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Sentence Processing in Aphasia:

Single Case Treatment Studies

Volume II

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Chapter 10 Case Study 2 MM

10.1 The Subject

MM suffered a left CVA in January 1977 when she was 50. Her stroke resulted in severe dysphasia and a dense right hemiplegia. MM recalls a brief period of therapy immediately following her CVA but she was soon discharged on grounds of poor prognosis. Following self referral she attended the City Dysphasic Groups (CDG) three times a week between November 1989 and Easter 1993. This study was conducted between January 1991 and August 1992.

MM left school at 14 to work as a machinist in a clothing factory, where she was eventually promoted to supervisor. Prior to her CVA she was employed as a civil servant. She is married with one adult daughter, two step sons and two grand children. MM retains many interests and hobbies. She is a keen dress maker and is a member of several societies for people with disabilities. With her husband she campaigned for better transport services for members of the Dysphasic Groups, which included lobbying her MP. She learnt to drive after her CVA. She is a monolingual English speaker.

No information was available about MM's early speech and language presentation. Informal observations at the time of referral to CDG indicated that her comprehension was 'functional'. Speech was almost entirely limited to single words with severe word finding problems and dyspraxia. She made some use of supplementary gesture, which was enhanced by her subsequent therapy in CDG. She also employed some supportive writing which was largely confined to proper names and numbers. Administration of the BDAE yielded a diagnosis of Broca's Dysphasia.

10.2 Spontaneous Speech

Spontaneous speech (see table 10.1 and appendix 10.1) was hugely impoverished. Three attempts to elicit a corpus yielded just 70 analysable words (further elicitation was deemed inappropriate).

Table 1: Spontaneous Speech Samples

Description of weekend:

'Mother's Dayer Nicholamealsflowers.....er chocolates'

Description of an episode of 'Home and Away':

'er house ... dinnerniceoh yes drinkinger man..... er policeoh (gestures finger wagging) yes'

Account of the Cinderella Story:

'crying yes nice ... (writes '12' on pad) eleven o clock yes... er danceer wine cheerio ... er horses ... horses er twelve ... finishshoe ... no no no (gestures towards her feet) ah ball ...shoe ...shoes ... no no no big ones.

A simple quantitative analysis (table 10.2) showed an almost complete lack of structure. There were no utterances with verb argument structure and just one which combined arguments: 'Cinderella nice'. The two word utterance count includes 2 compound nouns: 'Mother's day' and 'leisure centre' and is therefore not a true reflection of her ability to create novel phrases. The proportion of verbs in MM's output was also reduced when compared with normal, and non-fluent dysphasic speakers (Saffran et al 1989).

In addition to the verb argument deficit, MM's output was morphologically impoverished. The proportion of closed class words was well below normal (Saffran et al 1989) and even this may be an over-estimation. Eight of MM's closed class words were isolated negative markers. Excluding these negatives would yield a closed class count of virtually nil. While most of MM's verbs were inflected these took the form of the nominal 'ing' form.

Table 10.2 Analysis of spontaneous utterances

Total number of words	70
Total number of utterances	62
Number of nouns	37
Number of verbs	12
Proportion nouns:verbs	3.1
Number of utterances with verb argument structure	0
Number of utterances with combined arguments	1
Number of phrases	5
Number of closed class words	10
Proportion of closed class words	.14
Proportion of inflected verbs	.83

Conclusion

MM displayed an almost total inability to signal verb argument relationships in her output. This seemed partly due to a verb production deficit, since the representation of verbs in her output was reduced. Furthermore most of her verbs carried the nominal 'ing' inflection, which raised doubt about their true status (in therapy tasks MM was known to produce pseudo verbs, such as 'chipping' and 'carroting' for eating). Morphological/syntactic features were almost completely lacking.

10.3 Investigations into Noun and Verb Production

An informal picture description task was used to test the hypothesis that MM had a specific verb anomia. Her attempts to say in a single word what people were doing in 12 simple action pictures are shown in table 10.3. Just 2 'verbs' were elicited: 'spooning' for feeding and 'gardening' for carrying. Her attempts illustrate the noun

preference seen in her spontaneous speech. For example she was able to say 'duster' but not 'dusting', and when she produced 'painting' she gestured the outline of the frame. Subsequent attempts to cue the verb still elicited nouns.

Table 10.3 Picture Description:

Target.	Production.
a man reading a book	'man ... chair ... book'
a woman driving a car	'my car ... ford escort .. blue ..(writes 'mirror') and er ford'
a man smoking a pipe	'man .. woman.. pipes .. jumper'
a woman dusting a shelf	'woman .. books .. duster.. blue .. shoes'
children watching television	'man no boy .. two .. girls.. telly'
a man carrying a box	'oh yes man .. shirt .. yellow .. gardening'
a man cutting bread	'man .. yellow .. shirt ..
a man closing a door	'cupboard door'
a woman feeding a baby	'baby .. baby .. spooning'
a man cutting a boy's hair	'man ..'
a woman giving a boy a present	'boy no girl no boy yes .. woman .. dress .. er boy good'
a man painting a picture of a girl	'girl .. father .. painting (gestures frame)..girl chairs .. painting'

The possible influence of frequency on performance was explored. Most of the verb targets in the 12 pictures were of high frequency, for example eight had ratings of over 100. The frequency range was 1264 - 9, and the group mean was 266 (stem ratings are used as any form of the verb would have been scored correct). The words MM did

produce in this task ranged in frequency from 2110 to 1. The mean rating was 241. Thirteen items had ratings below 100 and three below 10. Thus MM was able to access nouns and adjectives which were either of comparable or lower frequency than the verb targets. It seemed that MM's failure to produce verbs was not due to frequency.

MM's naming in this task revealed a curious perspective on the picture. She often mentioned quite 'peripheral' features of the pictures such as the furniture or people's clothes and most strikingly the mirror in the driving picture. Rather than focussing on the main event MM seemed to be simply listing everything that she could name.

More extensive investigations of MM's verb and noun production were subsequently conducted.

Noun/Verb Photos (Byng 1988)

In this task MM was required to 'name' 42 object and 42 action pictures. The target nouns and verbs shared phonological forms. For example the noun member of a pair showed a square of butter and the verb member someone buttering bread. The nouns and verbs were presented on separate occasions to avoid priming (see section 9.4).

MM's naming of these pictures revealed a significant advantage for the nouns (verbs: 16/42 vs nouns: 29/42 chi square = 6.89, $p < .01$). Given the complete lack of appropriate verbs in the above task her verb score here was surprisingly high. Her performance might have been boosted by the nature of the stimuli. MM tended to create pseudo verbs from nouns, eg in this task she produced 'cabbaging' for a woman spooning cabbage into a jar and 'needling' for someone threading a needle. It is possible that some of her correct verbs were more fortuitous applications of this strategy.

When 'verbs' were accessed there was no evidence of any structure. Most were produced in isolation or as part of a list of single words, eg:

'zips .. zipping'

'oranges .. tangerine .. peel'

Seventeen of the verb errors involved the production of associated nouns, such as 'bacon' for grilling. On five occasions she made either no response or only produced a gesture. There were two pseudo verbs and two inappropriate verbs. With the object pictures most errors were again associated nouns or no responses. Three of these associated responses seemed to be semantic errors: 'oven' for grill, 'record' for tape, and 'belt' for buckle.

The Definition Naming Test

In this test MM was asked to produce either a single noun or verb in response to a definition cue (see section 8.4). The targets were matched for frequency.

Once again MM found the nouns significantly easier to access than the verbs (verbs: 8/33 vs nouns: 22/33, chi square = 10.32, $p < .01$). There were 5 types of verb error: repetition of material in the definition (8); production of associated nouns (8) eg 'blood' for bleed and 'colours' for decorate; derivational errors (1) 'teacher' for teach; no response (5); and semantic errors (3) eg 'freezing' for melt, 'writing' for read and 'kneel' for bow. Most of the noun errors were no responses (8). There were also 3 errors in which associated nouns were produced, such as 'Town hall' for office. One of these seemed a clear semantic error: 'atlas' for globe.

This task supported the earlier observation that the noun>verb effect was not due to frequency, since the targets were matched. However MM's ability to access verbs might be frequency sensitive, since 6 of her 8 correct verbs had frequencies above the group median. No

frequency effect was evident with the nouns: 12 correct responses were above the median and 10 below.

Conclusions from the Naming Tasks

MM's naming of nouns was consistently better than verbs across a variety of tasks. Furthermore attempts to produce verbs often only stimulated associated nouns. The noun advantage occurred even when targets were matched for phonological form or frequency.

The tasks offered two early indicators of the site of MM's naming deficit. Firstly MM made a number of semantic errors, with both nouns and verbs, indicating a possible central semantic deficit. Secondly MM often named quite inconsequential aspects of pictures (see table 10.2), which suggested that she was failing to focus on the main event. Without this focus the drive for verb production would be markedly reduced.

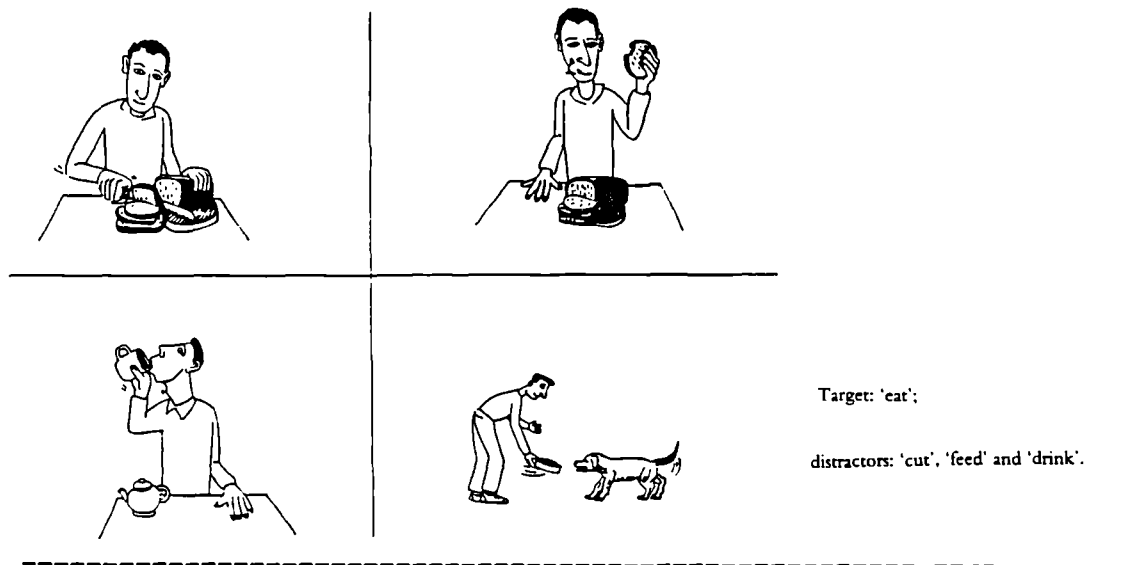
These two early hypotheses motivated the following investigations. Lexical semantics was investigated in a number of comprehension and input tasks (sections 10.4 - 10.5). The ability to conceptualise events was probed with the Event Perception Test and Role Video (section 10.6).

10.4 Investigations of Noun and Verb Semantics

It was hypothesised that MM's naming deficit might be due to disordered semantic representations. This would predict impaired lexical comprehension, particularly with verbs.

MM was asked to do a test in which a spoken verb is matched to one of four action pictures. These consisted of the target, an unrelated distractor and two semantically related distractors (Thus in figure 10.1: Target 'eat', Distractors 'cut', 'feed' and 'drink').

Figure 10.1 Example from MM's verb-picture matching test



Five non aphasic pilot subjects made no errors on this test. MM scored 17/22 and all errors involved selection of related distractors. Moreover, MM did slightly better on a similar test with nouns (Kay, Lesser and Coltheart 1992) where she scored 37/40. Though not a striking deficit the result was compatible with the view that MM's verb access problems might originate in the semantic system.

A second task permitted further comparisons between nouns and verbs. MM was shown a single picture and asked a yes/no question, eg:

picture	question
a man peeling an orange	is this peeling (verb test)
a man pushing a car	is this pulling (" ")
an axe	is this an axe (noun test)
a parachute	is this a plane (" ")

The questions either offered the target word, a semantic distractor, or a gross distractor. The tests are fully described in sections 8.6 and 8.7.

With the verb stimuli MM scored 84/100. Four errors involved the rejection of the target word. All others entailed the acceptance of a semantic distractor. Semantic distractors in this test were of two kinds. Twenty were semantically related to the target but syntactically different (SS distractors). For example the SS distractor for 'roll' was 'fall'. MM made 3 errors with this type of distractor (17/20). Twenty of the semantic distractors were both semantically and syntactically related (SI distractors). For example the SI distractor for 'spin' was 'roll'. These distractors were very close in meaning to the targets. Thus 'spin' and 'roll' both denote rotational movement which can be 'spontaneous' or initiated by an agent. They differ purely in the idiosyncratic feature of direction. With these distractors MM performed at chance (11/20).

MM scored 98/100 with nouns which was significantly better than her verb result (comparing nouns and verbs 98/100 vs 84/100 chi square = 10.32, $p < .01$). Both errors involved the acceptance of close semantic distractors.

Conclusions

MM made some semantic errors in all comprehension tests. However in the second task she was significantly more impaired when tested with verbs (despite the fact that the verb stimuli had higher frequency ratings than the nouns). MM retained some verb knowledge. She could differentiate targets from gross distractors and was above chance with the SS distractors. However when distractors were both semantically and syntactically related to the target her performance dropped to chance.

These tests only probed verbs' core meaning. They did not explore the structurally relevant aspects such as argument structure and mapping rules. This was investigated in the following assessments.

10.5 Investigation of Verb Argument Knowledge

MM's semantic difficulties with verbs may impair her access to the structural information encoded with them. Without this information she will not know which argument roles are specified by a verb or how they are mapped onto syntactic forms. This might impair both verb access and use.

Sentence Judgement Task

Sensitivity to verb argument information was investigated in a sentence judgement task. MM was presented with 76 spoken sentences, half of which contained violations. Of the 38 anomalous sentences 20 involved verb role violations, eg:

- a) The potato peels.
The dinner eats.
- b) The man falls the stone.
The thug dies the woman.
- c) The woman spills the floor.
The man fills the water.

Detection of these violations required knowledge about the number of arguments commanded by the verb and how those arguments are mapped onto syntax. (See section 8.9 for a fuller discussion of these stimuli).

The remaining 18 sentences violated either verb selection restrictions, eg:

The man writes the painting
or the relationship between the verb and an optional modifier, eg:
The man is swimming in the street.

Sensitivity to these latter violations did not depend on verb argument or mapping knowledge; they could be rejected purely by

accessing the core meaning of the verb. (MM was presented with an early version of this test which contained only 18 stimuli of this kind, compared with the final 20).

MM's scores were well above chance with both the correct sentences and the violations of selection restrictions (correct: 34/38; selection restriction violations: 15/18). Furthermore she displayed some ability to correct these anomalies. For example with 'the man skates on the water' she offered 'ice' as a suitable location. Although MM made a few errors (which was unsurprising given her impaired verb comprehension) it seemed that she could often access the general verb semantics required by these stimuli.

With the verb role violations MM was at chance (8/20). This suggested that she no longer retained the specific information about the number of arguments entailed by verbs or how they should be mapped onto sentence positions. Instead she seemed to infer probable world events from the stimuli using an asyntactic interpretation of the key words. For example with 'the man falls the stone' she gestured being hit on the head and said 'ambulance'.

This task suggested that the structural information encoded with verbs was no longer available to MM. Access to the components of verb semantics which do not control syntax was better preserved. This was evaluated further in a second sentence level task.

Sentence Anagram Task with Distractors

MM's knowledge of verbs was investigated further in a sentence ordering task (see section 8.8 for a full description). The task had two levels. At the first MM was asked to arrange three written sentence fragments into a sensible order. Her performance was virtually unimpaired (31/32) and indicated that she could arrange arguments around a verb when all the components of a sentence were available to her and when the stimuli were non-reversible.

In the second level a distractor fragment had to be eliminated before those remaining were arranged into a sentence. Two types of distractors were used, items being presented in random order. It should be noted that some items permitted more than one resolution.

Half the items tapped mapping skills. Here all three noun phrases were possible arguments of the event and to succeed MM had to know how they are organised around the verb, eg:

the water	the letter
the man	the man
fills	the pen
the jug	writes

Thus in order to succeed with the first example, MM must know that 'fill' maps the goal rather than the theme, onto the direct object position.

The other 16 items in the test did not call upon mapping knowledge. Here success depended purely on awareness of the verbs' selection restrictions, eg:

the mountain	reads
the man	the man
the field	the television
climbs	the newspaper

Distractors made the task more difficult for MM. However her difficulty was not general. On selection restriction items her performance remained prompt and virtually unimpaired (Section C: 15/16). When a mapping decision was demanded her performance (9/16) showed a significant decline ($\chi^2 = 4.14$, $p < 0.05$). With just one exception all errors involved the selection of an inappropriate argument for the post verbal slot, eg: 'the man/pours/the glass', 'the man/writes/the pen'. Her approach to the task suggested that she was ordering the fragments initially at chance and judging the

results. For example she often produced bizarre orderings, such as NNV, which were then rejected. Thus even successful performance on these items was accompanied by considerable hesitation and uncertainty.

Interpreting performance on this task is problematic. MM produced no function words and showed difficulty understanding them in comprehension testing (Test of the Reception of Grammar). It is possible therefore that some of her errors with the verb role distractors were due to her function word deficit. For example when ordering 'the man/writes/the pen' MM may have intended 'the man/writes/with the pen'. However not all her errors could be explained this way. No additional function words could make 'the man/pours/the glass' acceptable. Therefore the task gave further support to the hypothesis that MM could not access the subcategorisation information encoded with verbs.

Conclusions

Both the sentence judgement and anagram task suggested that MM's semantic impairment with verbs extended beyond their core meanings. She was poor at detecting verb argument anomalies and found it difficult to order sentence fragments when a mapping decision was required. It seemed that MM could no longer access verbs' thematic structures or their mapping rules.

10.6 Investigations into Event Conceptualisation

The above tests supported the hypothesis that MM's verb production deficit was partly due to a central semantic impairment affecting verb's core meanings and their structural information.

The second assessment hypothesis stated that the verb disorder might be related to a failure to conceptualise the actions and events which they encode. This was derived from the observation that MM

apparently failed to focus on the main event when describing pictures.

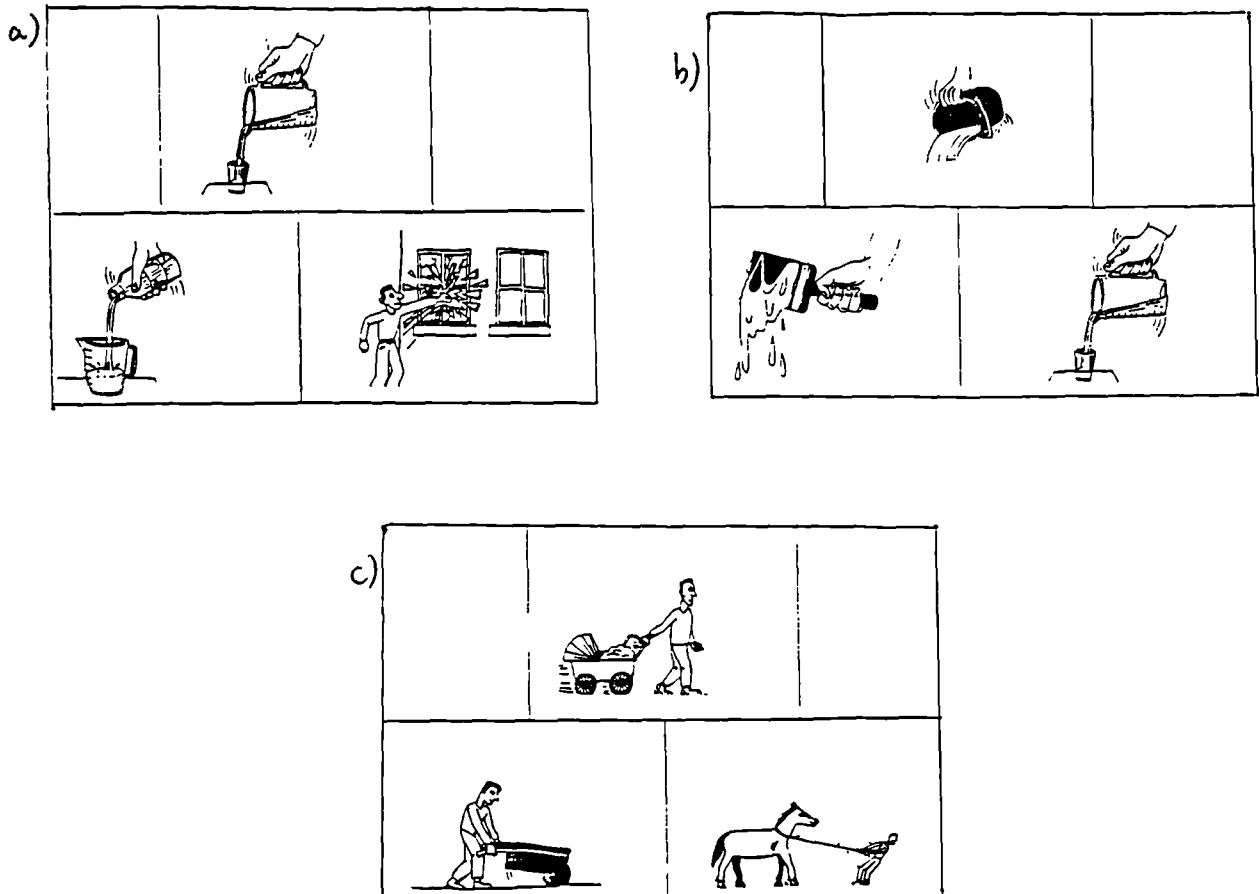
MM performed well (48/52) on the pyramids and palm trees test, suggesting that she could perceive and make semantic judgements about object pictures. A similar non verbal assessment was used to investigate her ability to process pictures of events.

The Event Perception Test

This test examined MM's ability to match different representations of the same action or verb. Each item consisted of three pictures, two of the target verb and a third of a distractor (see fig. 10.2). She was asked to indicate which 2 pictures went together; no verbal response was required. The test has 60 items. In 20 the distractor verb picture is unrelated to the target (example a: 'pour' and 'break'). In the other 40 the distractors and the target are semantically related (example b: 'pour' and 'drip'; example c: 'pull' and 'push'). The test is fully described in section 8.2.

In order to succeed on this task it is necessary to perceive the aspects of events which relate to verb selection. In example (b) the events are differentiated by manner of movement while example (c) requires appreciation of direction. The differentiating features do not necessarily reflect visual similarity. In example (b) all events are visually similar while in example (c) the events which look alike are in fact encoded by different verbs. Despite the non verbal nature of the task the matching can therefore only be achieved reliably if the subject is attending to the linguistically relevant features of events.

Figure 10.2 Examples from the Event Perception Test



MM made 10 errors on this test, 8 of which occurred on the semantic distractor items. Errors were not obviously related to visual factors. For example she succeeded with example (c), despite the visual 'trap'. MM was worse than non dysphasic subjects on this task (all of whom made 3 errors or less) although not dramatically so.

