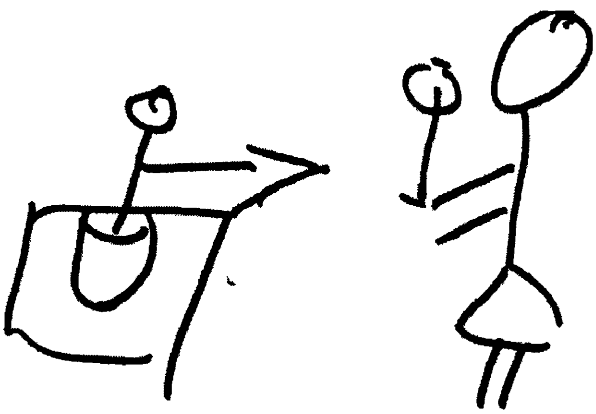
HS



JH



JA



APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

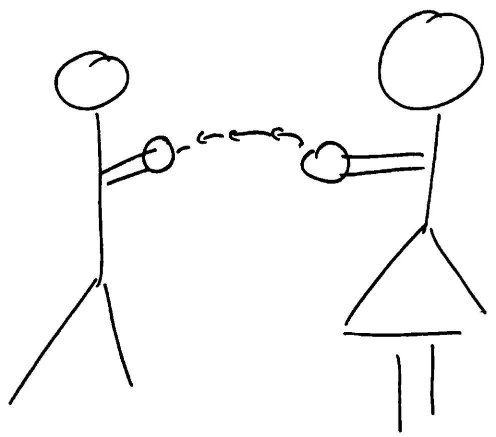
EXAMPLE 3: Use of double-arrow strategy in *throw* and *grab* events

A) *Throw* events

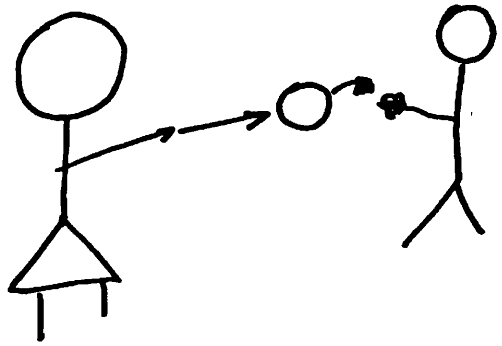
Verbal condition:

Stimulus sentence: Mary throws the ball to Bill

JR



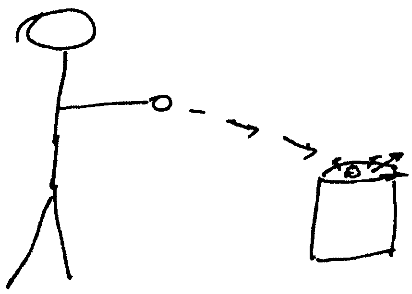
RS



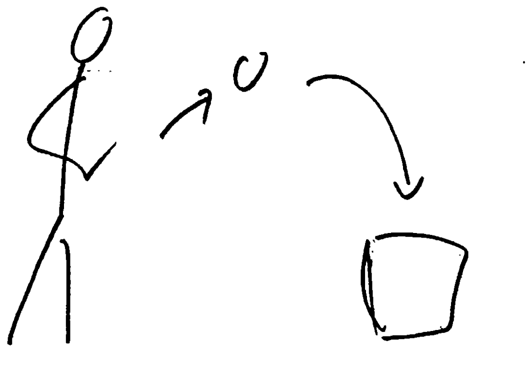
Visual condition:

Stimulus event: Boy throws ball into bucket

HS



MW



APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

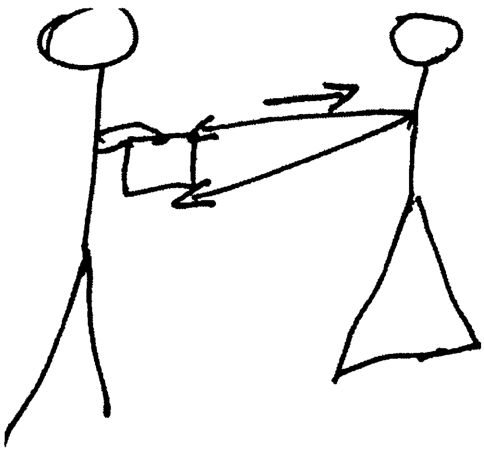
EXAMPLE 3, continued: Use of double-arrow strategy in *throw* and *grab* events

B) G*rab* events

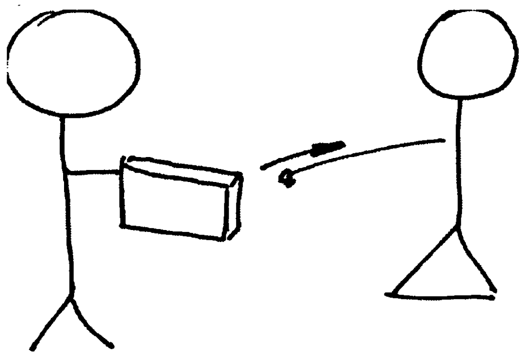
Visual condition.

Stimulus event: Girl grabs case from boy

HS



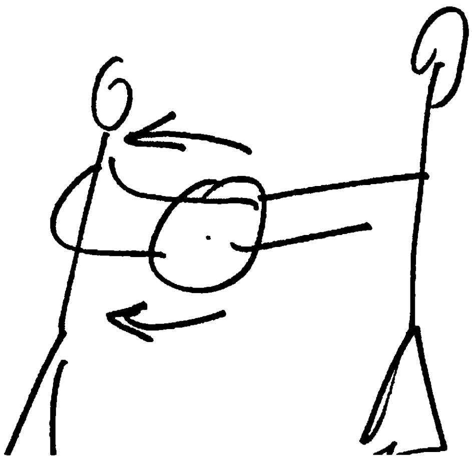
RS



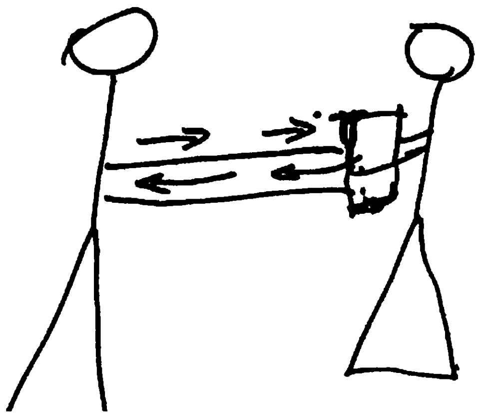
Verbal condition:

Stimulus sentence: Bill grabs the cushion from Mary

MW



HS



APPENDIX R (contd.)

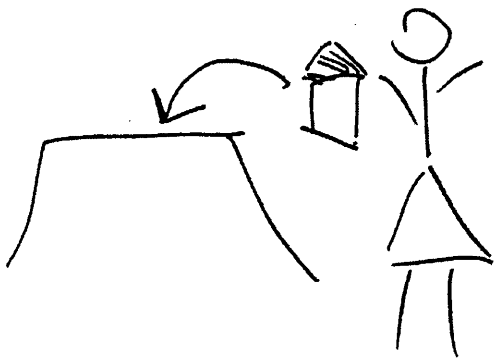
EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 4: Examples of different arrow positions in control participants' drawings