The Role Video Test

In this second non verbal task MM was asked to make decisions about events recorded on video. Sixteen events represented people acting

upon an object (a woman burning paper, a man ironing a shirt) and a further sixteen were reversible, involving either interactions between two people or changes of possession (a woman shooting a man, a man selling a camera to a woman).

MM saw each event twice. After the first presentation she was given 3 photographs. She was then shown the clip again and asked to select the photograph which showed the outcome of the event. The photos consisted of the target, an event distractor in which the theme has been involved in a different action, and a role distractor in which the target action has been performed on either a different theme or a different goal (see section 8.3) for a fuller description of this test). Below are some examples of stimuli from the test:

A. Non Reversible event: Video of a woman burning paper.

Photos: burnt paper (target)
 torn paper (event distractor)
 a burnt box (role distractor)

B. Reversible interactive event: Video of a woman shooting a man

Photos: the man dead on the floor (target)
 the man wearing a coat (event distractor)
 the woman dead on the floor (role distractor)

C. Change of possession event: Video of a man selling a camera to a woman

Photos: the woman holding the camera (target)
 the woman holding a letter (event distractor)
 the man holding the camera (role distractor)

In B the role distractors transpose agent and theme. Thus the woman becomes the theme rather than the agent of the event. In C the role distractors transpose source and goal. The man is now the goal and

not the source of the transaction. To succeed on these items the subject must process and retain the specific roles performed by the participants in the event. In contrast the role distractors in A merely import objects visible in the video but uninvolved in the event. Thus the box in the example is visible in the background of the filmed event. This task enabled us to explore MM's ability to make role judgements about events. In particular her performance on the reversible items would show whether she could isolate and retain key roles from interactive events.

On the non reversible items MM was error free. However she made 3 errors on reversible interactions (5/8) and 2 on changes of possession (6/8). In each case the role distractor was selected. It might be suggested that her problem here was visual, for example she may be unable to discriminate the two people either in the video or photographs. Yet this seems unlikely. Both the people in the video were known to MM and she repeatedly named them during the task. Also the visual demands of the non reversible items were often greater, for example one item required her to discriminate a table completely covered by a cloth and a covered chair. Despite these difficulties her performance on this section was error free. The Role Video was administered to 5 non dysphasic controls none of whom produced any errors.

The result supports the hypothesis that MM has difficulty processing role information from events. Her performance on non reversible items showed that she can make broad decisions about cause and effect and show basic sequencing skills. In interactive and change of possession events the role distractors are a major problem for her. Indeed, assuming that she can readily reject event distractors, her choice between targets and role distractors is not significantly above chance.

Conclusions

The non verbal assessments suggested that the verb deficit might be related to problems in processing representations of events. In the Event Perception Test she had some difficulties matching different portrayals of the same verb and with the video task she apparently failed to focus on the role information within interactive events.

Accounting for MM's problems with these tests is difficult. Clearly MM did not have a general event confusion. The Role Video revealed a basic grasp of cause and effect and several other tests confirmed that she could infer probable events from linguistic stimuli. For example with the Sentence Anagram Task no pictures were provided. Yet MM could still deduce the probable target and order the fragments appropriately, providing there was no distractor. Furthermore her gestures during the task showed that she was relating her sentence to an event concept. MM's lifestyle would also argue against a general confusion. She retained several interests (including political ones) and, most strikingly, had learnt to drive since her stroke.

MM's problems did not seem to be visual. In the Event Perception Test visually similar pictures did not consistently stimulate errors and in the Role video she was able to perform subtle visual discriminations with the non reversible items.

An alternative account would suggest that MM had problems isolating the features of events which relate most to language. The Event Perception Test required her to identify those properties of events which are 'lexically significant'. For example 'Pouring' and 'Dripping' events have many similarities. They both involve liquids descending under gravity. They are assigned different verb labels purely on grounds of manner. In order to differentiate between pictures of 'pouring' and 'dripping' the subject must focus on the linguistically relevant manner information, and it may be here that MM was failing. Her difficulties with the Role Video suggested that her representations of dynamic events were poorly structured. This

would not disadvantage her with the non reversible events. For example it is sufficient to know that some burning has occurred involving a woman and a paper to select the correct outcome photo. With interactions between people the loss of structured information will cause difficulties. Here the outcome can only be detected if a clear representation of who is performing which role has been formed.

The relationship between the event processing disorder and MM's language problems is uncertain. It may be that MM was unable to formulate structured and thematic representations at the message level (see section 2.6). Without these representations she would be unable to drive verb selection and create a predicate argument structure. In other words the mechanism which mediates between general thought and language may have been impaired. Alternatively the errors in the non verbal tasks may be a product of her linguistic problems, for example without verb argument information it may be difficult to retain even non verbal representations of event structures.

Despite these complexities MM's problems with the non verbal tasks lent support to the hypothesis that a disorder in processing representations of events was contributing to the verb production problem.

10.7 Reading Assessments

Testing so far identified two possible impairments contributing to the verb production deficit, namely a central semantic impairment and a difficulty in processing representations of events. So far phonological factors had not been considered. However MM had an articulatory dyspraxia and made phonological errors. A further deficit at the level of the phonological output lexicon therefore seemed possible. This was explored via a number of assessments which investigated MM's ability to access phonology from the written word.

The first required MM to read aloud 15 non words, each of 3 letters (this occurred prior to the publication of PALPA, therefore stimuli were drawn from the Coltheart Battery). MM scored 1/15. Most errors were lexicalisations, eg 'keg' for 'kag'. It seemed that MM could not employ the sublexical reading route. Therefore when reading aloud she would have to access her phonological output lexicon.

In the next task MM was asked to read aloud 12 verbs which she had previously been asked to name from pictures (see table 10.3). She scored 10/12, which was significantly better than her naming performance (naming 0/12 vs reading 10/12, chi square = 13.89, $p < .001$). This trend was confirmed in a second reading task, which used 32 of the verb stimuli from the Definition Naming Test (see section 10.3). MM had only been able to name 8 of these stimuli, yet she read aloud 20, which was again a significant improvement (naming 8/32 vs reading 20/32, chi square = 7.68, $p < .01$). When the noun stimuli were tested MM's reading was again better than her naming, although not significantly (reading: 28/32; naming 21/32; chi square = 3.13). Reading performance was not sensitive to frequency with either the nouns or the verbs.

Why was MM's reading aloud of verbs better than her naming? It was possible that when reading she was accessing phonology directly from the visual input lexicon and thereby 'bypassing' her deficit within the semantic system. If this were the case reading should be impervious to the semantic status of the stimuli. This was investigated by asking MM to read and 'define' 32 abstract words (drawn from the Coltheart Battery). MM could only read aloud 8 of these words. Furthermore her ability to pronounce them seemed related to comprehension. All the words which she read aloud were also appropriately 'defined'. For example with 'fraud' she gestured money and indignation, and with 'false' offered 'teeth'. She was only able to signal comprehension of 3 other words, none of which were produced. Most of the words which were not read aloud were also not understood. With several of these she seemed to make visual errors. For example with 'theory' she produced 'therapy' and

gestured exercise and with 'prior' produced 'church' (which was possibly derived from priory). There were two apparent homophone errors. 'Pause' induced 'dog .. paw', and in response to 'fate' MM produced 'ball .. raffle'.

MM's performance with the abstract words indicated that she received only minimal assistance from the direct reading route (her two homophone errors above were possible applications of this route). Generally her performance suggested that words which were difficult to comprehend were also difficult to say. It seemed that MM was having to read via her damaged semantic system.

The final reading assessment compared MM's ability to read aloud nouns and verbs which were matched for imageability and frequency (see section 8.5). MM scored 20/22 for the nouns and 12/22 for the verbs. As in her naming, nouns showed a significant advantage over verbs (20/22 vs 12/22, chi square = 9.28, $p < .01$). There was no frequency effect either for nouns or verbs.

Conclusions

MM's almost total inability to read non words confirmed that the sub-lexical route was not available. Employment of the direct route to the phonological output lexicon was counter indicated by her poor performance with abstract words and the evidence that pronunciation seemed to depend on comprehension. This suggested that MM had to process words though her impaired semantic system when reading aloud. The finding that nouns were better read than verbs was consistent with this view, since comprehension testing had shown that the semantic deficit was more profound for verbs (see section 10.4).

The evidence that MM read verbs better than she named them was more difficult to explain, since in both tasks she was employing the same semantic route to phonology. This result may be a further manifestation of MM's problems in event processing. In the naming tasks she either had to interpret a picture of an event, or infer an

event from a definition. These processes were not engaged by the reading task, which may account for the better performance. Interestingly there were no significant differences between MM's reading and naming of nouns. This finding is consistent with the above discussion, since object naming also requires no event processing.

The reading tasks confirmed that MM's production problems were due mainly to deficits in the semantic system and possibly at the level of event processing. There were signs of additional problems at the level of phonology. MM made 6 phonological errors on the reading tasks, eg /gɑ:z/ for 'ask' and /dʒæŋŋ/ for hanging (although differentiating these from dyspraxic errors is problematic). Furthermore with 4 of the verb stimuli she was able to demonstrate good comprehension despite an inability to produce the word, eg with 'add' she wrote out a calculation. This suggested that there might be some specific problems in accessing entries within the phonological output lexicon. However this deficit seemed to impact less on MM's production than her higher order impairments, as was confirmed in the following cueing task.

10.8 Cued Production

In this task MM was asked to describe 10 action pictures using a given written verb. When necessary the therapist helped her to read the verb aloud. Her attempts to employ the verbs are given in Table 10.4.

In two cases MM reproduced the verb within some argument structure. However in the other 8 instances provision of the verb did not raise the quality of her output. Indeed in four cases she still omitted the verb from her description.

MM's performance on this task was consistent with the view that she was unable to access the structural information encoded with verbs (section 10.5). Thus even though she was given 'pouring' she did not

know how many arguments the verb commands, or how those arguments should be mapped onto sentence positions. As a result her output floundered among possible candidate nouns.

Table 10.4 Picture description with verb provided.

Target	Production
a woman brushing her hair	'brushingwoman....hair'
a boy throwing a ball	'black ..no ..boy ..brown ..ball'
a woman tearing a magazine	'a woman '
a man pouring a jug of water	'pouring..glass..man..jug..water'
a man closing a door	'closing ..alright?'
a woman dusting shelves	'a woman ..dusting cupboard'
children watching television	'telly ..children ..telly ..dinner yes'
a man smoking a pipe	'pipe?'
a man cutting bread	'a man ..cutting ..bread'
a woman driving a car	'driving ..woman ..blue..car'

This task reduced the phonological demands to a minimum. MM was given the target verb and helped to pronounce it. Yet her output was still grossly impaired. It seemed that MM's speech was primarily handicapped by her higher order semantic and event problems. The implications for therapy were clear. Only treatment tackling these conceptual and semantic problems could hope to benefit her output.

10.9 Investigation of Sentence Comprehension

Thus far assessments have indicated that MM could not compose verb structures to represent meaning relationships. The Jones Word Order Test was used to assess whether MM could comprehend meaning relationships in sentences. In this task interactive events are

described by simple SVO sentences ('The vicar shoots the doctor'). The target picture is presented with pictures of a reversal (the doctor shooting the vicar) and a lexical distractor (the vicar pushing the doctor). MM was presented with 30 items from the auditory version of the task.

MM made 10 errors (20/30). Nine involved the selection of the reversal picture. Her errors might be attributed to a failure to retain word order on input. A simple word order task in which she was asked to point to sequences of 2 and then 3 object pictures appeared to rule this out. She scored (18/20) on this test and quickly corrected her two errors.

Reversal errors in comprehension have been interpreted within the mapping hypothesis (Schwartz et al 1980, Byng 1988 and see section 5.3). This states that errors arise because roles cannot be mapped to the noun phrases in the sentence. Two types of mapping disorder have been suggested. In the 'procedural' version the subject lacks the general rules that assign thematic roles to syntax. In the other, the verb-specific mapping information is lost. This form of the disorder generates difficulties even with simple active sentences, like those used in the Jones test. Previous comprehension testing showed that MM lacked knowledge about verbs' thematic and mapping structures. It therefore seemed likely that she had a lexical, rather than procedural mapping disorder.

MM's performance on the Jones Test might also be compared with the results of the Role Video. This showed that MM could not reliably identify participant roles in interactive events. It is possible that she experienced similar problems interpreting the Jones Test pictures, or was failing to integrate her interpretation with the meaning of the sentences.

10.10 Summary of Assessment Findings and Implications for Therapy

This section will attempt to interpret the assessment findings against the production and comprehension 'models' offered in Chapter 7.

MM's output lacked verb argument structure. This seemed partly due to a lexical verb deficit, since verb access was reduced in spontaneous speech and picture description. Naming and reading aloud tasks confirmed that verb production was significantly more impaired than noun production, even when the targets were matched for phonological form or frequency.

MM's lexical impairment seemed to reside in the semantic system, since she made semantic errors both on output and input (the fact that her production was not frequency sensitive was consistent with this view). Comprehension testing produced significantly more errors with verbs than nouns, which suggested that verbs' semantic representations were particularly impaired. The verb impairment seemed to affect her access to verbs' structural information. She failed to detect verb role violations in a sentence judgement task and was unable to organise sentence fragments when a mapping decision was required.

It was therefore hypothesised that MM had an impairment in the semantic lexicon, which particularly affected verbs and their structural information. In production this would result in inadequate verb information being supplied to the processor of the predicate argument structure and therefore an inability to compute the functional level representation. This interpretation of her deficit was supported by a cuing task in which MM was asked to describe pictures using a provided verb. Her output was still massively impaired. It seemed that simply providing the phonological form of the verb was insufficient to overcome her problems. Unlike EM, MM was unable to use cue verbs, presumably because she lacked their argument and mapping information.

Non verbal assessments suggested that MM had additional problems in interpreting representations of events. With the Event Perception Test she had difficulties matching different representations of the same verb and on the Role Video she apparently failed to focus on the role information within interactive events. These problems seemed neither visual nor due to a general confusion. Two possible accounts of the 'event disorder' were entertained. One suggested that she was failing to formulate structured and thematic representations at the message level. As a result she lacked the mechanism which translates between general thought and language and could not drive verb access or create a linguistic predicate argument structure. The other account argued that the event disorder was a product of the verb impairment. Without verb argument structures it may be difficult to formulate and retain even non-verbal representations of events.

Thus MM's principle output deficits seemed to reside in the early message and functional level processes. Additional deficits at the positional level were possible. When reading aloud she produced some phonological errors and there were instances when she clearly had some access to the meaning of the word despite an inability to access its form. However any phonological deficit seemed much less significant than her higher order semantic impairment. A deficit in the syntactic processor was also possible, since MM's output showed an almost complete absence of syntactic markers. MM's dyspraxia signalled an impairment in the late articulatory processes.

Comprehension

The Jones Test showed that MM could not interpret even simple reversible sentences. Parsing abilities were not specifically tested. However MM could retain word order information, which is the key syntactic device used by these forms. Therefore it seemed unlikely that her difficulties on the test were syntactic. Instead her problems were interpreted as a further manifestation of her semantic verb impairment. It seemed that MM's verbs were stripped of their argument structure. As a result the mapping processes would be

unable to operate. MM's problems with event representations may have also contributed to her difficulties. In other words she may have failed to interpret some of the Jones Test pictures.

Assessment findings suggested that production and comprehension were impaired by two principal disorders: a difficulty in processing events and a semantic verb impairment. The relationship between these deficits was unclear. For example the verb deficit might be due partly to the earlier event impairment, or MM's problems with events might be a product of the verb disorder. The different possible relationships offered different indications for therapy. One would suggest that therapy should target the event disorder, in order to bring about gains in verb and sentence production. The other suggests that working on verbs and their argument structures might resolve the event deficit.

I decided to take the first course and conduct an 'event therapy'. A number of factors stimulated this decision:

- Event therapy could exploit non-verbal tasks. MM found production effortful and quite stressful. It was therefore hypothesised that she would benefit from a therapy which removed the emphasis from speech.
- If necessary event therapy could act as a useful precursor to verb therapy. In other words thematic concepts, such as agent and patient, might be established in discussion about events and then exploited in a verb/mapping therapy.
- Pure event therapy had not been tried. This, therefore, was an opportunity to test a new therapeutic approach.

10.11 The Therapy Programme

It was decided that therapy should target the very early stages of sentence construction. A treatment was devised which aimed to help MM identify the roles played by the participants in events. It also aimed to improve her focus on the nature of the action or verb. It was hypothesised that by stimulating more thematically structured representations of events the production of verbs and verb structures might improve.

The therapy was strongly influenced by Jones's work with BB (1986). There the subject was asked to identify the verb and key roles from given written sentences. MM was asked to make similar judgements using representations of events. Eighteen such events were videorecorded and presented in a hierarchy of complexity:

level 1: people acting upon objects, eg a man ironing a shirt (6 items)

level 2: instruments acting upon objects, eg a hammer breaking a cup (4 items)

level 3: interactive events involving two people, eg a woman punching a man (8 items)

In the first stage of therapy MM was shown the event and asked to identify the agent. This was accomplished by selecting a photograph from a given pair, eg: man or woman (level 1), hammer or saw (level 2) and man or woman again (level 3). Typical instructions for this level were 'Can you show me which person is in charge of this action?' or 'Who did it?' or 'Which object did the action?'. With the non-reversible events MM found this stage quite easy. Here agents seemed relatively salient for her, possibly because they were either the only animate or moving entity. With the reversible events MM made few errors but clearly had to consider the task more deeply.

Following all selections MM was invited to review the event and check that her response was correct.

As MM became more competent the number of distractors was increased. Distractors were included which played different roles in the event. For example selections for the level one item might include pictures of a man, a woman, the shirt and the iron.

At the next stage MM was asked to identify the theme again from a given photo selection: eg an ironed shirt or ironed pair of trousers (level 1), a broken cup or broken saucer (level 2), and a man with a black eye or woman with a black eye (level 3). In levels 1 and 2 distractor photographs were objects which appeared during the video. Typical instructions for this stage were 'Who was the victim?' or 'Which object was changed by the event?'. Again the number of distractors was increased when MM could select the theme from 2 photographs.

The concept of theme was more problematic for MM, particularly when one of the distractors was the instrument. Here she was assisted by further questions which aimed to emphasise that the theme undergoes a change as a result of the event (eg 'which one ends up ironed?', 'which one ends up broken?', 'which one ends up with a black eye?'). As MM became more reliable in selecting the theme, these questions were mixed with questions about the agent (eg 'which person gets arrested?'/ 'which person ends up in hospital?'). The third stage of therapy directed MM's focus onto the nature of the action or verb. Here outcome photos were opposed for selection: (eg an ironed shirt or a torn shirt (level 1), a broken cup or a full cup (level 2) and a man with a black eye or a man who is soaking wet (level 3). Selection was followed by discussion of how MM would describe or gesture the action that had occurred. The nature of the action in the distractor photograph was also discussed.

Therapy was planned to include a further stage in which MM selected a written verb from semantically related options. It did not include

production, in other words MM was not required to map identified roles onto an SVO structure or to produce spoken sentences. Both intentions were amended. The early stages almost always stimulated spoken verb production. As a result the verb selection task was not included. Furthermore MM made it clear that she wanted to make additional use of the materials. Even in the early sessions it was clear that she was relating the tasks to the formulation of an SVO description of the events. For example she would arrange selected agent and theme photographs in a subject and object position around a 'verb gap' on the desk before her. During stage 3 when the verb photographs were selected and discussed her gestures showed that she was relating this to her hypothesised verb gap. MM's contribution to therapy resulted in a greater emphasis on speech production than anticipated. From an early stage she began to produce SVO output and even used distractor photographs to stimulate related productions.

The early emergence of structured output during therapy gave strong support to the treatment rationale. I had hypothesised that sentence production was being obstructed by poor event conceptualisation. Clarifying her conceptions of events and encouraging her to focus on participant roles seemed to have an immediate impact on MM's capacity to create structure. The early non-verbal work also seemed to provide a safe setting in which MM felt able to experiment with output.

The therapy was administered three times a week over a period of one month. The total therapy time was 12 hours. With the quite small number of therapy stimuli and the repetitive nature of the task I was concerned that MM might find the treatment boring. However there was no indication that this was the case. She continued to listen intently to the therapy questions and explanations, even when she had heard them several times before. It seemed that the treatment made intuitive sense to her.

10.12 Evaluation of Therapy

MM's ability to describe 50 action pictures was measured before and after therapy. Reassessment was conducted 8 weeks after therapy to measure maintenance.

The pictures comprised:

10 non reversible pictures involving verbs which were treated in therapy;

10 non reversible pictures involving novel verbs;

10 reversible pictures involving verbs treated in therapy;

10 reversible pictures involving novel verbs;

10 pictures showing change of possession events. These pictures illustrate a 3 argument structure which was not treated in therapy.

Assessment of treated verbs introduced the verb in a new context. Thus they did not simply reproduce events from therapy. Those of novel verbs and of new structures were included to assess generalisation.

MM's description of the pictures was videorecorded and scored using two procedures:

a) Linguistic Score

The analysis produced numerical scores for both lexical and structural features in production. The lexical score awarded one point for each verb and each obligatory argument noun. Optional arguments and modifiers were also noted. The structural score gave one point for an argument correctly positioned in relationship to the verb. Two points were awarded if all nouns were correctly arranged.

Morphology was not scored, ie 'the man is breaking the window' would receive the same score as 'man break window'.

b) Communicative Score

This procedure scored MM's capacity to communicate the content of the pictures to observers. Two new videotapes were made. Each contained a random ordering of half of each type of item from pre and post therapy descriptions. No item was repeated on the tape. Two observers were assigned to each tape and asked to judge the content of the pictures described. In other words they were asked to repeat everything that they had understood from MM's descriptions. There were two familiar observers (MM's husband and her regular therapist) and two naive observers who had no prior contact with a dysphasic person.

The observers' judgments were recorded on audio tape and scored. Separate scores were given for lexical and structural content. The lexical score gave one point for each key word comprehended by the observer. For example 'its something about a window' would gain a point. In the structural scoring one point was given if the observer recognised the relationship between one argument and the verb, such as 'its about a man breaking something'. Two points were awarded when the total verb argument relationship was understood.

The Communicative Score differed from the Linguistic Score in that here MM could profit from items communicated in gesture or other non verbal behaviours. Indeed the observers were encouraged to attend to both MM's speech and her actions.

In addition a number of other measures were readministered after therapy. These comprised: The Jones Test, The Role Video, The Test of Event Perception, and the Sentence Anagram Task with distractors. A post therapy spontaneous speech sample was taken to assess generalisation to un-cued conditions. A control task consisting of naming 30 low frequency object pictures was also administered. A

previous study had shown that MM's naming responded to therapy (Pring, Hamilton, Harwood, and MacBride 1993). The naming task was therefore judged to be a valid external control.

10.13 Results and Discussion

Picture Description Task - Linguistic Scores

Verb Production: MM's verb production (see table 10.5) during the picture description task improved significantly (McNemar Test, chi square = 8.47, $p < 0.005$), and was maintained at follow up (chi square = 8.44, $p < 0.01$). Improvement was seen for both treated and untreated SVO verbs, but not for SV00 items. The scores for each category were not analysed statistically due to the small number of items and the accidental discrepancy between baseline scores for treated and untreated verbs.

Table 10.5 Number of verbs produced in the picture description task

	Pre	Post	Follow up
Total	18/50	32/50	31/50
Breakdown:			
Treated items	12/20	20/20	17/20
Untreated items	5/20	9/20	11/20
Untreated SV00	1/10	3/10	3/10

Argument Production: Table 10.6 shows the pre therapy, post therapy, and follow up argument scores from the picture description task. The results reflect only the naming of relevant arguments and not whether the argument was appropriately positioned in respect to the verb. Despite the unimpressive numerical improvement, an analysis comparing the number of items in which all arguments are correctly named shows significant gains post therapy (McNemar chi square = 8.47, $p < 0.01$) and at follow up (McNemar chi square = 5.06, $p < 0.025$).

Table 10.6 Number of argument nouns produced in the picture
description task

	Pre	Post	Follow up
Total	79/110	95/110	93/100
Breakdown			
Treated items:	29/40	36/40	37/40
Untreated SVO:	29/40	39/40	35/40
Untreated SV00:	21/30	20/30	21/30

Production of optional items: The number of optional items produced was noted. These included instruments, adjectives, and nouns which would appear as part of a modifying phrase in normal production. Prior to therapy MM produced 34 optional items. The suspicion that this was abnormally high was investigated by asking 5 non dysphasic subjects to describe the pictures. The mean number of optional items produced by these subjects was 20.6 (range 8-28). Thus despite her severe naming problems MM produced more optional elaborations than any of the non dysphasics. Unlike these subjects MM was not focussing her descriptions on the central verb argument relationship. Post therapy MM produced 17 optional items, and at follow up 18. Both scores were below the non dysphasic group mean. Therefore MM's naming following therapy showed an interesting change. Optional items were reduced while argument nouns increased. A plausible interpretation is that through therapy she developed a more argument centred focus on the pictured events.

Production of noun/verb combinations: The structural scores are summarised in table 10.7. These show the number of noun/verb combinations achieved during the picture description task. Given the almost complete lack of structure at baseline the improvement following therapy is obvious. Before therapy no items were totally correct. Following therapy there were 18 in which full structure was achieved (McNemar chi square = 16.05, $p < 0.001$). This improvement was maintained at follow up (McNemar chi square = 15.05, $p < 0.001$). Thus therapy has improved MM's ability to position arguments around a

verb. The increase in argument production cannot account for this gain. Prior to therapy MM accesses a large number of the required nouns. Only after therapy is she able to place them in an appropriate word order.

Table 10.7 Structure scores for picture description task

	Pre	Post	Follow up
All Items	2/100	45/100	43/100
Breakdown			
Treated items:	2/40	30/40	23/40
Untreated SVO:	0/40	15/40	18/40
Untreated SV00:	0/20	0/20	2/20
reversible SVO sentences only:			
Total	0/40	23/40	21/40
Breakdown			
Treated items:	0/20	15/20	9/20
Untreated items:	0/20	8/20	12/20

Function words and inflections: Even post therapy MM's output omitted function words and inflections. No auxiliaries or determiners were represented, and the majority of verbs were uninflected or nominalised.

Picture Description Task - Communication Score

Familiar observers produced higher comprehension scores, both before and after therapy. However the pattern of their results was similar to that of the naive observers. Table 10.8 shows the changes after therapy. Both pairs of observers showed significant improvement (Naive observers: chi square = 6.28 $p < 0.025$, familiar observers: chi square = 6.08, $p < 0.025$). Gains are seen in both treated and untreated items. These scores only give credit for pictures which are totally understood. Improved partial comprehension is not reflected.

Table 10.8 Number of pictures totally comprehended by observers

	Naive Observers		Familiar Observers	
Pre therapy:	7/50		13/50	
Post therapy:	19/50		26/50	
	Pre	Post	Pre	Post
Treated items	2/20	9/20	5/20	12/20
Untreated items	5/30	10/30	8/30	14/30

Table 10.9 shows the number of individual nouns and verbs understood pre and post therapy. None of the narrow gains was significant. This suggests that improved comprehension did not arise from a better understanding at the single word level.

Table 10.9 Number of verbs and nouns comprehended by observers

	Naive Observers		Familiar Observers	
	Pre	Post	Pre	Post
Verbs Total	27/50	34/50	32/50	36/50
Treated items:	12/20	15/20	15/20	16/20
Untreated items:	15/30	19/30	17/30	20/30
Nouns Total	69/110	82/110	70/110	83/110
Treated items:	25/40	31/40	25/40	33/40
Untreated items:	44/70	51/70	45/70	50/70

Table 10.10 shows the number of verb argument relationships comprehended. Both naive (chi square = 15.31, $p < 0.001$) and familiar observers (chi square = 11.54, $p < 0.001$) understood significantly more verb argument relationships post therapy. Gains are derived from treated SV0 (naive: chi square = 7.42, $p < 0.01$, familiar: chi square = 5.38, $p < 0.025$) and untreated SV0 items (naive: chi square = 7.42, $p < 0.01$, familiar: chi square = 4.94, $p < 0.05$). There is also an improvement in the reversible items (naive: chi square = 7.76, $p < 0.01$, familiar: chi square = 5.08, $p < 0.025$). As the reversible items cannot be understood by inference this result offers the

clearest indication of MM's improved capacity to employ word order. Comprehension of the relationships within three argument SVOO events did not improve for either type of observer.

Table 10.10 The Number of verb/argument relations comprehended by
observers

	Naive Observers		Familiar Observers	
	Pre	Post	Pre	Post
All Items:	25/100	53/100	35/100	60/100
Treated SVO items	10/40	23/40	14/40	28/40
Untreated SVO items	10/40	23/40	12/40	25/40
Untreated SVOO items	5/20	7/20	9/20	7/20
Reversible SVO items only:				
Total:	8/40	21/40	12/40	23/40
Treated items	4/20	9/20	5/20	11/20
Untreated items	4/20	12/20	7/20	12/20

The results indicate that the improved comprehension of post therapy descriptions resulted mainly from MM's greater ability to communicate argument structure. This ability has generalised to untreated items which share the two argument form. Observation suggested that the skill also generalised to use of gesture. On a few occasions MM gestured verbs which she could not access, placing them in an appropriate sentence order, eg: 'man (lift gesture) woman'. This structured use of gesture may have contributed to improved comprehension of event relationships.

Spontaneous Speech

Following therapy a second Cinderella sample was elicited (see appendix 10.3).

MM's spontaneous production remained severely impaired, and it was only possible to elicit a corpus of 50 analysable words. Table 10.11

presents the quantitative analysis of this corpus, with comparative pre therapy data.

No significant changes occurred. There were 2 utterances which combined a verb with arguments: 'polish floor' and 'Cinders and Prince married' (compared to none at baseline), and two others in which arguments were linked. However the representation of verbs actually declined after therapy (although not significantly). The production of closed class words and inflections also remained minimal.

Table 10.11 Analysis of post therapy spontaneous utterances, with comparative pre therapy data.

	pre	post
Total number of words	70	50
Total number of utterances	62	40
Number of nouns	37	32
Number of verbs	12	6
Proportion nouns:verbs	3.1	5.3
Number of utterances with verb argument structure	0	2
Number of utterances with combined arguments	1	2
Number of phrases	5	3
Number of closed class words	10	4
Proportion of closed class words	.14	.08
Proportion of inflected verbs	.83	.16

Further Evaluation

Table 10.12 summarises the results of the other assessments. On the tests of event conceptualisation MM was now close to ceiling. No errors occurred on the Role Video Test and just 4 in the Event Perception Test (which was similar to the performance of non dysphasic pilot subjects). These tasks assess role identification and the recognition of linguistically distinct events, which were skills directly targeted in therapy.

The Jones Test indicated that the understanding of reversible active sentences had improved, though not significantly. The Sentence Anagram Task with distractors was also marginally improved. Her small gain was derived entirely from items which required a mapping decision, which may reflect an increased capacity to access verb argument information. Scores on the control naming task remained static which supported the claim that gains are therapy specific.

Table 10.12 Additional Assessments

Assessment	Pre Therapy	Post Therapy	Follow up
Role Video	27/32	32/32	-
Event Perception Test	50/60	56/60	-
Jones Test	20/30	27/30	-
Sentence Anagram Test	24/32	28/32	-
Control Naming Assessment	12/30	11/30	13/30

10.14 Summary and General Discussion

A dysphasic subject with symptoms of a semantic verb deficit was studied. Investigations revealed poor verb production, semantic errors in verb comprehension and reduced access to verb argument information. In addition MM was unable to compose sentence structures even when provided with the verb. Reversal errors were seen in a comprehension test involving simple active sentences. Non verbal assessments suggested that problems in conceptualising events were contributing to the verb disorder.

Treatment aimed to improve event processing. Non verbal therapy tasks directed the subject's focus onto the agent and theme roles in simple interactive events and stimulated discussion about the nature of the verb. Following therapy the ability to structure two argument descriptions of action pictures improved. The skill generalised to representations of events not used in therapy. Verb production also improved. These gains were reflected in observers' improved comprehension of the subject's output. Analysis suggested that observers were benefitting primarily from MM's increased capacity to signal verb argument relationships, rather than any improvements in naming.

Gains were specific to the content of therapy. An unrelated control task did not improve. Also the quality of MM's output showed subtle, but interesting changes. Thus verb and argument production increased, while the number of non-argument nouns and adjectives decreased. It seemed that MM's focus on pictures had changed. Before therapy she was not oriented to the main event. After therapy she was.

Despite these encouraging signs the effects of therapy were limited. There were no significant gains in sentence comprehension. Also the structural benefits were confined to 2 argument forms. Her post therapy descriptions contained just one embryo three argument structure ('woman chuck water man').

There were also only minimal changes in spontaneous speech. A post therapy account of the Cinderella story yielded just two utterances with verb argument structure (although there had been none at baseline) and generally verbs were still under-represented. A few sentences were produced in conversation during and immediately post therapy (see Table 10.13).

Table 10.13 Examples of spontaneous sentences produced after therapy

Sit down.
Dont't do that.
Ring Chingford Leisure Centre.
Lost it. (re a piece of paper in her bag)
Cut it. (re the therapist's hair)
Jim driving shop.
Bob bash me.

Function words and inflections did not improve either. Mapping therapy conducted with BB (Jones 1986) did stimulate the production of grammatical markers. It seems possible that BB had no real difficulty at this level. Once access to the meaning relations of sentences was achieved production of function words was released. MM's continuing problem may indicate that she had an additional deficit in the syntactic processor, which in the Garrett-type model retrieves function words and inflections. Alternatively the lack of syntactic markers may be a product of her late articulatory problems. In other words MM may have been computing syntactic morphology but her dyspraxia may have prevented its realisation.

Despite its limitations, therapy did produce significant gains in a speech production task. The time post onset (14 years) and the presence of a stable experimental control offer persuasive evidence that improvements were a direct consequence of the therapy.

It is important to consider how therapy brought about these gains. Several accounts seem possible. Despite the emphasis on a non verbal approach, MM verbalised more than expected during the sessions. It

is unlikely that speech practice was the source of improvement, however. MM's treatment records reveal that previous therapies had often included production of spoken sentences. Yet pre therapy assessments showed a minimal capacity to produce uncued SVO sentences. If speech practice were an effective treatment for MM a better baseline performance would be anticipated.

A second interpretation is that treatment worked by emphasising the relationship between identified argument roles and a spoken SVO sentence. Through speech MM may have been consciously mapping the roles extracted from the event onto a sentence frame. Relating verb roles to sentence positions is a key component of the mapping therapies described in the literature (Jones 1986, Byng 1988, Nickels et al 1991). Thus this therapy might have been using new materials to achieve a familiar aim. Yet there are significant differences. Previous mapping therapies incorporated extensive work on word order or sentence analysis. They asked subjects to locate agents and themes in given sentences (Jones 1986) or to slot noun roles into a sentence frame (Nickels et al 1991). These tasks were not employed here. Instead the subject was encouraged to focus purely on the meaning relationships within an event. Of course it is difficult to know exactly how a patient is using therapy. MM may have been formulating connections between the event structure and sentence form. We can only emphasise that this aspect was not focussed in the therapy tasks.

The third interpretation would argue that the event processing task was the crucial component of the therapy. This account minimises the contribution made by the speech practice. The important work of identifying event roles has taken place before speech began.

The bias of this therapy differed from previous work on mapping. The emphasis on event processing was introduced in response to the subject's hypothesised deficit in this area. Therapy was based on the assumption that the production of verb argument structure is driven by a thematically structured representation of the event.

Following therapy MM's event skills seemed to improve, as measured on the non verbal assessments. She also produced more verbs which were combined with some argument structure. Therefore the gains made in therapy seemed consistent with the therapy hypothesis.

This interpretation invites further consideration of the relationship between event processing and other aspects of sentence production. One model might postulate sequential stages. At the first stage a structured representation of the event is composed which codifies the nature of the event, the participants (or arguments) involved and their thematic roles. A perspective is also adopted. This specifies who or what will be foregrounded in the final description of the event. Thus for a giving/taking event these message processes establish that the event involves the transfer of an object between two people. The change of possession is marked as permanent, unidirectional and free. Three arguments are identified, together with their thematic roles: the source (giver), goal (recipient) and theme (object) and a perspective is adopted which focuses one of these participants.

The resulting representation of the event drives the creation of a predicate argument structure. A lexical search identifies a verb/verbs which fulfil the event, role and focus specifications. For example the lack of obligation in the transaction identifies give/take as possible verbs. The chosen perspective further narrows the selection. A focus on the recipient will yield 'take', whereas focussing the giver will elicit 'give'. Identification of the participant roles will direct noun access and will help determine which nouns occupy key argument positions.

An alternative model suggests an interactive relationship between event processing and verb use. This would permit a mutual influence between the two stages outlined above. In particular it assumes that verb selection might direct event perception. The example above may be re-worked to demonstrate the more interactive model. Here the speaker makes the preliminary observation that the event involves

change of possession. A family of verbs expressing such an event is activated: give, take, donate, receive, offer, lend, sell etc. The speaker now reinspects the event against the criteria specified by each verb. These would include semantic criteria, such as whether the change of possession is permanent, whether some form of obligation is established, whether there is a dual transfer involving goods and money. The verbs also specify argument requirements. Reexamination of the event will identify participants who might be mapped onto the required argument roles. The process of event inspection will in turn set up new criteria which restrict verb selection.

The interactive model suggests that our perspective on events is to some extent governed by the verbs available in our linguistic culture. When we process events we extract information which is consistent with the content of our lexicon and grammar. This model predicts that all aphasic subjects who have deficits in verb retrieval and show verb based mapping problems may have associated problems in event processing.

MM's performance seemed consistent with the first of these interpretations. Therapy worked almost exclusively on event conceptualisation. Yet this was sufficient to stimulate verb and word order production, even during the treatment tasks. Of course we do not know whether MM might equally have benefited from verb or mapping therapy. Evidence that this latter type of therapy can bring about improvements in event processing would certainly support the more interactive view.

Why was progress not observed in spontaneous speech? MM was thought to have difficulty conceptualising events. It is possible that this short period of therapy helped her process events in highly focussed verb pictures but was inadequate for the complex and dynamic events which are the subjects of spontaneous production.

This view was tested by administering the Multiple Event Description Task (Byng Black and Smith, unpub). In this task MM was asked to describe 50 video events. These were of 5 kinds (10 items in each):

- Single events (SE)
eg a man playing a piano
- Single events involving two related entities (SERE)
eg a woman tickling a child
- Multiple events with unrelated entities (MEUE)
eg a woman climbing a ladder and a child builds a tower
- Multiple events with related entities (MERE)
eg a woman kisses a man while he eats a biscuit
- Single events with multiple perspectives (SEMP)
eg a woman feeding a child/the child eating
a man talking to a woman/the woman listening to the man

MM's descriptions of these events were recorded and transcribed. Three scores were applied. One recorded the number of correct verbs. With single events the maximum verb score per item was one, with multiple events it was two. The second, structural score, awarded 1 point if one noun was correctly related to the verb and 2 for a complete verb argument structure. Thus each single event carried a maximum structural score of 2 and each multiple event a maximum score of 4. Although the SEMP items might stimulate two sentences, eg 'the man kills a woman, the woman dies' it was judged that most normal speakers would produce just one. Therefore the maximum structural score for these items was 2. The number of optional (non-argument) entities mentioned was also noted.

It was hypothesised that after therapy MM could still only process highly focused and unitary event structures. This predicted that performance on the multiple events would be significantly worse than

the single events. It was hypothesised that events entailing multiple perspective (SEMP) would be similarly problematic.

Table 10.14 summarises MM's scores on this task.

Table 10.14 Scores on the Multiple Event Description Task

	Event Type:				
	SE	SERE	MEUE	MERE	SEMP
verb score	6/10	6/10	10/20	11/20	8/10
structural score	12/20	11/20	16/40	12/40	5/20
optionals	2	3	11	5	5

MM's verb production was unaffected by the condition. However her ability to compose argument structure clearly was. Single events (SE and SERE) produced significantly better structural scores than multiple events (MEUE and MERE) (23/40 vs 28/80, chi square = 4.64, $p < .05$). The SEMP structural score was also low and significantly worse than the combined scores for the other single events (23/40 vs 5/20, chi square = 4.42, $p < .05$). Relatedness did not seem to influence structure. The structural scores for single events and single events with related entities were very close. Furthermore all unrelated events (SE and MEUE) produced virtually the same structural score as all related events (SERE and MERE): 28/60 vs 23/60.

The results seem to confirm the hypothesis. When MM had to process two events in parallel the production of structure declined. This was not because she was only targeting one of the depicted events. Her output showed that she was attending to both participants, although in a highly disorganised manner, eg:

'boy (gestures splashing) garden water pouring ... woman fountain jug
no'

(a boy splashes a woman while she waters the garden)

'bye bye boy paints colours woman'

(a boy paints a woman, the woman waves)

Structural scores were also depressed for the single events with multiple perspective. Here MM often accessed a correct verb, but was unable to combine it with the appropriate nouns, eg:

'Ball ... man girls .. er boy no no catch boy'

(the man catches the ball, the woman throws it)

While multiplicity was a problem for MM, relatedness was not. With several single events MM was able to employ word order to express reversible meaning relations, eg: 'woman tickling boy'. This seemed further evidence of the skills developed in therapy.

The optionals count is difficult to evaluate. The numbers suggest that MM's tendency to list non-arguments increased in the multiple event conditions. This might be because in these complex events there are more potential items to name. Alternatively it may be further evidence that MM was finding it difficult to organise her focus over these events and as a result was reverting to her strategy of mentioning anything she can see.

This task supported the hypothesis that MM was still unable to process complex events after therapy. With single events she performed well, even in the reversible condition. Where she had to process parallel events, or events permitting a multiple perspective, her performance declined. It seemed that further therapy was needed to help MM process more complex event representations. Such a therapy might achieve gains in spontaneous production.

This study identified a subject with an apparent deficit in the early message level processes. Therapy aimed to improve her ability to formulate structured representations of events and brought about gains in verb and sentence production. This suggested that event processing is a crucial precursor to structured output. However progress was limited to constrained picture description tasks; there were no obvious benefits for spontaneous speech. A subsequent assessment in which MM was asked to describe a range of video events suggested that she was still unable to process multiple or complex events. It was hypothesised that this might account for her continued problem with spontaneous production. Despite the limitations the study suggests that event processing tasks might act as an inspirational point of entry into some verb disorders.

Chapter 11 Case Study 3 PB

11.1 The Subject

PB had a left CVA in January 1985 when he was 46 which resulted in a right hemiplegia and severe dysphasia. He is married with three adult sons and prior to his CVA was a chiropodist. He is left handed and a monolingual English speaker. PB received prolonged and intensive speech and language therapy following his stroke. At the time of this study (January 1991 - November 1992) language therapy had ceased, although he still attended self help and adjustment groups. He was ambulant and had resumed driving.

Immediately following his stroke PB's output was limited to two stock phrases: 'Tuesday afternoon' and 'everything about it'. Later testing with the Boston Diagnostic Aphasia Examination (December 1986) yielded a diagnosis of 'Wernicke's type aphasia', although his profile was acknowledged to be atypical. Reported features of speech were word finding problems, semantic and phonological errors and paragrammatisms.

Comprehension was initially severely impaired, even at the single word level. The BDAE (December 1986) revealed problems with body part identification, following commands and comprehending complex ideational material. On the Test of the Reception of Grammar (November 1989) he failed 2 pronoun sections, plurals, reversible prepositions and all sections involving modifying phrases.

INVESTIGATIONS OF COMPREHENSION

11.2 Test of Sentence Comprehension

PB's comprehension of word order was explored with a version of the Jones Test (1984). In this task a spoken sentence has to be matched to one of three pictures, eg:

Stimulus: 'The vicar shoots the doctor'.

Pictures: target
 the doctor shoots the vicar (reversal)
 the vicar shakes the doctor (lexical distractor)

The stimuli were modified to include passive and cleft sentences. The clefts shifted either the subject or object noun phrase, eg:
'It's the explorer that watches the airman' (cleft subject)
'It's the nun that the swimmer paints' (cleft object)

Results:	active sentences	16/20
	passive sentences	10/20
	cleft subjects	5/10
	cleft objects	7/10

All errors entailed the selection of reversals.

PB's difficulties increased with syntactic complexity. As PB was able to eliminate lexical distractors we can infer that his performance with passives and clefts was at chance.

Reversal errors in comprehension can arise from a number of sources. It is possible that PB's deficit was syntactic, especially given his greater difficulty with the complex sentences. However there were signs that he was parsing the stimuli. He was clearly not using a simple word order heuristic. This would have resulted in consistent reversal of passives and cleft objects, neither of which was seen. His performance with the cleft subjects was perhaps most striking. Despite the clefting these sentences retain canonical word order and as a result good performance might be anticipated. Yet PB reversed half these items. It seems that PB was sensitive to syntactic markers even though he could not interpret them.

Another account of reversal errors implicates a mapping disorder (Linebarger et al 1983; Schwartz et al 1985 and see Section 5.3). Two variants of this disorder have been proposed. In one, the verb

specific mapping information is lost. In the other, lexical information remains but the subject has lost the procedures which assign roles to syntax. PB's data was consistent with the latter version of the deficit, since errors increased in the moved argument conditions when the mappings between syntax and semantics were opaque. However he also had difficulties with the simpler forms, suggesting additional lexical problems.

Conclusion

PB's comprehension of word order was poor. This might be due to a parsing deficit, although his performance indicated some sensitivity to syntactic features. A mapping deficit was also entertained, with evidence supporting both variants of the disorder. These early hypotheses motivated the following investigations.

11.3 Investigation of Parsing Skills

A Sentence Judgement task similar to that in Linebarger et al (1983) was used. Forty sentences were read to PB, half of which contained syntactic violations. Error sentences included violations of constituent order:

*pours the water the man

gap violations:

*Bob read the book that I wrote a story

and auxiliary violations:

*is the boy is having a good time

The correct sentences mirrored the structures used in the anomalous items. PB was required to indicate whether each sentence was 'right' or 'wrong'. He was assisted with cards showing a tick and a cross.