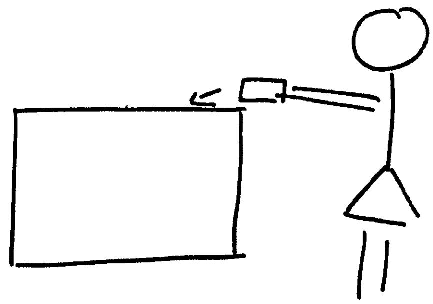
A) Theme to end position

Visual condition
Stimulus event: Girl puts book on table

HS

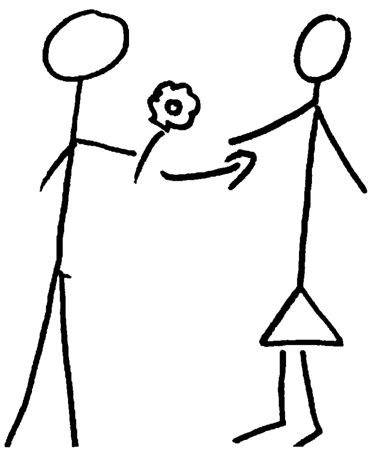


JR

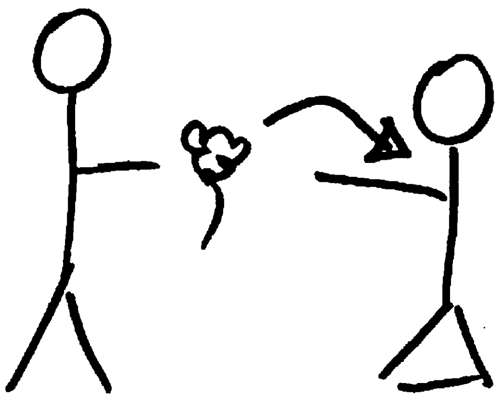


Stimulus event: Girl takes flower from boy

DEB



AS



APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 4 (continued): Examples of different arrow positions in control participants' drawings

A) Theme to end position (contd.)

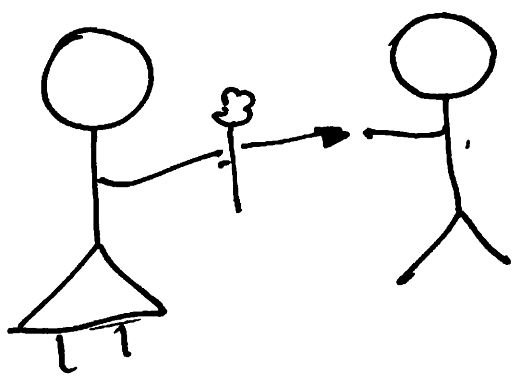
Verbal condition
Stimulus sentence: Bill picks the ball out of the box

HH

JA

Stimulus sentence: Mary gives the flower to Bill

RS



RW

APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 4, continued: Examples of different arrow positions in control participants' drawings

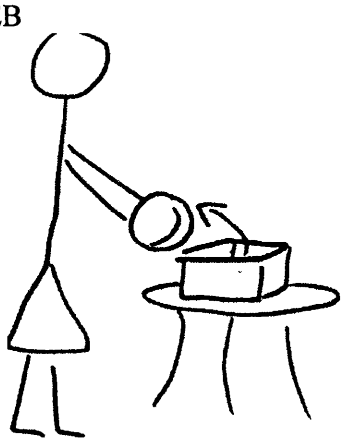
B) Start position to Theme

Visual condition:

Stimulus event:

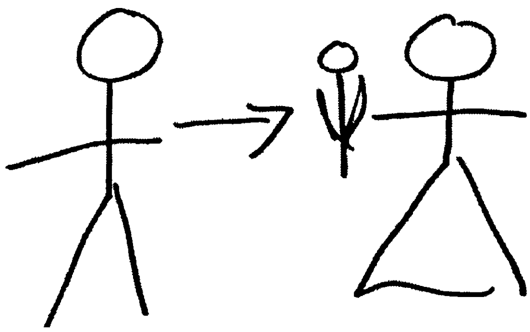
Girl takes ball out of box

DEB



Girl takes flower from boy

JA

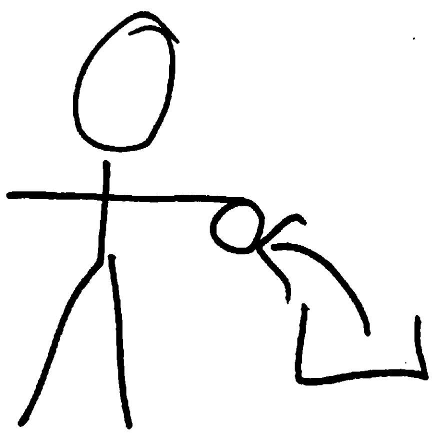


Verbal condition:

Stimulus sentence:

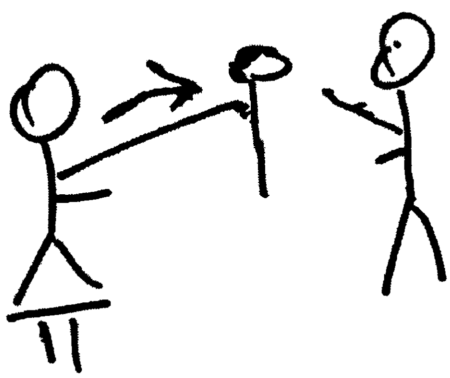
The boy picks the ball out of the box

JA



The girl gives the flower to the boy

TH



APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 4 (continued): Examples of different arrow positions in control participants' drawings

C) Start position to end position

Visual condition:

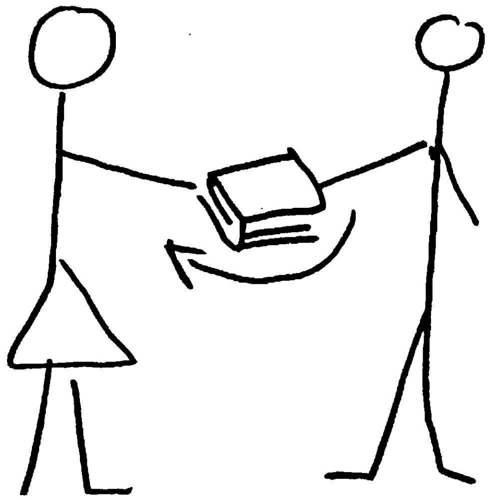
Stimulusevent:

Boy picks cushion off chair

MW

Girl takes book from boy

DEB

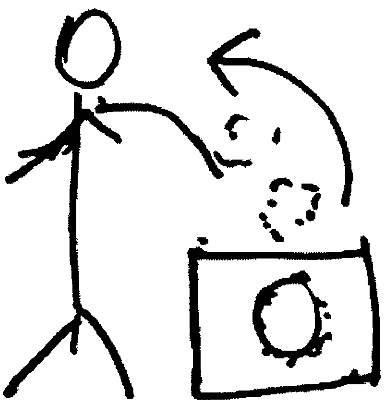


Verbal condition:

Stimulus sentence:

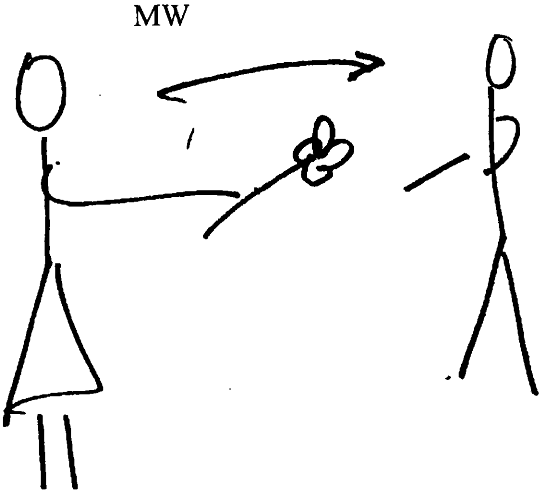
The boy picks the ball out of the box

TH



The girl gives the flower to the boy

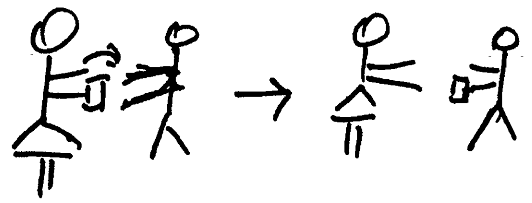
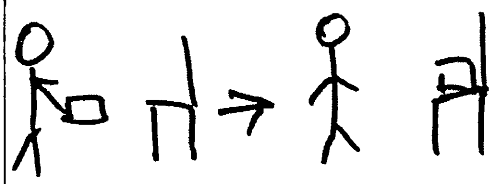
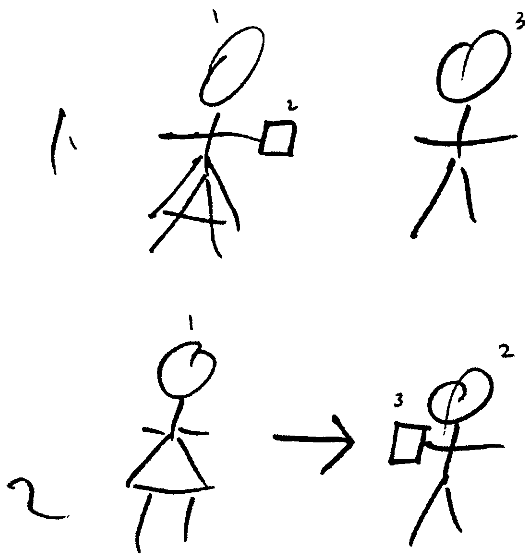
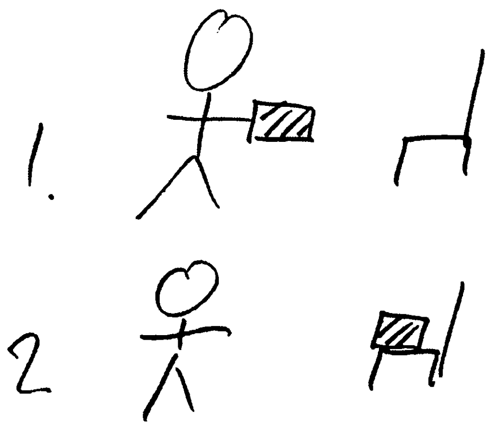
MW



APPENDIX R (contd.)

EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 5: Use of strip cartoon strategy in visual condition by participants TH and JZ

Stimulus: Girl gives cup to boy	Stimulus: Boy puts box on chair
TH 	TH 
JZ 	JZ 

APPENDIX R (contd.)

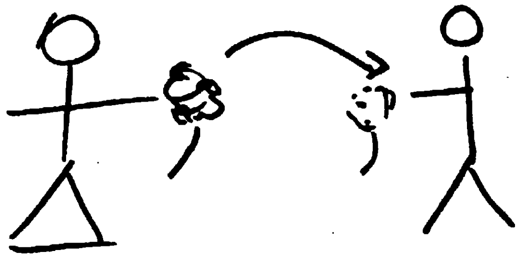
EXAMPLES OF CONTROL PARTICIPANTS' DRAWINGS

EXAMPLE 6: Use of double-Theme strategy by control participants

Verbal condition:

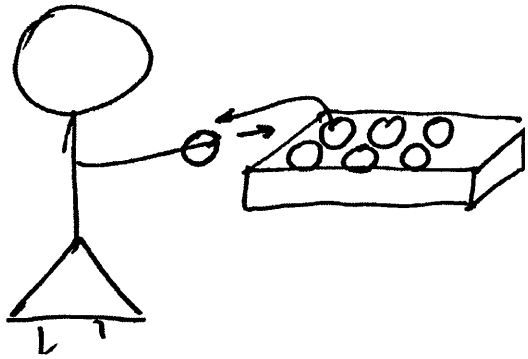
Stimulus sentence:
Mary gives the flower to Bill

AS



Mary takes the apple out of the bowl

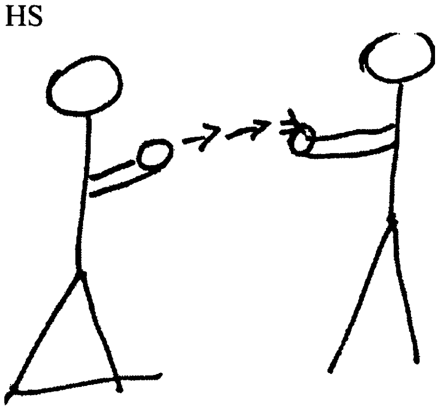
RS



Visual condition:

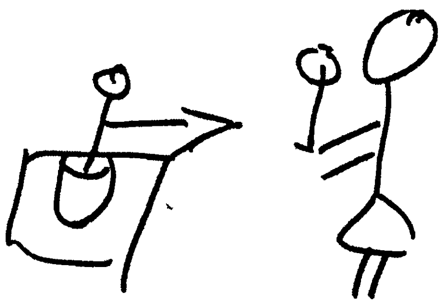
Stimulus event:
Girl throws ball to boy

HS



Girl picks flower out of vase

JA



APPENDIX S

CONTROL STUDY, ANALYSIS 6: TEMPORAL ORDER OF DRAWING.

Total number of temporal order response types A, B, C & D produced by individual control participants(maximum per cell = 8). (The totals do not always add up to 32, due to the exclusion of response types E & F from the analysis.)

A) VISUAL CONDITION

	CSPOS				CSPOSS				CGPOS				CGPOSS				Total
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
AS	5	3	0	0	5	2	0	1	5	3	0	0	1	4	0	3	**32**
DEB	8	0	0	0	5	0	3	0	8	0	0	0	2	1	5	0	**32**
HH	3	0	0	4	7	0	0	0	0	2	6	0	2	1	4	1	**30**
HS	3	4	0	1	5	0	0	3	0	7	1	0	1	2	4	1	**32**
JA	4	3	0	1	3	2	0	3	3	5	0	0	3	1	2	2	**32**
JH	2	1	0	5	5	2	0	1	1	3	4	0	0	0	5	3	**32**
JR	7	1	0	0	8	0	0	0	0	7	1	0	1	1	5	0	**31**
JZ	6	0	0	2	6	0	1	0	0	5	3	0	0	1	5	1	**30**
MW	6	0	1	1	5	0	0	3	0	0	3	0	3	1	1	2	**26**
RS	3	1	0	4	5	1	0	2	2	2	2	2	0	4	3	1	**32**
RW	3	4	1	0	2	3	1	2	3	4	1	0	2	2	2	2	**32**
TH	5	2	0	1	5	2	0	1	0	6	2	0	1	3	4	0	**32**
Total	**55**	**19**	**2**	**19**	**61**	**12**	**2**	**16**	**22**	**44**	**23**	**2**	**16**	**21**	**40**	**16**	**373**

B) VERBAL CONDITION

	CSPOS				CSPOSS				CGPOS				CGPOSS				Total
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
AS	8	0	0	0	8	0	0	0	7	1	0	0	8	0	0	0	**32**
DEB	8	0	0	0	8	0	0	0	8	0	0	0	5	3	0	0	**32**
HH	4	2	0	1	7	1	0	0	0	4	4	0	0	6	2	0	**31**
HS	7	1	0	0	8	0	0	0	3	3	1	1	1	4	3	0	**32**
JA	8	0	0	0	7	1	0	0	7	1	0	0	3	5	0	0	**32**
JH	1	2	0	5	8	0	0	0	0	2	5	1	2	2	2	2	**32**
JR	6	2	0	0	8	0	0	0	0	8	0	0	1	7	0	0	**32**
JZ	0	1	4	3	0	7	1	0	2	1	0	5	4	3	0	1	**32**
MW	7	0	0	1	8	0	0	0	6	1	1	0	6	2	0	0	**32**
RS	7	1	0	0	6	1	0	1	0	8	0	0	2	5	0	1	**32**
RW	2	3	0	3	5	3	0	0	1	6	0	0	2	5	0	1	**31**
TH	7	1	0	0	7	1	0	0	0	7	0	0	4	4	0	0	**31**
Total	**65**	**13**	**4**	**13**	**80**	**14**	**1**	**1**	**34**	**42**	**11**	**7**	**38**	**46**	**7**	**5**	**381**

Key: CSPOS = put*-type position change events; CSPOSS =* give*-type possession change events; CGPOS =* pick*-type position change events; CGPOSS =* take*-type possession change events.*