PB made just 3 errors, all on anomalous sentences. His good performance supported the view that parsing was relatively preserved (and showed that short term memory was sufficient to permit this level of analysis).

It seemed that PB was recovering syntactic information from sentences. This suggested that his reversal errors in comprehension were due to either a lexical or procedural mapping problem. The following assessments probed PB's semantic verb knowledge. Impairments here would support a lexical mapping disorder.

11.4 Investigations of Noun and Verb Semantics

The Verb and Noun Comprehension Tests were administered (see sections 8.6 and 8.7). PB was shown a single picture and asked a yes/no question, eg:

Picture	Question
a parachute	is this a plane (noun test)
a man eating an apple	is this drinking (verb test)

The questions either offered the target or a distractor. These were of three kinds: gross distractors, distant semantic distractors (in the case of the verbs these were semantically related but syntactically different), and close semantic distractors (here the verbs were both semantically and syntactically related). PB's results are given in Table 11.1.

PB made semantic errors on both tests, although there were marginally more with the verbs. Performance was unaffected by the closeness of the distractors. Indeed distant distractors were more problematic for the verbs.

Table 11.1 Results of the Tests of Verb and Noun Comprehension

	Verbs	Nouns
target	40/40	40/40
gross distractors	20/20	20/20
distant semantic distractors	11/20	17/20
close semantic distractors	17/20	17/20
Total	88/100	94/100

This task revealed a general deficit in lexical semantics, but not a specific one for verbs. However it only investigated verbs' core meanings. Mapping requires access to verbs thematic structures. This was tested in the following assessment.

11.5 Comprehension of Reverse Role Verbs (see section 9.9)

PB was shown a picture of a transaction between two people, eg a woman selling a car to a man. He was then asked to point to one of the participants in response to a spoken question, eg 'which one is selling?' or a given written verb (eg 'sell'). In order to succeed on this task the verb's mapping and focus information must be retrieved.

This was compared to a condition involving pictures of related actions (eg a picture of two men, one eating and the other drinking). As above PB was asked to point to one participant in response to a spoken or written verb.

Results:	Auditory	Written
Related Actions	19/20	17/20
Reverse Role Verbs	13/20	7/20

PB made errors with both types of stimuli, but performance with the reverse role verbs was significantly worse than with the related actions (combined auditory and written scores, chi square = 13.38, $p < .001$). Indeed on the reverse role verbs PB was not above chance.

Conclusions

The lexical assessments revealed a general semantic deficit. Where PB was only required to access core meanings, as in the first assessment, nouns and verbs were equal. Where the task demanded access to thematic role structures, as with the reverse role verbs, his abilities declined dramatically. PB's ability to exploit the

mapping information attached to verbs seemed impaired. This was investigated further in the following sections.

11.6 Sentence Judgement Test (see section 8.9)

PB was asked to judge 80 spoken sentences, 40 of which were anomalous. Half the anomalous sentences violated the verb's argument structure, eg:

*The thug dies the woman

The woman spills the floor

The other 20 either contravened the selection restrictions of the verb, or the relationship between the verb and an optional modifier, eg:

The woman murders the table

The man skates on the water

These latter anomalies could be detected purely by accessing the core meaning of the verb, while the former required knowledge about the number of arguments controlled by the verb and how they are assigned to syntax.

Overall PB scored 67/80. Almost all errors occurred with the violations of verb argument structure (10/20). With selection restriction anomalies he scored 19/20 and correct sentences 38/40.

Some of the verb argument anomalies could be corrected through the addition of a function word, eg:

'the thug dies **with** the woman'.

Therefore PB's difficulties with these items might be due to function word insensitivity. However his ability to detect syntactic violations, many of which involved closed class vocabulary, would argue against this (see section 11.3).

There were two types of verb argument anomaly used in this task. Some violated both the mapping and the subcategorisation rules of the verb (as in the 'die' example above). With these PB scored 7/10. The other anomalies combined the verb with an acceptable syntactic

structure although with inappropriate assignments to that structure. Thus 'spill' (above) permits a direct object. The anomaly occurs because the probable goal, rather than theme, has been mapped onto that phrase. With these violations PB scored 3/10. Although the numbers are small they suggest that PB was making some use of syntactic cues when detecting anomalies. He was most disadvantaged when the decision rested solely on the assignment rules of the verb.

Several of the verb argument anomalies were multi dimensioned. Thus the 'spill' example above violates both the mapping principles of the verb and its selection restrictions. PB performed well with the pure selection restriction violations. It is therefore surprising that he was unable to apply this knowledge to the argument anomalies. It seemed that the thematic appropriateness of the post verbal argument caused him to disregard selection restriction information. This in turn suggests that he was able to judge the type of arguments entailed with verbs. His difficulty was purely with their assignment.

11.7 Sentence Anagram Task with Distractors (see section 8.8)

This task required PB to construct an SVO sentence from given written fragments (when necessary assistance was given with reading). Four such fragments were available, therefore one had to be eliminated prior to composing the sentence. Half the items (16) offered two possible themes, only one of which obeyed the verb's selection restrictions, eg:

the man	the hammer
the newspaper	sharpens
the television	the man
reads	the knife

The other items (16) offered different potential arguments of the verb, eg:

the water
the glass
pours
the man

the water
the jug
fills
the man

Here elimination and ordering could only be accomplished if the verb's mapping principles are retained. Thus 'pour' maps the theme onto direct object, and 'fill' the goal.

Performance with the selection restriction distractors was significantly better than performance with the argument distractors (15/16 vs 8/16, chi square = 4.24, $p < .05$). All but one of PB's errors involved the mis-selection of the post verbal argument. Even when he had chosen the correct fragment he often thought the other would be equally acceptable (for example he felt darns/the wool and darns/the sock were both correct). Once again PB revealed a selective impairment in verb semantics. He was aware of verbs' selection restrictions but lacked knowledge about they assign their arguments in SVO sentences.

11.8 Sentence Anagram Task (2)

A second sentence anagram task probed PB's comprehension of agentive and non-agentive verbs. The stimuli were adapted from the Reversible Sentence Test (Black et al 1991).

Once again PB was asked to order three fragments into a sentence - this time to describe a given picture (no distractor fragment was included). Half the verbs were agentive, eg:

the cook/protects/the dancer (15 items)

and half were non-agentive, eg:

the cook/surprises/the dancer (15 items)

When necessary, assistance was given with reading.

PB's ability to order the sentences was dependent on the nature of the verb. With agentive verbs he was almost faultless (14/15). Non-agentive verbs were significantly more problematic (7/15; comparing

agentive and non-agentive scores chi square = 5.71, $p < .02$). All errors were reversals.

Why were the non-agentive stimuli more difficult? Clearly familiarity was not a factor, since the non-agentive verbs had higher frequencies than the agentive ones (see appendix 11.1). Non-agentive verbs refer to psychological rather than physical events. They might therefore be more difficult to match to a picture. A subsequent task seemed to discount this. PB was asked to match a spoken verb to one of three pictures. For example with the verb 'admire' the pictures showed a judge admiring a juggling pilot, a vicar noticing a sailor and cowboy pleasing a boxer by handing him a present. He scored 29/30 (both the agentive and non-agentive verbs were tested). This showed that PB could comprehend the core meaning of the verbs and match them appropriately to representations of events.

A third account suggests that PB could not access the mapping rules of the non-agentive verbs. These verbs assign the roles of stimulus and experiencer. They also employ idiosyncratic mapping procedures. Seven of the verbs used in the task mapped the experiencer onto the subject (eg: the workman hears the diver) while 8 assigned the stimulus to subject (eg: the sailor frightens the vicar). PB seemed insensitive to the specific requirements of these verbs and tended to assign the stimulus routinely to subject (thus 5 of his 7 errors occurred with the experiencer as subject verbs). The agentive verbs require less item specific knowledge since all map agents onto subject.

11.9 Summary and Conclusions from the Comprehension Testing

This section will aim to interpret PB's comprehension performance against the 'model' of sentence comprehension (see section 7.5 and figure 7.2).

PB made numerous reversal errors in a test of sentence comprehension, particularly with non-canonical structures. A deficit within the

parser seemed discounted by a grammaticality judgement task in which PB showed that he could detect a variety of complex syntactic violations. This task also confirmed that the early acoustic and phonological procedures must be functioning. A disorder within the mapping processes was therefore hypothesised. Evidence of increased difficulty with moved argument structures suggested that PB may have lost the rules which assign verbs' thematic roles to syntax. Subsequent testing also indicated a deficit within the lexical semantic system. He showed semantic difficulties with both nouns and verbs. However verb comprehension declined dramatically when tasks required access to thematic role information. For example comprehension of reverse role verbs, even in isolation, was at chance. PB was also unable to employ verb specific thematic information in sentence judgement and anagram tasks, although he could apparently apply their selection restrictions. A particular deficit in verb semantics was hypothesised. Access to core meaning was relatively preserved while thematic role information was obscured. This deficit would also bear upon the operations of the mapping processor, since it would deprive the processor of essential verb information.

A semantic verb deficit would also manifest in production, particularly in poor verb retrieval and use. Word order errors, reflecting an inability to select and assign verbs' thematic roles, would also be anticipated.

INVESTIGATIONS OF PRODUCTION

11.10 Informal Observations

PB's speech was fluent with no articulatory dyspraxia. He could communicate simple ideas and events very successfully, although often in single phrases. With more complex targets his output often failed. This can be seen in his account of the transaction between his son and the garage in Table 11.2. Many syntactic features were retained. Function words and inflections were present and some

complex verb structures were achieved, eg the double object dative and sentence complement in the given samples. However other aspects of verb use were impaired. For example although PB could access the syntactic forms required by 'bring' he could not assign sentence nouns appropriately to them. He also appeared to make a reversal error with 'ring'. Other utterances lacked a verb and as a result any argument structure.

It seemed that both verb retrieval and use were impaired. Accessed verbs were often produced within appropriate subcategorisation frames, but with anomalous assignments to those frames. These observations stimulated the following investigations.

Table 11.2 Samples of Spontaneous Speech Pre Therapy

- a) I myself cup of tea, transport, at Monday, the man driving the car, drinking whiskey, and tape (gestures fiddling with a car cassette player) ... he's crashed the road, S Hill, and off in the car, well the policeman station, make a claim to M and myself.
- b) M and C is gone to Ipswich on the train .. no coach. The garage is ringing M to say the car is bringing the truck .. no.
- JM: So the garage rang M?
- No M rang the garage .. could it be possible .. bring the car a truck no.
- (target: M rang the garage to ask them to pick up the car with a truck)
-

11.11 Investigations of Verb Access

Verb and noun naming were investigated using two tasks: the Byng Photographs (see section 9.4) and the Definition Naming Test (see section 8.4). The results are presented in table 11.3.

Overall nouns were named significantly better than verbs (chi square = 7.07, $p < .01$). The individual tasks also showed an advantage for

the nouns, although only significantly so with the photographs (chi square = 5.106, $p < .05$). The effects of frequency were unclear. Verb errors did not seem to be sensitive to frequency. However with nouns there was a frequency effect. For example 8 of PB's ten errors with the photographs fell below the frequency median.

PB's naming attempts stimulated several semantic errors. There were 12 such errors with the nouns (8 with the definitions and 4 with the photographs). Most other noun errors consisted of circumlocutions. For example for 'file' (photographs) he produced:
'insurance and tax .. income tax .. letters bag .. box'.

With the verb targets PB produced 15 semantic errors. Eight of these crossed word class boundaries. Thus for 'steal' (definitions) he said 'thief', and 'buy' (definitions) generated 'with a cheque'. In addition, 7 of his failures with the verb photographs showed an ability to access the associated noun forms. For example for the 'hoeing' picture he produced:

'she is in the garden with a spade or hoe (can you tell me what she is doing?) .. er earth'

Other verb errors involved the use of non-specific and perseverative verbs, no responses and one phonological error.

PB's naming showed a powerful word class effect. Not only were nouns named more successfully than verbs, but also verb targets tended to stimulate associated nouns. The presence of semantic errors suggested that PB's naming deficit arose at least partly from a semantic disorder, which was consistent with comprehension testing.

Table 11.3 Results of the Verb and Noun Naming Tasks

	Verbs	Nouns
Byng Photographs	21/42	32/42
Definitions	14/33	21/33
Total	36/75	53/75

11.12 Verb and Noun Reading

Lexical access was also tested by asking PB to read aloud 67 frequency matched nouns and verbs (see section 8.5). His performance showed an advantage for the nouns (nouns: 57/67, verbs: 26/67 chi square = 28.48, $p < .001$). A subset of noun/verb pairs which were matched for both frequency and imageability still revealed a better noun performance (nouns: 18/22, verbs: 10/22; chi square = 4.81, $p < .05$).

Some of the stimuli used in the reading test straddled word class boundaries. For example 'shoot' (verb) can also be a noun. These ambiguous items were deemed acceptable since the alternative forms have much lower frequencies than the targets (following Zingeser and Berndt 1990). The verb group contained 24 items with low frequency noun readings. PB's performance with this sub-group was much better than with unambiguous verbs (ambiguous verbs: 14/24, unambiguous verbs 12/43, chi square = 4.8, $p < .05$). It seemed possible that PB was able to exploit some of the low frequency noun partners when reading aloud ambiguous verbs.

How was reading accomplished? PB's reading showed no regularity effect. Furthermore he was unable to read non-words. It seemed that the sub-lexical route was unavailable. Abstract word reading was also very poor (see Pring, White-Thomson, Pound, Marshall & Davis 1990). This suggested that PB read aloud via the semantic route. Thus his difficulty with verbs might be further evidence of a category specific semantic impairment. If this were the case, it should be evident in his errors.

Below is the error breakdown in the reading aloud task:

	visual	semantic	no response	phonological	other
nouns	2	1	-	3	4
verbs	21	9	1	1	9

When PB made a reading error he was asked to gesture or explain his understanding of the word. With semantic errors he showed misunderstandings which were consistent with his reading of the word. Thus with 'write' he produced 'read' and gestured reading a book. With visual errors PB either offered an explanation which was consistent with his reading of the word or could offer no account of its meaning. This factor distinguished the visual errors from his phonological errors, since the latter items were comprehended. Items which generated 'no response' and 'other' errors (unrelated words or neologisms) were not understood.

The breakdown supports the hypothesis that PB's reading difficulty with verbs had a semantic origin. He made more semantic errors with verbs than nouns. Furthermore with 40 of the verbs he seemed unable to access the meaning of the word (compared with just 7 of the nouns).

The high number of visual errors with verbs suggested that there might be an additional deficit within the visual input lexicon. However a subsequent lexical decision task appeared to rule this out. The stimuli consisted of 33 of the verb targets and 33 pseudo verbs, which were created from the real verbs by altering one letter. PB scored 60/66 on this task (words: 31/33, non words: 29/33). It seemed that his visual errors could not be attributed to a malfunctioning input lexicon.

Accounting for PB's visual reading errors is difficult. They may have been a product of the semantic deficit. When reading a word several items may be activated in the visual input lexicon, eg the target and a number of visually related partners. The target receives the most activation and is therefore 'relayed' to semantics. However owing to the deficit here many verbs cannot be processed. Subsequent, or parallel processing, might also communicate the visually related partners to semantics. PB's semantic representations for nouns were less impaired (see comprehension testing). Therefore some of the visually related nouns might be

processed through to output phonology. This account predicts that a high number of PB's visual errors with verbs will cross word class boundaries. This was indeed the case. Eighteen such errors were realised as nouns.

Nouns also showed some semantic effects, which were consistent with the results of comprehension testing. There was one semantic error and a further 6 items which were not understood. Yet here there was also a frequency effect, in that all noun errors occurred on items which were below the frequency median (no such effect was seen with verbs). Thus there seemed two possible sources of the noun errors: a mild semantic deficit and a frequency sensitive impairment within the phonological output lexicon. It is possible that there was a comparable phonological deficit for verbs, although the more profound semantic impairment masked its effects.

Conclusions

PB's reading, like his naming, was better for nouns than verbs even when targets were matched for both frequency and imageability. The poor verb reading seemed due to a semantic deficit. There were several semantic errors and with 40 items PB could not demonstrate an understanding of the word. There were also many visual errors, although a lexical decision test suggested that the visual input lexicon was functioning well. It was hypothesised that these were a further product of his poor verb semantics. Nouns also showed some semantic effects, although these were less profound than with the verbs. Errors with nouns were sensitive to frequency, suggesting an additional impairment within the phonological output lexicon.

There were two difficulties with PB's reading data. Firstly PB's reading aloud of verbs was very poor (just 39% correct). Furthermore over half the stimuli were apparently not understood. Yet previous assessments (section 11.6) showed that his written comprehension of verbs was above chance (excluding the reverse role verbs). How did this discrepancy arise? Twenty of the reading stimuli were the

reverse role type of verb (eg they assigned roles of goal source and theme, and expressed transfer either of an object or information). PB found these verbs particularly problematic, therefore their high representation within the reading task might have skewed the results. However his score with these stimuli (8/20) was comparable with his performance overall. Another explanation implicates differences between the reading and comprehension tasks. Comprehension testing provided PB with pictures, one of which represented the target. These may have offered additional semantic information to assist his reading of the words.

There was another difficulty. Half the stimuli in the reading task were targets in the Definition Naming Test (see section 11.11). Thus PB's naming and reading might be compared. With verbs performance was equal (naming: 13/32, reading: 18/32, chi square = 0.99, not significant). Yet with nouns PB was significantly more successful when reading (naming: 20/32, reading: 28/32, chi square = 4.08, $p < .05$). This result is hard to explain, since PB's reading and naming were apparently accomplished by the same route. It may be an artifice of the tasks. The definition test imposed additional comprehension demands which could have suppressed naming performance. However PB's reading advantage has been reported elsewhere (Marshall, Pound, White-Thomson and Pring 1990; Pring et al 1990). It seems that his ability to access phonology from written nouns merits further investigation.

Despite the difficulties, the naming and reading assessments were compatible with the view that verb access was selectively impaired, principally because of an impairment within the semantic system.

The naming and reading tasks compared noun and verb access in isolation. In the following sections PB's ability to express predicate argument relations was explored.

11.13 Spontaneous Speech Analysis

A spontaneous speech sample of 185 words (55 utterances) was collected following the methodology of Saffran et al (1989) (see appendix 11.2). Verb argument structure was analysed using Byng and Black's procedure (1989). The results are shown in Table 11.4.

Table 11.4 Analysis of predicate argument structure in spontaneous speech

Utterance Category

Single phrases:	
Noun phrase	20
Verb only	3
Prepositional phrase only	5
Adjective/adverbial phrase only	1
PP + XP	1
Predicate argument structure:	
NP + Verb	4
Verb + NP	4
Verb + AP/PP/Adv P	1
NP + Verb + NP	4
NP + Verb + PP	6
NP + Verb + AP/Adv P	2
Verb + NP + NP/PP	1
NP + Verb + NP + NP/PP	1
NP + Verb + Sentence Complement	1
NP + arg comp	1
Total Number of Utterances	55

XP denotes any non argument phrase

Over half PB's utterances lacked a verb. When a verb was achieved it was usually combined with some argument structure (only three verbs appeared in isolation). Nine utterances (16% of the corpus) linked the verb with a single argument and 15 (27%) with two arguments. Thus PB displayed some ability to compose predicate argument structure. However several of his structured utterances were anomalous, eg:

'the prince is running the horses to the house'
 'make a claim to M and myself'
 'M and myself walking to the knock at the door'
 'the Prince Charming tried the shoe'

A second quantitative analysis explored the morphological, as well as structural, features of PB's output (Saffran et al 1989). The results are presented in Table 11.5.

Table 11.5 Quantitative analysis of Spontaneous Speech

Total number of words analysed	187
Morphological measures	
Closed class : total narrative words	.41 #
Nouns : pronouns	8.4 #
Proportion of nouns with determiner	.85
Proportion of verbs with inflections	.84
Aux score	1.5
Structural measures	
Nouns : verbs	2.4 #
Proportion of words in sentences	.52 #
Proportion of sentences that are well formed	.67 #
Sentence elaboration index	1.16 #
Frequency of embeddings	.08 #

indicates measures which fall within the range of agrammatic speakers in Saffran et al 1989.

Only two of PB's morphological measures fell within the 'agrammatic' range. One was the overall proportion of closed class words. Here PB scored higher than most agrammatic speakers, who fell below .4 (Saffran et al 1989). PB's use of pronouns was well below normal. However this was clearly influenced by the task. In the Cinderella narrative he produced no pronouns, whereas the personal account of a car crash contained 8. Indeed the proportion of nouns to pronouns in this latter narrative (3.6) fell comfortably outside the agrammatic range.

On all other morphological measures PB was well outside the agrammatic range and indeed performed close to the non-dysphasic subjects. Of particular interest was his ability to realise the morphology of verbs and verb phrases. The 'aux score' records the realisation of auxiliaries and inflections for verbs within sentences. Non-dysphasics' aux scores ranged from 1 - 1.8. Thus PB was well within their limits. In addition 84% of verbs which required inflections were inflected.

In contrast all of PB's structural measures were abnormal. The proportion of verbs in his output is reduced, only half his output fell within sentences and a high proportion of his sentences were ill formed. The sentence elaboration index reflects the number of content words, over and above the minimal noun + verb, appearing in PB's sentences. His score of 1.16 indicates that most of his sentences were unelaborated. Embeddings were virtually non-existent.

Conclusions

Predicate argument structure in PB's speech was clearly impaired. Many utterances lacked a verb (Table 11.4) and there was a reduction in sentence level structural features (Table 11.5). However morphological aspects of syntax were better realised. Strikingly, despite the verb deficit, PB seemed able to realise the auxiliaries and inflections attached to the verb phrase.

11.14 Analysis of Picture Description

Output was investigated further in a picture description task. Ten items showed two argument events, eg a woman kissing a man. With these PB achieved 5 correct responses. His failures seemed due to an inability to retrieve the verb. This resulted in both semantic and phonological errors, eg 'strangle' (for stab) and 'crash' (for splash).

PB was also asked to describe 10 pictures showing three argument transactions, such as a woman selling a car to a man. Here just one appropriate three argument response was achieved: 'the girl is throwing the bone to the dog', although with other items PB was able to express aspects of the event, eg:

'one woman with a chair is looking at the book, the boy is in the chair listening' (a woman reading to a boy)

'one man is walking to the post' (a man posting a letter to his girlfriend).

PB experienced particular difficulty accessing three argument verbs. This was not due to frequency. Most of the verbs which could be used to describe the pictures had high frequency ratings (eg read, show, throw, give, feed, teach, lend, sell and post) and PB achieved better verb access with the lower frequency two argument set. Furthermore a number of his responses to the three argument pictures contained inappropriate verbs which were lower in frequency than the possible targets (eg 'picking' for feed and 'stamping' for lend).

PB's problems were not solely due to verb retrieval. Even when an appropriate verb was accessed he was unable to organise the nouns around it:

'the woman and the man, the man is paying the money for the girl for sale in the car'

Why was PB's production with these pictures so poor? These transactions could be described in a number of ways (see figure 11.1). PB was always asked to base his description on one of the characters, eg 'tell me what the woman is doing'. Yet he often seemed unable to retain this focus in his output, eg:

'the woman and a boy the woman throwing no .. the ball .. er ships ..
the
boy is ..'

It seemed that PB's output was hindered by the multiple perspectives available in these pictures. The two argument events may have been easier because they lacked such multiplicity.

Despite the problems PB's responses to the pictures suggested some preservation of syntactic skills. All verbs were produced within some syntactic structure. Even the anomalous use of 'pay' above contains an appropriate prepositional form.

Figure 11.1 Example Stimulus from the Picture Description Task



The woman gives a boat to a boy
The boy takes the boat from the woman

Conclusions:

Both spontaneous speech and picture description revealed impaired verb argument skills. Some of PB's difficulties seemed due to poor verb retrieval, which was consistent with the results of the lexical assessments (sections 11.12 and 11.13). When verbs were accessed there were additional problems and semantic anomalies were frequent. Output seemed influenced by the complexity of the event to be

described, suggesting that PB might have problems with event analysis. Despite these difficulties there was some evidence that he could access the syntactic structures demanded by verbs.

11.15 Investigations of Event Analysis

PB's poor verb production might be due to an impairment in the pre-verbal analysis of events. This view was supported by some of the picture description data, which suggested a difficulty in maintaining a specific perspective over three argument transactions.

PB's ability to analyse representations of events was explored using the Event Perception Test (see section 8.2). Here two representations of the same verb had to be matched, in the presence of related and unrelated distractors. Related distractors were of two kinds. SS distractors differed from the target because of broad, syntactically relevant, semantic features. For example the SS distractor for 'peel' was 'cut'. Both verbs express change of state, but 'peel' focuses on the effect while 'cut' focuses on the manner of the action. This difference has syntactic consequences (eg with 'cut' the object can be expressed within a prepositional phrase, whereas with 'peel' it cannot). SI distractors differed from the target through fine 'idiosyncratic' semantic features, which were not syntactically relevant.

PB made just 6 errors on this test which was close to the performance of non-dysphasic controls (see section 8.2). However the distribution of his errors was different, since five occurred with the SS distractors. Furthermore the pattern was repeated in a retest, when PB made 2 errors with SI distractors and 6 with SS distractors (errors were not stimulated by the same items across test administrations).

PB's performance on the Event Perception Test suggested some insensitivity to the broad, syntactically relevant, features of events such as manner and effect. This insensitivity might generate

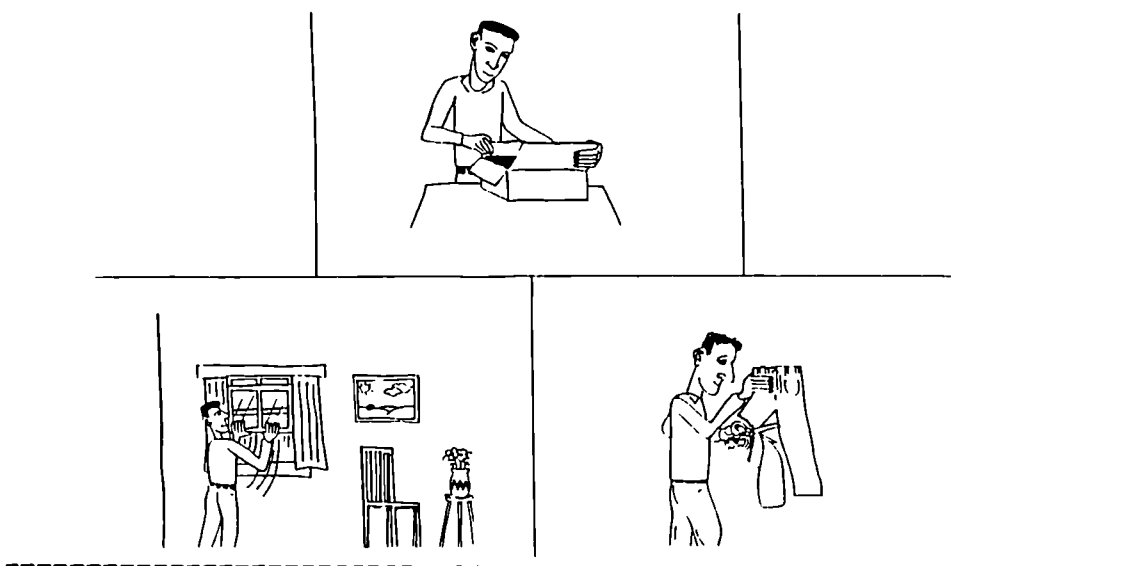
poorly differentiated semantic verb specifications, which may contribute to his difficulties in verb retrieval. We might illustrate this by considering one of his error items in greater detail (see figure 11.2). This item requires the subject to match two representations of 'open'. The distractor (SS) illustrates a cutting event. Both 'cut' and 'open' are change of state verbs and in both the object is altered by introducing a division or a cavity. The verbs differ in focus. 'Cut' contains a strong manner component, while 'open' is a pure effect verb. Insensitivity to the manner/effect division would make these events very difficult to categorise. Indeed PB took a long time over this item and indicated that he was unable to select between the two options. He also attempted to describe the items and his output seemed to reflect his poor semantic discrimination of the events:

'the man is undoing the box' (opening the box)

'the man is cutting the window' (opening the window)

'the man is cutting the jumper er trousers' (cutting the trousers)

Figure 11.2 Example from the Event Perception Test



The Role Video was also used to explore PB's recognition of role relationships within interactive events (see section 8.3). Performance on this task was faultless.

Conclusions:

Conclusions from the non-verbal tasks must be guarded. The video test suggested that PB could analyse participants' roles in interactive events, even with three argument transactions. His performance on the Event Perception Test was interesting, in that errors were almost entirely confined to the SS items. This suggested some insensitivity to semantic features like manner and effect which 'control' verbs' syntactic usage and it was argued that this might account for some of his difficulties in verb production. Despite this, his generally good performance on the non verbal tests suggested that PB's output difficulties arose mainly from a later stage of processing.

11.16 Subcategorisation Analysis

The quantitative analysis (table 11.5) and picture description samples suggested that PB could still realise the syntactic structures demanded by verbs. This was investigated in an analysis of 374 verb phrases which were produced by PB in 3 conditions:

- spontaneous and conversational speech (51 items)
- picture description (143 items)
- production cued by a given noun or verb (180 items)

The analysis focussed purely on syntax. Semantic anomalies were disregarded. Where the constituent structure of a verb phrase was appropriate to its subcategorisation it was marked correct. Thus 'I buy the money for the milkman' was correct since this structure [- NP PP] is subcategorised by the verb.

This analysis yielded only 27 errors (7% of the corpus). The error breakdown was as follows:

spontaneous speech: 1 error (2%)
picture description: 12 errors (8.4%)
cued production: 14 errors (7.8%)

Almost half the errors occurred with just 2 verbs: 'put' (9 errors) and 'throw' (4 errors). Both these verbs were heavily used by PB. 'Put' appeared 22 times and 'throw' 25 times and in most cases their use was semantically anomalous, eg: 'she is throwing the letter the parcel' (picture description of a woman tying a parcel). Furthermore PB's aborted verb phrases (which were not included in the corpus) often contained these verbs. It seemed that 'put' and 'throw' had a particular status for PB, in that they tended to appear whenever verb search was failing. They might almost be classed as verb neologisms. If 'put' and 'throw' are excluded from the analysis PB's subcategorisation performance is even more impressive (14 errors from a corpus of 327 verb phrases, or 4.3%)

PB might have avoided syntactic errors by depending on a few stereotypical forms. However there was evidence to the contrary. PB made use of 138 different verbs within the corpus. Of these 33 appeared with varying subcategorisations. For example 'bring' was used on three occasions, each time with a different structure:

M bring up rubbish	(V + particle + NP)
The car is bringing the truck	(V + NP)
bring the car a truck	(V + NP + NP)

PB's syntactic knowledge can also be seen in his use of related verbs with different subcategorisations. The corpus contained a surprising number of verbs about communication, eg: 'tell', 'speak', 'say', 'talk', 'ask', 'chat', 'describe' and 'write'. These verbs vary according to whether they take a direct object, prepositional phrase, sentence complement or double object dative, eg:

She told/asked/described/*wrote/*said/*chatted/*talked/*spoke John.
 She spoke/talked/chatted/said/wrote/*described/*asked/*told to John.

With one exception PB's uses of these verbs were syntactically correct. Furthermore complex forms, such as sentence complements and three argument structures appear (see Table 11.6)

Table 11.6 PB's uses of verbs about communication

Say:

say its alright (s)	(Say + S)
to say that its alright (s)	(Say + S)
to say the car is bringing the truck (s)	(Say + S)
to say that the .. slipped over the banana (pd)	(Say + S)

Chat:

chatting to say that the ..	*(Chat + S)
-----------------------------	-------------

Tell:

tell her something (c)	(Tell + NP)
------------------------	-------------

Ask:

asked a question (c)	(Ask + NP)
----------------------	------------

Talk:

talking to the family (c)	(Talk + PP)
talk to the other one (c)	(Talk + PP)
in the pub .. talking (pd)	(Talk)

Speak:

speaking to Mike (c)	(Speak + PP)
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Describe:

describing the boy (pd)	(Describe + NP)
-------------------------	-----------------

Write:

write the letter to the post (c)	(Write + NP + PP)
write the lessons (c)	(Write + NP)
writing the card (pd)	(Write + NP)
writing a letter (pd)	(Write + NP)

s = spontaneous production

pd = picture description

c = cued production

Conclusion:

The analysis supported the hypothesis that PB retained surprising knowledge about the syntactic properties of verbs. Very few of his verb phrases violated strict subcategorisation rules. Furthermore several verbs were used with different structures and the syntactic differences between related verbs were respected.

11.17 Analysis of the Semantic Properties of PB's Verb Phrases

The subcategorisation analysis indicated a remarkable preservation of the constituent structure of verb phrases. However many of these utterances were anomalous. Therefore a second, semantic, analysis was conducted. This revealed 135 errors (36% of the corpus).

Three types of error were identified:

Verb Selection Errors

These took the form of non-specific verbs, inappropriate verbs, associated verbs, perseverative verbs, and neologisms, see examples below:

- 'he is doing water' (picture description - watering a plant)
- 'one dog is looking' (picture description - dog biting a cat)
- 'the girl is Hoovering the towels' (picture description - ironing)
- 'the boy is throwing the soap' (picture description - bathing a baby)
- 'I ply the curtains' (cued with 'curtain')

Selection errors occurred either in picture description or when an inappropriate verb was coupled with a supplied noun. It is probable that PB also made numerous selection errors in spontaneous speech. However it was decided that without a known target these could not be identified.

There were 60 verb selection errors. 52 occurred in the picture description data (34% of items) and 8 in the cued production data (4% of items).

Assignment Errors

This classification was given when arguments were mis-assigned to syntactic positions within the verb phrase, or when obligatory arguments were omitted, see examples below:

'the woman is putting the shelf to the book' (picture description)

'the bike is riding sonny' (cued production)

'paying to the girl' (picture description)

Obviously the argument omissions also featured in the previous analysis as subcategorisation violations.

Distinguishing assignment errors from verb selection errors was often difficult. For example:

'the woman is lending the book in the library'

This was classed as an assignment error, since the goal argument was omitted. However 'lend' may have been a semantic error for 'borrow', in which case the assignment was correct. As suggested above it was decided that errors should be classed as verb selection only when there was a clear mis-match between the verb and a known target. Here 'lend' was an acceptable target for the picture.

There were 66 assignment errors (18% of the corpus). 20 occurred in the picture description data (14%), 8 in the spontaneous data (14%) and 38 in the cued production data (21%). Several errors failed to respect the division between obligatory and non-obligatory phrases. In 13 instances optional material was mapped onto obligatory argument positions eg:

'I cooked the oven'

'giant ant is killed by the knife with the girl'

There were also problems in handling related verbs which follow different mapping procedures. For example 'rob' and 'steal' differ in whether they assign the victim or the property to the direct object:

He robbed/*stole the woman.

He stole/*robbed the purse.

PB's output contravened these rules:

'to steal the woman with the bag'

'the robber robbed the purse'

Similar problems are seen with 'fill', 'flood' and 'seep':

'fill the water'

'the river is flooding the water'

'the plumber is seeping with a pipe'

Unclassifiable Errors

Several errors defied classification, eg:

'adding the solicitors to the house' (cued with the verb 'add')

Here the assignments are so anomalous that it is difficult to determine what event (if any) PB was aiming to communicate. It is possible that he understood 'add' as advertise (eg 'the solicitors are advertising the house').

There were 9 unclassifiable errors. 3 occurred in the spontaneous data and 6 in the cued production.

Conclusions:

The syntactic and semantic analyses of PB's verb production revealed an interesting contrast. PB's knowledge of the subcategorisation properties of verbs was surprisingly preserved. Few syntactic errors were made and a variety of structures were used. However 36% of PB's verb phrases were semantically anomalous and almost half these errors were due to mis-assignments. The contrast between PB's syntactic and semantic knowledge was most clearly seen in his management of related verbs. While the syntactic divisions between these verbs were respected, assignment divisions were not.

Why were so many assignment errors made? Similar problems in comprehension have been attributed to the application of a rigid mapping rule (Caplan and Futter 1986). If PB were employing a similar rule in production consistent assignments might be seen, eg:

Agent assigned to NP₁ (external noun phrase)
Theme assigned to NP₂
Source/Goal assigned to NP₃

Some of PB's assignment errors adopted this rule, eg:

'woman is .. singing a song on the audience' (a woman singing on a stage)

'the woman is licking the stamp to the envelope'

However 46 did not. For example goal arguments were often mapped onto NP₂:

'throwing .. the bride's dress' (picture description of people throwing confetti over a bride)

instruments displaced themes:

'shoot the gun through the king'

& probable agents appeared after the verb:

'I cooked the baker'

PB's assignment of arguments was not obviously governed by any consistent rule.

Alternatively the assignment errors might be a product of PB's naming deficit. In other words inappropriate noun phrases may follow the verb simply because these are more available to PB than the target. Some errors produced in the cued production condition seem interpretable in this way. In the following example the prominence of the cue word (oven) seems to sabotage PB's attempts to compose word order:

'I cooked the oven no .. serve the cooker to the oven ... I cooked the oven with a chicken no.'

However there was also evidence against this view. Ten of PB's assignment errors took the form of exchanges. If these errors are a product of PB's naming deficit a frequency effect should be observed. In other words we would expect high frequency nouns, which are more accessible for PB, to displace low frequency ones. In fact only two of PB's exchanges showed this pattern.

A third interpretation suggests that the assignment errors are a product of his verb deficit. Without access to verbs' thematic structures PB has no principled way of determining word order.

The naming and verb deficit hypotheses were investigated in the following assessment.

11.18 Constrained Sentence Production Task

In this task PB was asked to say 80 svo sentences, using a provided written (and read aloud) verb. The sentences had to be produced in response to a spoken scenario, eg:

- i) The manager shoots the lights. The accountant is crossing the road. So ... (injures)
Target: the manager injures the accountant
- ii) The husband sues the midwife for £100,000. So ... (ruins)
Target: the husband ruins the midwife
- iii) The dustman tells the queen about his stamp collection. He talks for 2 hours. So ... (bores)
Target: the dustman bores the queen
- iv) The juggler has gone off with the artist's girl friend.
So ... (resent)
Target: the artist resents the juggler

The provided verbs were in two groups. Half assigned the roles of agent and theme consistently to subject and object positions, eg 'injures' and 'ruins' above. The other half were idiosyncratic in their assignments. Here correct word order could be achieved only if the individual thematic properties of the verb were accessed. Thus 'bore' above assigns the stimulus to subject, while 'resent' assigns experiencer to subject. This group also exploited verb pairs like 'follow'/'lead' and 'chase'/'pursue' which express a particular focus

over an interactive event. The consistent and idiosyncratic verbs were matched for frequency.

The 80 target sentences were composed from 20 noun pairs, each of which had a high frequency and low frequency member. Thus in example (iii) above 'queen' is high frequency and 'dustman' low, similarly in (iv) 'artist' is high frequency and 'juggler' low. Each noun pair appeared in 4 targets, twice with a consistent verb and twice with an idiosyncratic verb. For example the 4 targets using 'queen' and 'dustman' were:

the dustman bites the queen
the queen bites the dustman
the dustman bores the queen
the queen bores the dustman

Thus in half the stimuli the high frequency noun appeared as subject and in half it appeared as object.

This task manipulated 2 variables. One was the nature of the verb, and the other was the comparative frequencies of the subject and object nouns. If PB's assignment disorder was due principally to his verb deficit his performance should display a verb effect. In other words we would anticipate a worse performance with the idiosyncratic verbs, since here correct assignment depends upon item specific verb information. If PB's naming deficit is contributing to his assignment problems a frequency effect should be seen. This would predict an advantage for sentences in which he can begin with the high frequency and hence more accessible noun. A third possibility predicts an interaction. For example PB may only be disadvantaged when he has to process an idiosyncratic verb and begin the sentence with a low frequency noun.

Results (Table 11.7)

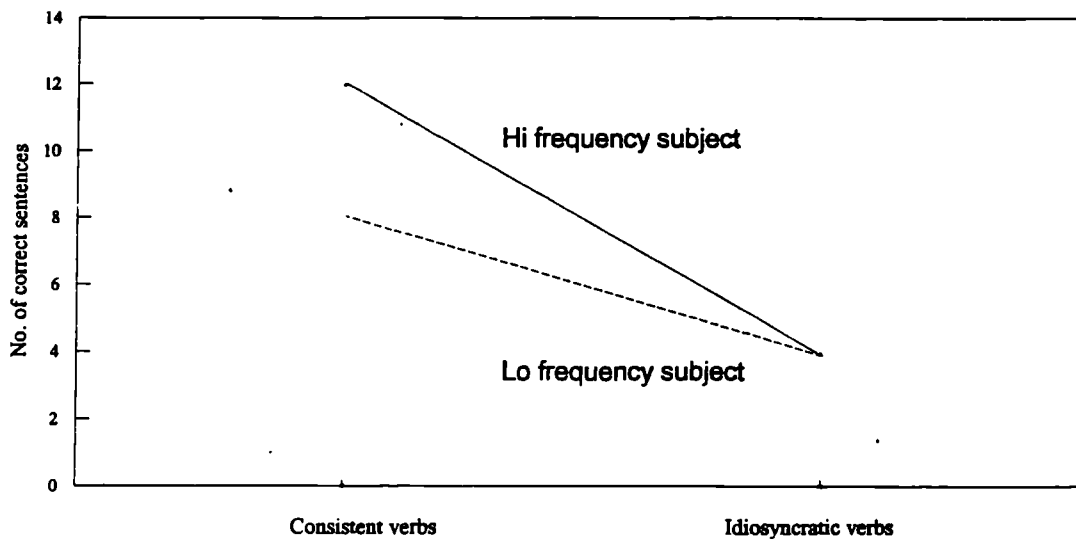
PB achieved 28 correct svo sentences on this task using the provided verbs. His performance was influenced by verb type. There were significantly more correct sentences with the consistent verbs than

with the idiosyncratic ones (20/40 vs 8/40, chi square = 6.65, $p < .01$). There was no effect for frequency (comparing sentences with high and low frequency subjects: 16/20 vs 12/20, not significant). However the visual representation of the results suggests that frequency might have interacted with verb type, since PB's best output was stimulated by both the frequency and the verb advantage (see fig. 11.3)

Table 11.7 Results of the Constrained Sentence Production Task

	Hi Freq Subject	Lo Freq Subject	Total
Consistent Verbs	12/20	8/20	20/40
Idiosyncratic Verbs	4/20	4/20	8/40
Total	16/40	12/40	28/40

Figure 11.3 Graph of the results of the constrained sentence production task



Errors (see table 11.8)

Few clear patterns emerged from PB's errors. 19 were impossible to classify. They comprised aborted attempts, confabulations, inappropriate nouns and verbs, or errors in which an appropriate noun order was combined with a passive form of the verb. Examples are provided below:

'he scratch .. scratch .. no'
(the chicken scratches the peacock)

'the accountant is walking to the road and at ... injures the foot'
(the manager injures the accountant)

'the farmer carries the horse'
(the horse drags the donkey)

'the donkey is frightened the horse .. the horse is frightened the donkey'
(the donkey frightens the horse)

Seventeen errors were reversals. This category was particularly pertinent to the frequency hypothesis which suggests that reversals should be more common when the target sentences require a low frequency subject. In fact reversals were evenly distributed throughout the sentence types. Neither verb type nor frequency influenced their occurrence.

Eight errors were classed as noun errors. Here PB either substituted a high frequency general noun for the target, or imported an inappropriate noun from the spoken scenario, eg:

'the lady teach no .. impresses the er chap'
(the woman impresses the plumber)

'the young boy is chasing the bike'
(the boy chases the postman)

Finally there were 8 errors in which PB failed to use the provided verb (verb errors). In five cases he replaced idiosyncratic verbs with derived adjectives. Although this strategy generated 3 appropriate sentences, he was still unable to employ the verbs. For example he successfully produced 'the dustman is bored with the queen' but could not use 'bore' as a verb.

Table 11.8 Breakdown of Errors on the Constrained Sentence Production Task

Sentence Type	reversal errors	verb errors	noun errors	other
consistent verbs with hi freq subjects:	3		1	4
consistent verbs with lo freq subjects:	4	3	2	3
idiosyncratic verbs with hi freq subjects:	6	3	4	3
idiosyncratic verbs with lo freq subjects:	4	2	1	9
Total	17	8	8	19

Conclusions:

This task suggested that PB's assignment problems were influenced more by the characteristics of the verb than the frequencies of the nouns. He was particularly disadvantaged when sentence generation required item specific verb information. In contrast the comparative frequencies of the subject and object noun phrases did not affect performance. Furthermore in over half of his reversal errors he replaced the high frequency subject with the low frequency noun. Although frequency per se was not a factor, it may have interacted

with the verb type. PB's best output was achieved when he was processing a consistent verb and could produce the high frequency noun as subject.

There are many problems with this task. Firstly it could be argued that it did not entail true lexical access. The target nouns were provided in the spoken scenario. Therefore PB might have reproduced them via sub-lexical repetition, which would not generate any frequency effects. However this seems highly unlikely. PB was required to interpret the scenario in order to derive the event or state of affairs and infer the outcome. Such deep semantic processing would surely inhibit superficial sub-lexical repetition.

Secondly the task might be vulnerable to unforeseen variables, such as the order of mention of the nouns in the scenario. While this was not specifically controlled, there was no evidence that it was a factor. Exactly half PB's responses began with the last mentioned noun, and half with the first mentioned noun.

The final and perhaps major objection suggests that PB's errors arose more from the input than the output components of the task. While this is a problem with the task overall, it should not generate the clear verb effect seen in PB's responses, especially as the scenarios for the idiosyncratic verbs were not obviously more complex than those for the consistent verbs. However the comprehension demands (and the oddity of some of the described events) undoubtedly makes this task different from normal speech production. As a result extrapolations should be guarded.

11.19 Summary and Conclusions of Production Testing

This section will attempt to interpret the results of production assessments against the Garrett-type model of sentence production (see section 7.2, figure 7.1).

An aspect of PB's output deficit was clearly lexical, since he exhibited naming problems with both nouns and verbs. The presence of semantic errors suggested that the problem was originating in the semantic lexicon, which was also consistent with the results of comprehension tests. It seemed that the semantic impairment was greater for verbs, since verb access was more impaired than noun access, even in frequency matched naming and reading tasks. There was also some evidence of impaired access to the phonological output lexicon, since noun retrieval was sensitive to frequency (see sections 11.11 and 11.12). No such effect was seen for verbs, possibly because the greater semantic deficit was masking its presence.

Spontaneous speech showed reduced predicate argument structure, which was largely attributed to the poor verb production. However even when verbs were accessed the resulting sentences were often semantically anomalous. PB showed particular difficulties in assigning thematic roles to verb phrases. Furthermore assignments were unprincipled. Non-obligatory material was assigned to argument positions and different roles appeared in various sentence locations.

PB's anomalous output may arise from a failure to analyse the properties of events and particularly the roles played by different participants. However this was discounted by his perfect performance on the Role Video. He also performed well on the Event Perception Test. It seemed that the message level processes were largely intact.

A second account might suggest that his word order problems were a product of the naming deficit. In other words the impairment might arise at the positional level, where noun phonologies are inserted into the planning frame. This hypothesis predicts that more frequent (and hence more accessible) nouns should usurp the positions of less frequent ones. This was tested in a constrained sentence production task. The task exploited 20 noun pairs which were separated by a wide frequency difference. The target sentences assigned either the

high frequency or low frequency noun to subject. If PB's naming deficit was affecting assignments he should show an advantage for sentences in which the most frequent noun can be used first. In fact no frequency effect was observed. However the properties of the verbs did affect performance. Half the verbs in the task adopted consistent mappings to syntax and half were idiosyncratic. Appropriate use of these latter verbs required access to item specific thematic information. PB showed a significant advantage for the consistent verbs.

It seemed that PB's word order problems were related to his semantic verb deficit. This deprived the processor of the predicate argument structure of essential thematic and mapping information. As a result PB was unable to compute the functional level representation. His deficit was not absolute. He could often still construct appropriate word order with consistent agentive verbs (eg in the constrained sentence production task), which indicated that he at least recognised the agentive properties of these verbs. However when using idiosyncratic verbs his performance declined. Here general verb knowledge is insufficient to create word order. Detailed information is required about the type of roles commanded by the verb and their assignments to syntax.

Despite his considerable functional level deficit PB's output preserved some syntactic features. The quantitative analysis (Table 11.5) showed that many aspects of grammatical morphology, including the morphology of verb phrases, were preserved. Furthermore an analysis of a large corpus of his verb phrases revealed that over 90% obeyed the subcategorisation properties of the predicate. Thus PB's output showed an interesting dissociation. The semantic use of verbs was impaired, whereas syntactic use was not. This dissociation is broadly consistent with the Garrett-type model, which suggests that the semantic and syntactic properties of verbs are exploited at different levels of processing. It seemed that PB's positional level skills, and particularly the operations of the syntactic processor,

were comparatively preserved. His fluent speech and the absence of dyspraxia signals intact phonetic and articulatory processes.

Thus PB's main output deficit was at the functional level and seemed chiefly due to his inability to retrieve the full semantic representation of the verb. Comprehension testing also revealed problems in tasks requiring access to verbs' thematic information. There were reversal errors in a sentence comprehension test and difficulties in understanding reverse role verbs. PB was also unable to employ verb specific information in sentence judgement and anagram tasks. It was concluded, therefore, that PB had a central semantic verb impairment which was affecting both comprehension and production. This impairment might reflect a loss of semantic information, or an access deficit.

11.20 The Design of the Therapy Study

Assessment suggested that verbs' thematic information was no longer available to PB, either because his verb representations were impoverished, or because he was failing to access their full semantic specifications. Therapy therefore aimed to 'reinstate' this information.

Treatment exploited a small group of verbs which express change of possession or communicative transactions, eg 'give/take' and 'teach/learn'. The tasks aimed to illuminate the thematic structures and assignment principles of these verbs (see following sections). As a result gains in verb production and structure were anticipated. Improved semantic knowledge should also enhance comprehension.

A number of therapy outcomes were possible, which might in part reflect the structure of the verb lexicon:

- PB's comprehension and production of the treated items might improve, with no generalisation beyond this set. This might suggest that PB's verb representations are individually

impaired. As a result he may require specific item by item therapy to restore verb information. It would also support the view that the processor of the predicate argument structure is heavily dependent on item specific lexical information.

- Production and comprehension gains may extend to all verbs which express change of possession or communication and assign the roles of goal, source and theme. This would suggest that PB's deficit was principally one of access. It might also indicate that verbs sharing the same thematic properties are grouped together in the lexicon. In other words therapy might enhance PB's access to a related network of verbs.
- Production and comprehension might improve across all classes of predicate. This would again be consistent with an access interpretation of the deficit and would suggest that therapy has stimulated access to all types of verb representations.

Clearly a therapy design was needed which was sensitive to these possible generalisations.

Evaluation of Production:

Picture Description

PB was asked to describe 48 action pictures before and after therapy and 6 weeks after therapy had ceased. The pictures comprised:

Section a) 24 three argument events using 12 treatment and 12 novel verbs. Half these pictures portrayed physical transfer (eg a woman selling a car to a man) and half portrayed communicative events (eg a man telling a child a story). This section aimed to evaluate PB's use of the treated verbs and any generalisation to untreated exemplars from the same verb class.

Section b) 12 change of location events using verbs which manipulate 3 event roles: agent theme and goal (eg pour and fill). The verbs differ according to whether they map the theme (or object being transferred) or goal (destination) onto direct object. Although not included in therapy these verbs shared certain features with the treated verb class, such as the expression of transfer and the presence of a goal argument. This section therefore aimed to evaluate possible generalisations to thematically similar verbs.

Section c) 12 pragmatically reversible events involving untreated, agentive verbs (eg a woman stabbing a man). This section aimed to evaluate generalisations to a different verb class.

Items from each section were presented randomly. Picture descriptions were recorded on video and scored using two procedures. A linguistic score evaluated verb access and the ability to map thematic roles appropriately to sentence form. A communicative score evaluated PB's ability to communicate the content of the pictures to observers. Pre and post therapy descriptions were presented in random order to 4 such observers. Two (familiar) observers knew PB. The other two (naive) had never met him and knew little about dysphasia. The observers were asked to judge the content of the unseen pictures from PB's descriptions. The number of correct judgements before and after therapy were compared.

Narrative Production

A post therapy Cinderella sample was taken to compare PB's narrative production with his pre therapy attempt. This sample was supplemented by a retelling of the car crash (see appendix 11.2)

The Cinderella task may elicit few three argument structures even with non-dysphasic speakers (see Byng and Black 1989). Thus a more targeted assessment was needed to evaluate PB's ability to exploit the treated verb class in narrative production. A story retelling task was used. Three stories, each of about 90 words, were told to

PB, first in their entirety and then in sections. He was then asked questions about the stories which aimed to elicit 26 propositions. Of these, 15 expressed 3 argument concepts. The questions provided minimal cues for the target structures, eg:

Q: What did he do with his flat?

A: He lent it to his brother.

Only 6 of the elicited propositions could use verbs which had been focussed in therapy and these were often presented in unfamiliar forms. For example the possible stimulus for 'teach' was 'His sister gave him lessons'. This therefore was a difficult task which required PB to understand, recall and effectively retell stories containing several three argument events.

Testing with 4 non-dysphasic controls confirmed that the questions reliably elicited the target propositions, although with variations in wording. Only one subject omitted any of the propositions, scoring 24/26.

This task was administered to PB pre and post therapy and 6 weeks after therapy had ceased. The stories and questions are provided in appendix 11.3.

These evaluative tasks aimed to test verb and sentence production in picture and more 'open' conditions. They aimed to explore item specific gains and generalisations, both to other members of the treated verb class and to different types of verb. Not all diagnostic assessments were re-administered. This was to avoid excessive testing.

Evaluation of Comprehension

PB's written and auditory comprehension of the reverse role verbs was evaluated post therapy (see section 11.5). This tested the class of

verb specifically focussed in therapy, with both treated and untreated exemplars.

Generalisations to different verb classes were evaluated through readministration of the sentence anagram task with distractors (see section 11.7) and the modified Jones Test (see section 11.2).

As in production, the design did not entail the re-administration of all diagnostic assessments.

Evaluation of an Unrelated Skill

PB might improve in all the above evaluative tasks. In this unlikely event a further evaluation was needed to show that the changes are due to therapy rather than spontaneous recovery. Therefore his ability to access and comprehend abstract nouns was tested pre and post therapy (using a definition naming test and synonym judgement test). These tasks tapped skills not specifically focussed in therapy.

11.21 The Therapy Rationale and Programme

Therapy aimed to improve PB's knowledge about the thematic structure and assignment principles of 6 three argument verbs and (later) their reverse role partners. The therapy verbs were: 'send', 'give', 'lend', 'teach', 'read' and 'tell' (reverse role partners: 'receive', 'take', 'borrow' and 'learn'). The selection of these verbs was motivated by the following factors:

- The verbs share the same role structure, eg goal, source and theme. This structure is extended to the communicative verbs (see Jackendoff 1983). Thus PB could be encouraged to perceive that different types of event might share similar underlying forms.

- Although their thematic structures are similar their assignments to syntax vary. Thus 'give' assigns the source to subject, while 'take' assigns goal to subject. This variation is not arbitrary, but arises from the particular focus expressed by the verb. I could therefore exploit event focus to explore mapping issues with PB.
- The role structures of the verbs can be made explicit through pictorial therapy materials (unlike the stimulus/experiencer verbs which are more difficult to depict).
- PB's use of these verbs was very poor (see picture description, section 11.14, and spontaneous sample table 11.2). Improving them would enable PB to express a much greater range of events and hopefully extend his communicative competence. Furthermore PB wanted to work on his deficiencies in therapy. He was most motivated by difficult tasks!

Therapy aimed to make the thematic structure of the verbs explicit through a schematic representation of the events they describe. A further component explored how the event roles are mapped onto the prepositional and dative structures subcategorised by the verbs. Treatment initially focussed on verbs expressing change of possession. The second stage targeted verbs about communication. The programme was influenced by other reported mapping therapies (Jones 1986; Byng 1988).

PB was seen twice a week for 6 weeks, each session lasting about an hour. He also carried out some home-work between sessions.

Task 1 (Comprehension)

Cards representing people and objects were produced. People cards consisted of stick men and women each with a fictional name. Object cards used magazine photographs. A written sentence employing one of the target verbs was presented and read aloud to PB. At this stage only 3 treatment verbs were used - 'give', 'send' and 'lend'. No

reverse role partners were included. The therapy also only used the prepositional sentence form, which ensured that the goal was consistently mapped onto the final noun phrase. This role was also made explicit through colour coding, eg:

John gave a jumper to **Bob**.

PB was asked to find the relevant cards and use them to represent the event described in the sentence. In order to capture the change of possession he was required to move the object card between the two people in the appropriate direction. Discussion drew PB's attention to the dynamics of the event. Typical questions might include:

'Who ends up with the jumper?'

'Who went to the shops and bought it in the first place?'

'Who will take it back to Marks and Sparks after christmas?'

This aspect of the therapy aimed to familiarise PB with the structure of the events described by these verbs. In other words PB was alerted to the three key participants and their roles. This was achieved partly through the materials, which graphically represented the transfer of the theme between goal and source, and partly through the discussion.

At first PB required considerable assistance with this phase of the therapy. He would typically collect the 3 participant pictures and lay them randomly on the table. Cuing encouraged him to identify the giver and then, by elimination, the receiver. These participants were placed in consistent positions on the desk, separated by a wide gap. The final stage, in which the theme was moved between the pictures was then easily achieved. In the early stages of therapy PB was heavily dependent on the word order of the sentence when representing the event. In other words the left most noun (subject) was always placed on his left side and the final noun on his right hand side. However during session 2 this dependency was reduced and PB began to reverse the order of his pictures while retaining the appropriate direction of the transfer.

Once PB had represented the event further discussion focussed on the sentence. Firstly PB was asked to note that the person in red ended up with the object. The relationship between the syntactic phrases and the roles of the event participants was also emphasised, eg that the first noun was always the source of the transfer and the final the receiver, eg: 'the jumper starts with this person and ends up with that person'.

The task was developed in two further stages. In the first the colour coding was eliminated. PB was more interested by the position of the nouns in the sentence, rather than their colours. This therefore imposed few additional demands.

The second stage introduced the alternative double object structure. (This was introduced after session 2 when PB's representations of the events were less dependent on sentence word order). To ease this progression the colour coding was reintroduced, eg:

John gave Bob a jumper.

This stage was problematic and induced several reversal errors. PB was asked to refer back to the colour coding to help him disambiguate the direction of the event. Specific questions about who was the giver and who was the receiver also provided helpful cues. As previously the task was progressed by eliminating the colour coding. Once PB was error free with the double object structure the original prepositional form was reintroduced and PB was required to process both forms randomly. In all sessions he worked with several examples of the 3 treatment verbs. Once error free performance was achieved in the comprehension task the production component was introduced.

Task 2 (Production)

PB was shown a schematic drawing representing the events which were focussed in the comprehension stage of therapy. The person acting as goal was represented in red.

Underneath each drawing was a colour coded sentence frame, in which the verb was supplied. PB was asked to fill in the missing nouns.

As before discussion drew his attention to the direction of the event and its relationship to the placement of sentence nouns.

The first development removed the colour coding. PB was largely untroubled by this progression. In the second development the verb was eliminated from the given sentence. Here PB was asked to consider the nature of the event which was taking place, eg: Would the recipient be able to keep the object? Did s/he have to pay for it? Would it have to be returned? These questions either successfully cued the verb or enabled PB to select it from a given list of options.

At his own request PB was provided with several home work assignments during this stage of the therapy. These were duplicates of the materials used in the session, and hence followed the hierarchy above. Thus PB was processing each set of materials twice, once with the therapist and then independently at home.

Task 3 (Comprehension with reverse role verbs)

This was similar to task 1, but now reverse role verbs were introduced, eg:

Bob borrows £5 from John.

John lends £5 to **Bob**.

As previously PB was asked to represent the events using the people and object cards. The sentences were presented initially in pairs, to emphasise that each referred to the same event, although from a different point of view. As these were achieved they were presented separately, and then without colour coding.

The introduction of reverse role verbs represented a major step for PB, mainly because he was so unclear about the meaning difference between the two verbs. It was noted that PB found 'pragmatically neutral' sentences particularly difficult to process, as in the above example where John might equally borrow money from Bob. Performance was facilitated when the sentence nouns offered cues about their roles, eg:

Bob borrows £1000 from the bank.

The bank lends £100 to **Bob**.

Here PB could use the bias within these events, eg that banks typically lend rather than borrow, to help him disambiguate the direction of transfer. Stimuli therefore progressed from pragmatically loaded to pragmatically neutral events. After PB had represented the event discussion drew his attention to the different placement of the arguments, according to the verb. It was emphasised that one sentence expressed the event from the point of view of the goal (or borrower) and the other from the point of view of the source (or lender).

(Note: 'lend' and 'borrow' are used interchangeably by some London speakers. The therapist was assured by PB's wife that his dialect distinguished the verbs).

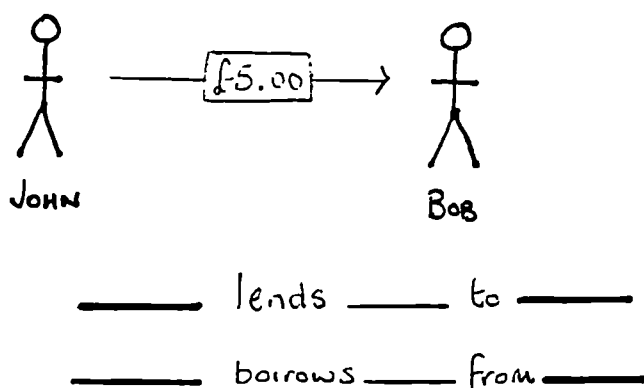
Task 4 (Production with reverse role verbs)

This stage employed similar tasks to those used in task 2, although now the stimuli included reverse role verb partners.

As above PB was given colour coded drawings of events. Two sentence frames were provided, with supplied reverse role verbs (see figure 11.4). The frames were also colour coded to indicate the position of the goal argument. PB was required to complete the sentences by writing in the appropriate nouns. The reversal in word order consequent on the verb was again emphasised. The hierarchy first eliminated the colour coding and then eliminated the verb. In this second condition just one frame was provided, together with an event drawing. PB was asked to first access the appropriate verb pair (eg lend/borrow). If he could not he was provided with options for selection. He was then asked which person he wished to focus in his description, eg 'Who are you going to make the sentence about?'. This noun was written into the subject slot. The role of this person was clarified, eg: 'Does this person end up with the money?/is he the lender or borrower?'. Arising from these questions PB was asked

to select the appropriate verb and complete his sentence. Homework tasks exploited the materials used during therapy. One set was colour coded and the other not. PB was also supplied with a crib sheet of the answers. This enabled him to check his responses after he had completed each stimuli.

Figure 11.4 Example of therapy stimuli used in Task '4



Once PB was error free with the reverse role verbs therapy moved on to the communicative/psychological predicates. These verbs were subjected to the same hierarchy of tasks. This stage of therapy was influenced by the Thematic Relations Hypothesis which suggests that communicative events involve the same basic thematic role structure as physical changes of possession (Jackendoff 1983). In accordance with this PB was encouraged to think about communicative events in terms of a transfer of information. For example in task 1 he was presented with colour coded sentences:

The professor teaches maths to the **student**.

As previously he was asked to represent the event with 2 personality cards and, in this case, a symbolic 'maths' card (showing cryptic algebra) which was moved between them. Discussion stressed that knowledge, or information, had 'changed hands' from the professor to the students. PB adapted to this stage of therapy very comfortably, and began to produce communicative predicates even during the comprehension tasks. This suggested that he was making connections

between the different types of events and generalising the learning achieved during the first stages of therapy.

Elaborations

Therapy involved a number of improvised tasks. These included acting out. For example the therapist would flagrantly thief PB's glasses (target 'take'). PB would be asked to draw what had happened and complete a given sentence frame. Returning the glasses stimulated similar work on 'give'. PB's spontaneous attempts at 3 argument structures were also focussed. By a fortunate coincidence his son was involved in farming broadcasting. PB was invited to conceive of his work in terms of a communicative transaction, eg sending out information to farmers, which was represented in a schematic drawing. This resulted in successful descriptions of his work, eg: 'J is broadcasting to the world'. A further stage invited him to generate sentences purely in response to a given situation cue, eg: 'Claire is going camping. She doesn't have any equipment. Joan has a tent which she doesn't need. How does Joan help Claire?'

11.22 Results of the Therapy Programme

Production

Picture Description - Linguistic Scores (table 11.9)

Overall PB produced significantly more correct descriptions post therapy (McNemar chi square = 11.52, $p < 0.001$). This improvement was maintained at follow up. The breakdown indicates that the 3 argument sentences were the main source of progress. These showed a significant improvement, which was maintained at follow up (pre and post therapy comparison: McNemar chi square = 7.69, $p < .01$); pre and maintenance comparison: McNemar chi square = 6.4, $p < .02$).

Improvement was not confined to the treated verbs, indeed PB achieved marginally higher scores on the the untreated items (treated and untreated verbs were not analysed separately owing to the small numbers and baseline discrepancy). There were no significant gains

in either the agentive or locative sentences, although qualitative evaluation suggested some progress. For example although there were only 3 totally correct agentive sentences post therapy, PB did access 6 appropriate verbs, five of which were combined with at least one argument. Four locative verbs were accessed pre therapy, only one of which was used with appropriate word order. Post therapy the number of verbs rose to five, all of which were linked to some argument structure.

Table 11.9 The number of correct picture descriptions achieved pre therapy, post therapy and at follow up

	Pre	Post	Follow up
Total	5/48	20/48	20/48
Sentence Type:			
3 argument (treated)	1/12	7/12	5/12
3 argument (untreated)	3/12	8/12	9/12
Agentive verbs	0/12	3/12	4/12
Locative verbs	1/12	2/12	2/12

Picture Description - Communicative Score (table 11.10)

Surprisingly naive and familiar observers produced virtually identical results. Both pairs of observers understood significantly more of the descriptions post therapy (familiar: chi square = 5.5, $p < .02$; naive: chi square = 4.61, $p < .05$). The gain was almost entirely due to improved comprehension of PB's 3 argument production (familiar: chi square = 6.74, $p < .01$; naive: chi square = 5.44, $p < .02$). Improvement generalised to the untreated 3 argument verbs, indeed the observers' combined post therapy score on this section was close to ceiling: 44/48. However there was no generalisation to the other sections, the small improvements here are not significant.

Table 11.10 The number of descriptions comprehended by familiar and naive observers

	pre therapy	post therapy
Familiar Observers		
Total	25/48	37/48
Sentence Type:		
3 argument	13/24	22/24
agentive verbs	6/12	8/12
locative verbs	6/12	7/12
Naive Observers		
Total	26/48	37/48
Sentence Type:		
3 argument	14/24	22/24
agentive verbs	6/12	7/12
locative verbs	6/12	8/12

Story Retelling Task (table 11.11)

PB communicated significantly more of the propositions both after therapy and at follow up (pre and post therapy comparison: McNemar chi square = 4.5, $p < .05$; pre and follow up comparison: McNemar chi square = 4.92, $p < .05$). Much of the improvement occurred on the 3 argument propositions, although when analysed separately this section did not show a significant gain. Like the non-dysphasic controls PB's responses generally deviated from the wording used in the text. This indicated that he was recreating, rather than parroting, the target propositions, eg:

Story version: 'she bought a car from a local showroom'

PB's version: 'Mary and Bob went to see the sales representative ..
to buy a new red car'

Story version: 'he feeds their cat'

PB's version: 'gave the cat food and drink'

Story version: 'his sister gave him lessons'

PB's version: 'teach Bob to pass the test'

Table 11.11 Number of propositions communicated in the Story
Retelling Task

	pre	post	f/up
total	6/26	14/26	15/26
3 argument propositions	3/15	8/15	8/15

Cinderella and Car Crash Narratives

PB's post therapy narratives are provided in appendix 11.4. Table 11.12 presents the predicate argument analysis of his utterances with pre therapy comparative data.

The post therapy corpus shows non significant increase in the proportion of utterances containing verb argument structure (from 43% of the corpus pre therapy to 59% post therapy) and a corresponding decrease in single phrases (from 54% to 41%). Although 3 argument utterances were still rare in his post therapy output there was some evidence of greater verb argument complexity. Pre therapy just 27% of his utterances combined more than a single argument with the verb. After therapy this rose to 39%.

Despite these small changes these data provide little evidence of marked improvements in spontaneous speech. Almost half his output remained single phrases and verb argument anomalies continued, eg:

'the woman is putting the mouse and a horse'
'sisters is trying the foot with the slippers'

Table 11.12 Predicate argument analysis of pre and post therapy narrative utterances

Utterance Category	Pre therapy	Post
Single phrases:		
Noun phrase	20	15
Verb only	3	2
Prepositional phrase only	5	1
Adj/adv phrase only	1	2
PP + XP	1	
Predicate argument structure:		
NP + Verb	4	3
Verb + NP	4	3
Verb + AP/PP/Adv P	1	2
NP + Verb + NP	4	4
NP + Verb + PP	6	5
NP + Verb + AP/Adv P	2	1
Verb + NP + NP/PP	1	1
NP + Verb + NP/PP + NP/PP	1	2
NP + Verb + Complement	1	4
NP + Verb + NP/PP + XP	-	2
NP + Verb + XP	-	2
NP + arg comp	1	-
Total Number of Utterances	55	49

XP denotes any non argument phrase

The Quantitative Analysis of the same corpus (table 11.13) showed a marginal improvement in structural quality of PB's output. There was a significant increase in the proportion of words in sentences (pre therapy 97/187 vs post therapy 167/225, chi square = 21.15, $p < .001$) and a slight increase in the sentence elaboration index. The latter measure is derived from the number of content words in subject noun phrases and verb phrases. PB's increase was due almost entirely to a greater ability to elaborate the verb phrase. Most morphological measures were unchanged. The exception was the production of pronouns, which actually declined. This is difficult to evaluate, since, at baseline, PB's pronoun production was erratic (see section 11.13). The lack of morphological improvement was consistent with the content of the treatment, which aimed to increase verb argument

structure, rather than function words and inflections. Also the margin for change here was less, given PB's reasonable preservation of grammatical markers before therapy.

 Table 11.13 Post therapy Quantitative Analysis of spontaneous speech, with pre therapy comparative data.

	Pre	Post
Total number of words analysed	187	225
Morphological measures		
Closed class : total narrative words	.41 #	.44 #
Nouns : pronouns	8.4 #	20.25 #
Proportion of nouns with determiner	.85	.89
Proportion of verbs with inflections	.84	.92
Aux score	1.5	1.52
Structural measures		
Nouns : verbs	2.4 #	2.38 #
Proportion of words in sentences	.52 #	.74
Proportion of sentences that are well formed	.67 #	.65 #
Sentence elaboration index	1.16 #	1.95
Frequency of embeddings	.08 #	.17 #

indicates measures which fall within the range of agrammatic speakers in Saffran et al 1989.

Comprehension

Comprehension of Reverse Role Verbs (Table 11.14 and see section 11.5).

Prior to therapy PB's comprehension of reverse role verbs was at chance. His post therapy performance was significantly improved (McNemar chi square = 9.6, $p < .01$). Improvement occurred with both the treated and untreated verbs.

Table 11.14 Comprehension of Reverse Role Verbs

	Total	Auditory	Visual
Pre Therapy	20/40	13/20	7/20
Treated verbs	10/20	7/10	3/10
Untreated verbs	10/20	6/10	4/10
Post Therapy	33/40	18/20	15/20
Treated verbs	16/20	8/10	8/10
Untreated verbs	17/20	10/10	7/10

Sentence Anagram Task with Distractors

In this task PB was required to construct a sentence from three given fragments while eliminating a fourth (see section 11.7). The additional/distractor fragment either offered an alternative theme, which violated the selection restrictions of the verb, or offered a different potential argument of the verb. At baseline PB scored 23/32 on this task. Most of his errors occurred with the argument distractor items, which tapped mapping skills.

After therapy PB scored 28/32, which was not a significant change. There was also no significant gain in the argument distractor items, although his score on this section rose from 8/16 to 12/16. Furthermore he continued to show considerable uncertainty with these items, even when he achieved a correct sentence.

Modified Jones Test

At baseline PB scored 38/60. Post therapy this rose to 45/60, which was not a significant improvement.

External Control Tasks

Measures of abstract word comprehension and production remained unchanged after therapy (synonym matching task: 58/72 pre therapy and

63/72 post therapy McNemar chi square = .75; producing abstract words from definitions: 14/36 pre therapy and 13/36 post therapy)

11.23 Summary and Discussion

A review of PB's Deficit

PB made numerous reversal errors in sentence comprehension, particularly when syntax was complex. Despite this he performed well on a syntax judgement task, suggesting that the parser was preserved. As a result a mapping disorder was hypothesised. PB's difficulties in interpreting moved argument structures suggested that he might have lost the procedural rules which map thematic roles onto non-canonical structures. Yet there was also evidence of an impairment within the semantic lexicon. PB made semantic errors with both nouns and verbs. However his performance with verbs declined dramatically when tasks required access to their thematic information. For example comprehension of reverse role verbs was at chance and PB was unable to carry out sentence judgment or anagram tasks which depended on verb argument information, although he could apparently apply their selection restrictions. It was therefore hypothesised that PB's key input deficit was in verb semantics. Core meaning was relatively preserved, while thematic role information was obscured. This deficit would necessarily impair the operation of the mapping processor, since this processor depends upon verb information.

PB's sentence production deficit also seemed due to a verb disorder. Analysis of spontaneous speech revealed that over half his utterances lacked a verb. Naming and reading assessments confirmed that verb retrieval was worse than noun retrieval, even for frequency matched targets. Furthermore PB made more semantic errors with verbs than nouns. When verbs were accessed they were often combined with anomalous word order. The constrained sentence production task (section 11.18) indicated that these errors were not affected by the comparative frequencies of the sentence nouns, although they were by the properties of the verb. It seemed that verbs were failing to

supply information about their thematic role structures and assignment principles. In contrast the subcategorisation of verbs was found to be comparatively preserved. Over 90% of PB's verb phrases employed appropriate syntactic structures and examples of complex forms were seen.

How might PB's deficit be interpreted against the Garrett type model of sentence production? (figure 7.1). Verbs' thematic role structures reflect the characteristics of events. For example actions involving an instigator and victim are typically described by verbs with two thematic roles. PB's difficulties may therefore arise from an early disorder in the interpretation of events and composition of message structures. However his good performance on the Role Video test, even with the reversible interactive events, seemed to discount this.

Although PB could interpret events he could not relate them to the focus expressed by individual verbs. Mapping between event and verb roles is not 'one to one'. Verbs are selective about which roles they draft into their thematic structures. For example thieving events entail three roles: the agent (thief), source (victim) and theme (property). Yet the verbs used to describe these events incorporate different obligatory roles within their structures. 'Rob', 'mug' and 'burgle' focus the victim and therefore specify the roles of agent and source, while 'steal' and 'nick', with a different focus, specify agent and theme. PB's output showed that he knew about the typical roles within thieving events but could not relate them to verbs' thematic structures:

'to steal the woman with the bag'

'the robber robbed the purse'

PB's difficulties were compounded by events involving several participants. Trading events involve numerous roles: goal (buyer), source (seller) and themes (goods and money). None of the trading verbs employ all these roles. Each adopts a specific focus, eg the

theme of 'buy' is the goods, whereas for 'pay' it is the money. While PB knew about the typical entities involved in trading events he seemed almost completely unaware of which roles are focussed by the individual verbs. As a result verbs are combined, almost at random, with event participants:

'in the shop or pet shop one woman and a cat is buying the man and paying the money the till' (pre-therapy description of a woman selling a cat to a man)

This argument suggests that PB was able to formulate message structures but could not translate them into verb/argument forms. In terms of the model he was failing to map information from the message level onto functional level representations. Furthermore I have argued that such mapping depends upon the integrity of verbs' thematic information. Without access to this information PB could not determine which event roles feature as obligatory arguments of the verb, or how they should be allocated to sentence positions.

Although PB was unable to formulate verb argument structures at the functional level he could produce syntactic forms. This suggested that the positional level processes, and particularly the syntactic processor, were intact. Not only was PB achieving syntax but he was also composing forms which obeyed the subcategorisation principles of the verb. He therefore displayed an interesting dissociation in his verb knowledge. Thematic role information was impaired, while subcategorisation rules were intact.

A similar pattern of impairment has been observed elsewhere (Caramazza and Miceli 1991). This study described an Italian subject who like PB made few syntactic errors in output despite a marked word order deficit. In one task he was asked to describe a set of reversible and non-reversible pictures, using either the active or passive voice. The subject produced full sentences to all but one of the stimuli (99.8% of utterances). However he made many role reversal errors, which were entirely confined to the reversible items

(40/240). Errors could not be explained syntactically. Almost all passive structures were correct, although assignments to them were often disordered.

The dissociation between impaired thematic processing but retained subcategorisation rules is difficult to explain. There is considerable evidence that verbs' syntactic privileges are an expression of their semantic properties (eg Fisher, Gleitman and Gleitman 1991; Fisher, Hall, Rakowitz and Gleitman in press; Pinker 1989). Therefore we would expect that a semantic verb deficit would necessarily impair syntactic usage, particularly when that deficit affects thematic information. Why then was subcategorisation information available to PB? One explanation (see section 7.5) may be that the phonological form of the verb supplies information about the prosodic structure of the verb phrase. This view is consistent with the Garrett type model of production which locates phonological retrieval and syntax generation at the same level of processing. Thus in composing the planning frame the speaker may draw upon phrase information retrieved with the phonological form of the verb.

Aspects of PB's verb deficit remained unresolved after the investigation phase. In particular it was unclear whether his problem reflected a loss of verb information or a difficulty in access. The two accounts predict different therapy outcomes. If PB's verb entries are stripped of their thematic structures therapy will have to restore this information item by item. Generalisations beyond treated verbs would not be anticipated. In contrast an access deficit might permit generalisations, since therapy might encourage PB to carry out a more thorough retrieval of verb information. Thus the results of the therapy programme potentially offer further insights into the nature of the deficit.

The results of therapy

Following therapy PB's picture descriptions of 3 argument events improved both linguistically and in their communicative value to

observers. It was difficult to evaluate whether this skill extended to more open conditions. He was able to convey more propositions from complex stories containing several three argument concepts. However when analysed separately the specific three argument propositions were not significantly improved. His Cinderella and car crash narratives also showed no evidence of increased three argument production, although there were some marginal gains in the overall production of verb argument structure.

Comprehension of the treated class of verb improved, as measured on the reverse role verb comprehension test. However there was no generalisation. Performances on the sentence anagram task with distractors and the Modified Jones Test were unchanged.

What had therapy achieved? Firstly the effects were not item specific. PB's improvements in picture descriptions occurred with both treated and untreated three argument verbs. Similarly his improved comprehension of reverse role verbs straddled both treated and untreated exemplars. It seemed that PB acquired a general skill in retrieving a particular type of verb argument information. This in turn suggested that his original deficit was one of access rather than storage.

However this skill was confined to one class of verb. The picture evaluation included agentive and locative events. PB's descriptions of these events were unchanged by therapy. His performance with the locatives was particularly disappointing. These verbs share certain thematic properties with the treated verb class, for example they express the transfer of a theme to a goal. Nevertheless PB's ability to manipulate these roles with this verb group remained very impaired:

'in the office the woman is writing a letter and spill the black pen .. sheet' (post therapy description of a woman spilling ink over a letter)

Comprehension gains were also confined to the treated verb class. He was still poor at selecting post verbal arguments for the agentive and locative verbs in the sentence anagram task with distractors. Similarly there were no gains on the Modified Jones Test, which employed mainly agentive verbs.

How had treatment worked? PB may have developed specific skills in event analysis which stimulated better retrieval of verb information. Therapy had worked on just one type of event in which an object or item of information moves between two people. Consistent methods of representing these events were used and PB was asked to make explicit connections between these representations and the focus expressed by the verb and the consequent word order of the sentence. Thus PB was encouraged to undertake a number of processes before attempting production, such as identifying the roles of the participants and adopting a specific point of view. There were some indications that he was employing these skills during evaluation. After therapy PB displayed a novel capacity to correct errors. These corrections were often accompanied by gestures, in which PB separated his hands, tapped the table at two distinct points or moved one hand towards the other:

'Mary went to the house to the neighbour .. to buy the car off the neighbour no (separates hands) .. no no sell the .. Mary is selling the car to the neighbour'

PB's gestures suggested that he was attempting to 'schematise' the event in the manner adopted in therapy and that this strategy helped him to organise his output. Encouragingly this ability was seen even in the more open story retelling task and with untreated verbs, as in the above example.

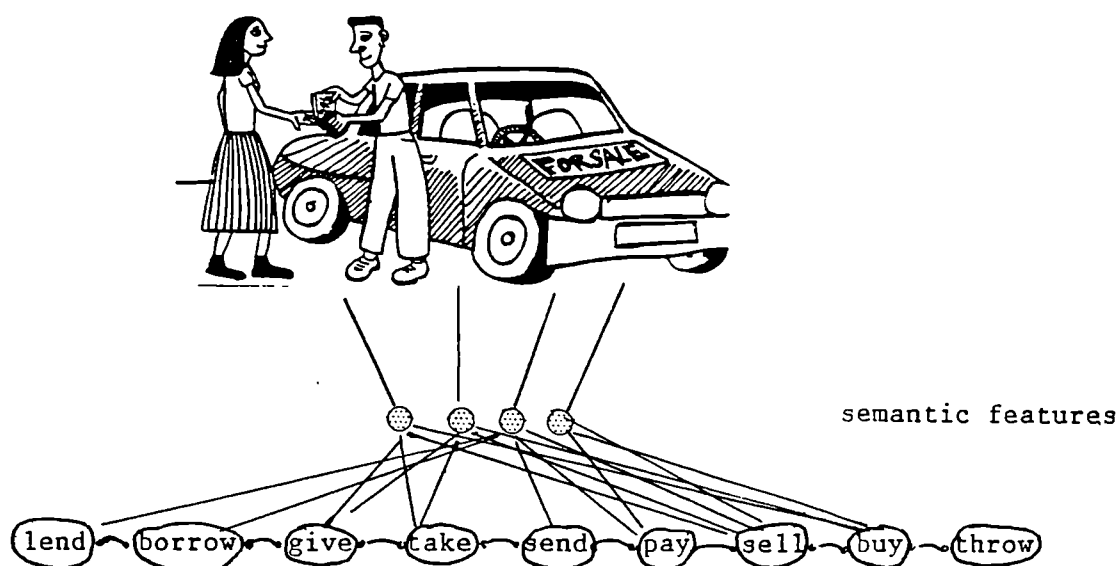
This argument suggests that PB has learnt how to exploit one event structure in order to achieve verb access and tease out the thematic roles commanded by the verb. Furthermore this skill seems to have extended to all verbs which map onto the treated type of event. However this is the limit of PB's progress. Where the event

structure is different he cannot employ his strategy and output fails.

The comprehension gain permits a similar explanation. PB only achieved significant progress on the test of reverse role verb comprehension. In this task he was shown a picture of an interactive event, of the type worked on in therapy. He was then required to match a given spoken or written verb to one of the participants, eg 'which one is selling/buying?'. Here PB could apply event analysis to determine the roles of the participants and match them to the focus expressed by the verb. The other comprehension tasks showed no change because they involved different types of event.

Alternatively the pattern of therapy effects may arise from the organisation of the verb lexicon. Verbs expressing similar events may be grouped into linked 'networks'. The change of possession verbs would constitute one such network. When describing a trading event all members of this network might be partially activated (see figure 11.5).

Figure 11.5 Activation of a verb network



Refining the semantic and focus specification both increases the activation of the target and inhibits the linked competitors. This account suggests that working on selected verbs might facilitate access across the entire network, firstly by strengthening the activation links between events and individual verbs and secondly by promoting inhibition between the members. This explanation accounts for PB's better verb access after therapy, and his improved ability to suppress semantic errors.

The effects of therapy were clearly specific to the content of the treatment, since only the treated class of verb improved. This, together with PB's time post onset, was strong evidence that progress was the result of therapy. Spontaneous recovery was also contra indicated by the stable performance on abstract word tasks. Despite the limited effects of therapy there was some generalisation to untreated change of possession and communication verbs, which suggested that PB's deficit was one of access rather than storage. It also invited further consideration of how therapy might have worked. Two explanations were offered. One argued that PB had developed a strategy for event analysis which facilitated verb retrieval and enabled him to identify the thematic structures of verbs. However he was only able to apply this strategy when events directly mirrored those used in therapy. The second account argued that therapy had improved access across a network of related verbs. These explanations may not be mutually exclusive. In other words PB may have achieved better access to the verb network via his event strategy. This suggests that the event analysis was an essential component of the therapy. Through the systematic exploration of event structures PB was able to regain access to the thematic properties of one class of verbs.

Chapter 12 Discussion

In this chapter I shall first summarise the three single case studies and discuss the patients' deficits and therapy outcomes against the models of sentence production and comprehension shown in figures 7.1 and 7.2. I shall then return to the theoretical questions raised in chapter 7. Finally I shall discuss how therapy may influence psycholinguistic processing.

12.1 Summary of Case Study 1 - EM

Comprehension

EM revealed few comprehension difficulties. She made virtually no lexical semantic errors, even when testing required access to verbs' grammatical properties (sections 9.8 and 9.9). She could detect (and correct) verb argument anomalies and performed well on the sentence anagram task with distractors, which again suggested that she could access the full lexical representation of verbs. There were some reversal errors on a test of sentence comprehension (section 9.12). However these were largely confined to the non-action verbs. Performance with the action verbs was over 85%, even with passive structures. Her difficulty also seemed task specific, since EM coped well with an active and passive sentence completion task which employed the same type of verb (section 9.13).

No single component of EM's comprehension system seemed significantly impaired. Single word tests suggested that the semantic lexicon was intact. The sentence judgements and anagram tasks indicated that the mapping processes were also functioning. Although parsing skills were not specifically tested, she could clearly analyse some non-canonical structures, since her performance with passives was equal to actives on the sentence comprehension test. She could also make inferences. The sentence completion task with non-action verbs required her to infer a probable event from two provided noun phrases, eg:

Tightrope walkers audiences

(verb options: admire, impress, balance, comfort)

Not only could EM make this inference, she could also use it to determine verb selection. It was concluded that EM's few comprehension difficulties (eg with the reversible sentence comprehension test) arose from the number of elements in the task. Although the independent elements of her comprehension system were apparently functioning, there was some 'overload' when she was required to carry out a task with several verbal and non-verbal processing elements.

Production

In contrast to her input EM's output was severely impaired. Naming tests, with both pictures and definitions, revealed a marked deficit in verb access (although she achieved approximately 90% of noun targets). This was also reflected in her spontaneous speech, since over 70% of her utterances lacked a verb. There was strong evidence that EM's verb retrieval deficit was occurring at the level of phonology:

- non-verbal testing suggested good pre-linguistic conceptual skills
- written verb naming was significantly better than spoken
- any semantic errors with verbs were rapidly rejected.

The phonological account of her naming deficit was also supported by the input tests, which revealed intact lexical semantics.

Despite her naming impairment EM read verbs aloud almost faultlessly. This indicated that verbs' phonological representations were preserved and could be accessed by the direct lexical reading route. One final cuing task was revealing. EM was asked to create spoken sentences from a provided noun or verb. With nouns production was

still severely impaired, but with verbs she achieved 27/32 correct sentences. Furthermore these sentences demonstrated a degree of syntactic variation.

Where was EM's output deficit on the Garrett-type production model? (see figure 7.1). The message level processes seemed intact (although the non-verbal investigations may fail to reveal some subtle deficits here). A functional level deficit was also ruled out by the lack of semantic errors in input testing and EM's ability to exploit verb cues. The cuing task also suggested that the syntactic processor was functioning, since once EM was provided with a verb she could generate appropriate syntactic structures. A deficit within the phonological output lexicon was counter-indicated by the reading aloud task. Her impairment was therefore isolated to the processes which link the semantic and phonological lexicon. This deficit was specific to verbs, suggesting that this route is marked for word class.

Although much of EM's sentence production system was apparently functioning, there was little evidence of this in her output. For example she rarely produced whole sentences minus the verb, despite the fact that this type of output might have been predicted from her deficit (see section 9.17). EM's poor verb access resulted in an almost total inability to realise sentences. Two reasons for this were considered. One suggested that the syntactic processor generated a planning frame which was then aborted due to the absence of a verb. The other argued that the verb form itself supplies much of the information needed for syntax. Therefore without the verb, planning frame composition cannot be achieved (these issues are discussed in greater depth in section 12.6). Either way it seemed that there was a productive relationship between EM's verb and sentence impairment.

This hypothesis was tested in the first therapy programme, which aimed to improve EM's access to verbs' phonologies (see sections 9.19 and 9.20). No specific work on sentence structure was included in

the therapy. Evaluation showed that EM's ability to access the treated verbs improved, at least in picture naming and question responses. This improvement was accompanied by gains in structure, which supported the hypothesis that EM's sentence production was dependent upon her ability to access the verb form.

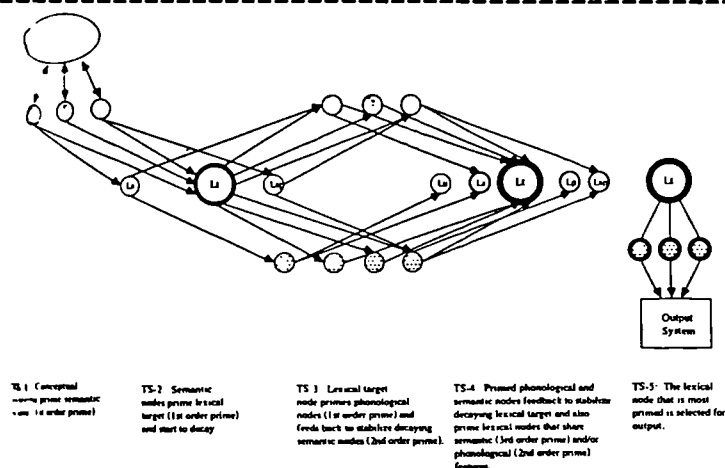
Despite these gains, there was no generalised improvement in verb naming (although verbs which were semantically related to the treated items may have become more accessible). There were also no benefits for narrative speech, even when the task allowed EM to depend upon the treated verbs. This latter finding generated a new hypothesis. It seemed that the quality of EM's output depended on the message demands of the task. Where a strong focus was provided, in the form of a picture or a question, EM coped well. When no focus was available she failed.

It was hypothesised that EM's conceptual and semantic skills were out of tune with her defective phonological skills. If EM could be encouraged to formulate and hold onto simpler messages her output might improve. This hypothesis was tested in the second therapy programme in which EM was encouraged to use gesture in order to 'focus' on just one action within a sequence of events. The programme also 'trained' a small group of general, high frequency verbs. Unlike the first therapy programme this procedure brought about gains in narrative speech. The gains seemed due to the gestural strategy, rather than the general verbs. However it was difficult to know exactly how this strategy worked. The therapy hypothesis states that gestures acted like a picture cue. In other words they helped EM to isolate one feature or moment of the story and thus enabled her to co-ordinate her rapid and intact message and semantic processing with her much slower phonological retrieval.

Connectionist accounts of lexical access may permit a more theoretical explanation, partly because these attempt to address the temporal properties of language production (eg Dell 1986; 1988; Dell and O'Seaghdha 1992). Figure 12.1 (From Martin and Saffran 1992)

illustrates the flow of activation over time during lexical access. Conceptual systems prime semantic nodes. The semantic network sends activation to both the target and related lexical nodes. These in turn feed activation back to the semantic level, as well as forward to the phonological network. The feedback is essential to stabilise the decaying semantic nodes. By now the lexical target has itself begun to decay. It is re-activated from two sources: feedback from the activated phonological nodes and input from the re-primed semantic nodes. These converging sources of input should ensure that the target, rather than related competitors, is selected for production.

Figure 12.1 The flow of activation over time during lexical access



EM's good comprehension suggests that the semantic nodes are preserved. Her reading performance would also indicate that the lexical and phonological units are retained. This evidence also shows that the lexical-phonological connections are preserved (assuming that the lexical nodes can be accessed directly from the written word). Therefore EM's naming impairment would seem to be due to damage in the connections between verbs' semantic and lexical units (1). In the model shown in figure 12.1 this would prevent activation reaching the phonological network and eliminate feedback to the semantic level. As a result it would be difficult for EM to

sustain semantic activation, even though units at this level are not in themselves impaired. The gestural strategy may have helped her overcome this problem by supplying additional input to the semantic level, thus preventing her semantic activation from fading before phonological access can be achieved.

(1) Footnote. Neologistic output has also been explained in terms of damage between the semantic and lexical nodes (Miller and Ellis 1987, Harley 1993). The lack of neologisms in EM's output is probably a consequence of her good comprehension and hence monitoring abilities.

12.2 Summary of Case Study 2 - MM

Comprehension

MM's sentence comprehension was poor, even with simple SVO sentences (see section 10.9). Her difficulties may have been due to a failure in the parser. Parsing skills per se were not investigated (and it is possible that MM's ability to analyse complex structures was impaired). However she could point to sequences of 2 and then 3 object pictures from spoken instructions. This indicated that she could recognise and retain word order information, which is the main syntactic device used in the tested SVO sentences.

An alternative locus of her comprehension deficit was within the lexical semantic system. MM made only one lexical error on the Jones test, indicating that she could derive at least the core meanings of the content words. However this might obscure more subtle lexical problems. In single word comprehension tasks she made several semantic errors, although these were largely confined to verbs (section 10.4). Furthermore sentence judgement and anagram tasks indicated that some aspects of verbs' meanings were more available than others. MM often detected violations of selection restrictions but was insensitive to verb argument anomalies. It seemed that her access to verbs' argument and mapping information was particularly impaired.

Thus MM's key input deficit seemed to be located within the lexical semantic system. This particularly obscured the grammatical information supplied with verbs. Such a deficit would also eliminate the mapping processes, in that without thematic verb information MM would have nothing to map onto the word order structures.

Production

MM's spontaneous speech showed an almost complete lack of structure and a dearth of verbs. The verb access impairment was confirmed in matched naming and reading tasks, which showed a significant advantage for nouns.

Where was output failing? Again it seemed that one deficit lay in the semantic lexicon, since naming attempts stimulated semantic errors or, in the case of verbs, related nouns. This view was also consistent with the results of the comprehension tests, which indicated a lexical semantic impairment.

However MM also showed evidence of a deficit within the message level processes. She made errors on non-verbal tasks of event analysis (sections 10.6). Her descriptions of events displayed a curious perspective. For example she often omitted key elements but mentioned peripheral features (section 10.3); and even after therapy her output was sensitive to the complexities of events. She was particularly impaired in describing multiple events or events which offered multiple perspectives (section 10.14). MM's deficit here was clearly subtle. It seemed that she could represent events at least visually, but was poor at deriving the structured representations which map onto language. (This is discussed further in section 12.4).

The message level hypothesis was pursued into therapy. Treatment aimed to encourage the formation of more thematically structured event representations, by asking specific questions about who is performing which role and by clarifying these relations with photo

selection. Outcomes showed that MM's descriptions of two argument events improved, including novel examples. However generalisation was extremely limited. Descriptions of different types of events, such as three argument events, did not improve. Comprehension also failed to show significant benefit. Perhaps most disappointingly there was no carry over to spontaneous speech.

It seemed that at least in picture description MM's output was being driven by a better appreciation of the role structure of the event, either because the message level processes had been reactivated, or because she was able to apply a conscious strategy for the analysis of events (see section 12.8 below). This was supported by post therapy performance on the non-verbal tasks which was now comparable with non-dysphasics.

Why was generalisation so limited? Two accounts might be offered:

- It was hypothesised that MM could only apply her developed event skills to highly focussed representations of events. When multiple events were presented, or events involving multiple perspectives, her output declined dramatically (section 10.14). It seemed that MM's ability to process the complex (and retrospective) events which form the subject of spontaneous narrative might still be impaired.
- MM had deficits elsewhere in the production system. Reading tasks produced phonological errors, suggesting that her ability to access representations within the phonological output lexicon was impaired. There were also virtually no syntactic markers in her output even after therapy, which pointed to an impairment in the syntactic processor. Finally her dyspraxia signalled impaired phonetic and articulatory processes. Such widespread damage in the output system might severely limit the effects of therapy.

Both accounts would suggest that more extensive therapy was required before significant changes in spontaneous production could be achieved.

12.3 Summary of Case Study 3 - PB

Comprehension

PB made several errors on a test of reversible sentence comprehension, particularly with non-canonical structures (section 11.2). A deficit within the parser was counter indicated by good performance on a syntax judgement task (section 11.3). It was therefore hypothesised that the mapping processes were impaired. The worse performance with passives and clefts suggested that PB may have lost the general mapping rules which assign thematic roles to moved argument structures. There was also evidence of a lexical semantic impairment. He made semantic errors with nouns and verbs on single word comprehension tests (section 11.4). His comprehension of reverse role verbs, such as 'buy' and 'sell' was particularly poor, suggesting that he could not access verbs' thematic information (section 11.5). This was also supported by the sentence judgement and anagram tasks (sections 11.6 and 11.7). It was concluded that PB's key input deficit lay within the lexical semantic system, which particularly impaired his access to verbs' grammatical information. The mapping processes were also impaired, partly because they were not receiving the necessary input from the semantic lexicon and partly because PB seemed to have lost the rules which map thematic roles onto non-canonical structures.

Production

The quality of PB's speech was quite different from both EM and MM, as it was fluent and contained more syntactic features. Despite this, PB also showed a marked verb production deficit, which was evident in spontaneous speech and matched naming and reading tasks (sections 11.11 and 11.12). Semantic errors, particularly with

verbs, were common. When verbs were produced they were almost always housed within syntactically appropriate verb phrases (section 11.16), although the ordering of arguments within those phrases was often anomalous (section 11.17). A constrained sentence production task indicated that the order problems were due more to the semantic properties of the verb than the comparative frequencies of the subject and object nouns (section 11.18).

Where was PB's deficit within the production model? His near normal performance on the non-verbal tasks of event analysis (section 11.15) suggested that most of his output problems arose after the message level. The naming deficit and output semantic errors indicated an impairment within the semantic lexicon (which was supported by the comprehension tests). This deficit would handicap the processing of the predicate argument structure, particularly as PB seemed to lack information about the thematic properties of verbs. This was also evident in his semantically anomalous output. The syntactic integrity of PB's verb phrases suggested that at least elements of the syntactic processor were functioning (this is discussed further in section 12.6). Thus it was concluded that PB's key output deficit lay in the functional level processes.

Therapy targeted this level of processing and particularly aimed to improve PB's access to grammatically relevant verb information. It exploited a small group of three argument verbs which express change of possession or communication, such as 'lend', 'borrow', 'teach' and 'learn'. Tasks encouraged PB to recover the thematic and assignment properties of these verbs. For example the production phase used schematic drawings of three argument events and asked PB to map information from these drawings onto given sentence frames.

Outcome measures showed that PB's descriptions of three argument events improved, both with treated and untreated verbs. His retelling of stories containing several three argument propositions also improved significantly. However there was no generalisation to different verb classes. His ability to describe two argument

agentive and locative events remained unchanged. Input tests also suggested that only the treated class of verb had benefited. His comprehension of reverse role verbs was better, but understanding of reversible agentive sentences remained unchanged.

It seemed that PB had learnt the properties of one class of verbs - those which express change of possession or communication and which employ the roles of goal, source and theme. It was suggested that he had achieved this either through an event analysis strategy or because therapy had given him access to a network of related verbs (section 11.23).

PB's therapy results suggest that each class of predicate might require specialised therapy before widespread generalisation can take place. This might be consequent on the structure of the verb lexicon. In other words verbs sharing semantic and thematic properties might be grouped into linked networks. This might enable therapy effects to generalise to untreated members of the network, but not to items outside the group. Support for this conclusion might be offered by the outcomes of other 'mapping therapies'. Table 12.1 summarises the results from some of the more extensively described mapping studies.

First a word about BB's results (Jones 1986). Little information is provided about the predicates used in BB's therapy, although the provided examples indicate that a variety of different verbs were used. Post therapy evaluations show striking gains in spontaneous speech and comprehension. Therefore it is assumed that extensive generalisation has taken place, which is beyond the specific items used in therapy and across different types of verb.

Similar generalisation occurred after BRB's therapy (Byng 1988). Here treatment was confined to prepositional predicates. Yet improvements were seen in verb argument production and in the comprehension of reversible agentive sentences. His understanding of reverse role verbs, which express the roles of goal and source, also

Table 12.1 Summary of outcomes from 7 single case investigations of mapping therapy

Patient	Improvement to treated verbs/ predicates		Generalisation to untreated exemplars of treated predicate		Generalisation to other classes of predicate		Extent of therapy
	comp	prod	comp	prod	comp	prod	
BB (1)	N/A	N/A	✓	✓	✓	✓	10 months
BRB (2)	✓	✓	✓	✓	✓	✓	2 sessions + h/wk
JG (2)	✓	✓	✓	✓	locatives* reverse role ✓	*	12 weeks
AER (3&4)	#	#	✓	✓	x	*	24 sessions
EM (4)	#	#	x	✓	x	x	24 sessions
LC (4)	#	#	x	✓	x	x	24 sessions
PB (5)	✓	✓	✓	✓	x	x	12 sessions

not specifically tested

* not analysed

(1) Jones 1986; (2) Byng 1988; (3) Nickels et al 1991; (4) Byng et al in press; (5) present study
(Note: EM is not the same subject as in Case Study 1)

improved. Other subjects showed more limited generalisation, particularly to untreated predicate types. For example AER's therapy used only agentive verbs and in post therapy comprehension testing only sentences employing this type of verb improved. JG's therapy, using agentive verbs, failed to benefit the comprehension of prepositions, although reverse role verbs did improve.

It seems that generalisation to different types of predicate is unusual. Why was this achieved for BB and BRB? One factor for BB may have been the extent of therapy, which continued for almost a year. Clearly this cannot explain BRB's performance, since he only received 2 therapy sessions. Byng (1988) suggests that his rapid and extensive gains may indicate that much mapping information was already available. In other words BRB may have been constructing good predicate argument structures even before therapy, but was unable to map these onto syntactic forms. Other subjects may fail at an earlier stage. They may retrieve inadequate thematic information from the predicate and thus fail to compute the functional level representation. These subjects may need therapy which encourages the retrieval of more elaborated verb information and as a result outcomes may be confined to the class of predicate treated. This account would seem to apply to PB. (A similar explanation for the various outcomes of mapping therapy has been recently proposed by Schwartz, Saffran, Fink, Myers and Martin (1993)).

In the following sections I shall consider the theoretical questions raised in Chapter 7 in the light of the three single case studies.

12.4 The Nature of the Message Level

Chapters 2 and 7 argued that the message level is distinct from general cognition in that it employs 'linguistic' codes (sections 2.6 and 7.2). The psychological reality of these codes is difficult to determine, although evidence from dysphasia might provide some support, particularly if we could identify a subject showing language specific conceptual problems.

MM seemed to offer this evidence. She was clearly not cognitively impaired. The Pyramids and Palm Trees test revealed near normal object semantic skills. More importantly her life style would argue against a general confusion, particularly her achievement in driving since her stroke (see 10.1).

Despite these skills MM showed signs of poor event conceptualisation, eg she made errors on non verbal tasks and her output displayed a curious perspective. MM's difficulties were subtle. She clearly could represent events at some level. Firstly she made no errors on the non-reversible sections of the role video, showing that she could interpret these events and infer their outcomes. There was also important evidence from the language tasks. For example MM performed well on aspects of the sentence anagram task (section 10.5). At the first stage of this task three sentence fragments had to be ordered into a sensible sentence. No pictures were provided, yet nevertheless MM could infer the probable event indicated by the fragments and achieve a sensible ordering. When a distractor fragment was introduced MM's performance declined. However she still coped well with the selection restriction distractors, eg:

reads
the man
the television
the newspaper

It seemed that MM was aware that these distractors belonged to a different type of event and could therefore easily eliminate them. When distractors offered an additional argument of the event, MM was floored:

the water
the man
the glass
fills

This seemed to indicate that MM could not access the thematic and mapping properties of verbs. In addition, these distractors may have been difficult because they are typically involved in the events described. Thus the difference between MM's performance with the selection restriction and argument distractors may, in part, reflect her broad event knowledge.

Similar evidence was derived from the Sentence Judgement Task (10.5). MM readily rejected violations of verb's idiosyncratic properties, such as 'the man is swimming in the street'. However verb argument violations, such as 'the man falls the stone' were much more problematic. Again it is possible that these violations were difficult because all the noun phrases were possible participants in the event. This was generally not the case with the selection restriction and modifier violations (streets are clearly not involved in swimming events). There was some direct evidence that MM was visualising events from the stimuli. For example with the above item she gestured being hit on the head with a stone and said 'ambulance'.

This evidence suggested that MM could represent events, at least in visual codes. Why then did she fail on the reversible sections of the Role Video? I argued that these items demand a different type of representation which specifies who is doing what to whom. Without this structured representation performance in judging outcomes will be error prone.

It seemed that MM's difficulties were confined to structured event representations of the type that serve as input to the language processor. As a result when describing events she had no logical means of determining her focus or expressing verb argument relationships. She was therefore reduced to simply naming what she could see in her visual representation.

Chapter 7 suggested that a therapy study might further illuminate the nature of the message level. If treatment focussing on the conceptual underpinnings of language can be shown to be effective,

the psychological reality of this level of processing might be supported.

MM's therapy provides such evidence. Treatment encouraged her to translate a visual representation of an event into a structured representation, which made the argument relationships explicit. No word order or syntactic work was included. Despite this, MM's ability to describe pictures improved, and extended to novel events which shared the same structure as those tackled in therapy. One interpretation of this result suggests that treatment enabled MM to formulate message level representations, and hence drive language more effectively.

The treatments offered to EM and PB also entailed some conscious event analysis. EM was invited to use gesture in order to segment actions and events into manageable 'portions'. PB's therapy exploited schematic drawings of change of possession and communication events. These aimed to capture the thematic relationship between the three arguments and were therefore quite different from naturalistic visual representations. PB was encouraged to form explicit connections between this structured representation and the argument relations of the sentence. In other words he was invited to 'externalise' the processes which translate between the message level and functional level representations.

Both EM's and PB's therapies brought about some gains, although it is difficult to know the contribution made by the event analysis. In EM's case it seems unlikely that the event component was righting a deficit. EM made no errors on the non verbal tasks and showed good semantic skills. Instead it was assumed that EM's conceptual and semantic level processing was 'out of kilter' with her phonological skills. The gestural therapy enabled her to delay and sustain semantic activation long enough to achieve phonological access. PB's message processes were also presumed to be intact. As with EM it seemed that the event analysis provided him with a strategy, in this

case to assist semantic verb retrieval and the creation of the predicate argument structure.

Thus all three subjects offer some evidence that therapy working at the level of the event can facilitate sentence production. In MM's case the therapy was presumed to be targeting a deficit, while for EM and PB it encouraged the use of intact processing in order to overcome deficits elsewhere in the production system.

It might be argued that rather than tapping into normal processing these event therapies were encouraging strategies which were quite different from the normal preparations for language. Of course in many ways this is true. In normal processing we do not gesture actions, or consciously schematise events, or review the argument structure of an event via a series of questions. Yet although these behaviours are in themselves 'abnormal' it seems reasonable to suggest that they are in some way analogous to the unconscious, rapid processes which normally occur at the message level. We might form a parallel with semantic naming therapies (eg Nettleton and Lesser 1991; Marshall et al 1990). These employ a variety of tasks which promote a better appreciation of word meaning, such as word to picture matching, semantic judgements and categorisation. None of these tasks reflect normal language behaviours, yet it is presumed that they in some way bear upon the normal operations of the semantic system and hence have the power to alter its functioning (these questions are considered further in section 12.8).

I have argued that this study supports the existence of a 'linguistic' message level, both by identifying a subject with an apparent deficit here and by showing that therapy targeting this level can assist sentence production. Many issues remain unresolved. One is the relationship between message and semantic processing. The model in figure 7.1 suggests that the functional level provides no feedback to the message level, while in section 10.14 a more interactive view was entertained. Resolving this relationship is problematic and demands more sensitive assessments than those used

here. Another relationship which remains unresolved is that between the message level and the inferential processes used during comprehension.

12.5 The Nature of Verbs' Representations

Section 7.3 argued that verbs' representations encode two types of semantic information. One captures the grammatically relevant properties of the verb, such as the number of arguments it takes and the thematic role of those arguments. The other encodes idiosyncratic properties, which have no bearing on the syntactic privileges of the verb. Jackendoff suggests that some of this latter information is represented in visual, rather than linguistic codes. The section also argued that this view of verbs' representations would be supported by evidence of dissociations in dysphasia.

MM and PB showed one such dissociation. Both made errors in verb comprehension tests, which indicated a general deficit in verb semantics (see sections 10.4 and 11.4). However different aspects of verb meaning were differently affected. In the sentence judgement task they were well above chance in detecting violations of verbs' selection restrictions, such as 'the woman murders the table'. They also identified anomalies within modifying phrases, such as: 'the man skates on the water'. These anomalies could be identified purely through the idiosyncratic features of verb meaning, eg it was enough to know that 'skate' takes place on ice. However with violations of verb argument structure they performed at chance. It seemed that they no longer knew about the argument and assignment properties of verbs. A similar pattern was revealed in the sentence anagram task with distractors (10.5 and 11.7). Both coped well with selection restriction distractors but poorly with argument distractors.

MM and PB displayed comparative preservation of the idiosyncratic features of verb meaning, with impaired comprehension of the grammatical properties. Of course, this evidence alone is insufficient to establish that these different types of meaning are

represented in separate codes. That would require a double dissociation. In other words we would need to identify a subject who retains knowledge about the grammatical aspects of verb meaning but not their idiosyncratic properties. One subject with dementia hints that such a dissociation may be possible (Schwartz, Marin and Saffran 1979). This subject (WL) had a severe semantic impairment with nouns and their referents. For example she confused the words 'cat' and 'dog' and made errors in sorting animal pictures. Her comprehension of sentences was also impaired. However this was mainly due to semantic errors with the nouns. She retained astonishing skills in interpreting verb argument relations. In one task she was shown a picture of a dog chasing a cat, and told 'the dog is chasing a cat. Show me the cat'. In cases like this, where the sentence matched the picture, WL identified the cat correctly, despite her semantic difficulties with the noun. In a second condition the experimenters offered a misleading sentence. For example she was given the same picture and told: 'the cat is chasing the dog, show me the cat'. Here she pointed to the dog. In other words WL was identifying the animals purely from their thematic role, as specified in the sentence. In order to do this she must have retained the argument and assignment properties of the verb. (Similar results were obtained with passive sentences).

WL shows that verbs' grammatical properties may be preserved, despite a severe semantic impairment. We cannot argue therefore that PB and MM had lost this aspect of meaning simply because it is more complex. Schwartz et al suggest that different aspects of meaning are differently represented in the brain. They argue that the perceptual noun meanings which were impaired in WL may be diffusely represented, whereas relational meanings are 'tightly wired' in the language centre. Unfortunately, we do not know whether WL could interpret the idiosyncratic properties of verbs. For example it would be very interesting to know whether she could differentiate 'chase' from 'follow', since these verbs differ purely on the idiosyncratic feature of rate. A deficit here would be consistent with the view that these features share similar codes to perceptual noun

meanings. Clearly further investigation of dementing subjects' verb knowledge is merited.

12.6 The Role of Verb Information in Sentence Generation

The production model (figure 7.1) suggests that lexical information plays a major role in the generation of sentences. At the functional level the semantic lexicon inputs to the processor of the predicate argument structure. This predicts that subjects with impaired lexical semantics should also display difficulties in computing argument structures, particularly when that semantic impairment affects access to the grammatically relevant properties of verbs. MM and PB satisfy this prediction. Input tests revealed disordered verb semantics and analyses of output showed reduced verb production and poor ability to signal argument relationships.

The syntactic processor also receives lexical input, from the phonological output lexicon, which is additional to the information relayed from the functional level. It was suggested that verb forms, in particular, may supply prosodic frames which help determine the syntax of the verb phrase.

The performances of PB and EM are consistent with this view. PB revealed a profound functional level impairment. He had poor access to semantic lexical information and reduced ability to signal meaning relations in his output. Despite this, over 90% of his verb phrases were syntactically correct. If the syntactic processor acted purely on the input of the functional level it would be difficult to account for the syntactic integrity of PB's output. Some additional resource must be available and it was argued that this came from the phonological form of the verb.

EM provides contrastive data. Her functional level processing was presumed to be intact, since she revealed good semantic skills and preserved knowledge about the grammatical properties of verbs. Despite this her output was structurally impoverished. This might

suggest that EM's syntactic processor was no longer functioning. Yet when EM was supplied with a verb cue she was able to generate good sentences. Also when she achieved verb access independently this generally co-occurred with sentence production. It seemed that her phonological verb retrieval deficit was preventing the realisation of syntax, either because this deficit made verb phrase structures unavailable, or because the lack of a verb caused EM to abort computed syntax.

EM and PB suggest that verbs' phonological representations provide an essential resource for the syntactic processor. Clearly not all syntactic processing exploits this source of information. Much syntax must be generated independently of the verb, such as the structure of the subject noun phrase and the internal structure of the post-verbal arguments. It seems reasonable to suggest that the verb can only specify the number and type of arguments within the verb phrase.

Is the syntax of the verb phrase computed solely from the lexical representation? Evidence from other subjects suggests not. Ellis, Miller and Sin (1983) describe a subject (RD) with neologistic jargon aphasia. Following Butterworth the neologisms are interpreted as a product of a word finding deficit. Excellent written comprehension suggested that this deficit was not due to impaired lexical semantics. Rather it seemed that RD was unable to access the phonological forms of words.

Despite RD's lexical deficit his output was syntactically structured. A sample of his speech reveals 10 reasonably well formed sentences (although containing word finding blocks and neologisms). Interestingly in 4 of these sentences RD failed to access the full phonology of either the main verb, or a verb within a subordinate clause:

'a /b^ n b^ n/ (BULL) a /b^ k/ is er ... /tʃ ɜ tʃ ɪ ŋ/ (CHASING) a boy or /sk ɜ t/

'a boy is /pʌvɪŋ/ (BLOWING) a .. no, I beg your pardon, by a bull (BOWL)'

'a boy is /swɪŋŋ/ (SWINGING) on the bank with his hand (FEET) in the /strɪŋt/'

'the other boy /sk/ .. boy is putting the er /bɒks/ (BLOCKS) of bottles (?) of /wɒdəʊ/ which has been /hɒpt/ (CHOPPED) in small pieces'

These sentences are of interest because they suggest that even when the phonological retrieval of the verb failed, RD could nevertheless construct some form of verb phrase.

Most of RD's neologisms were target related. It is therefore possible that he accessed sufficient phonological information about the verb to provide the required syntactic structures. However this does not account for the output of other jargon aphasics. Several of the errors recorded by Butterworth and Howard (1987) show a complete failure in the phonological retrieval of the verb. Yet, despite this, examples are given in which the verb neologism is housed within a viable syntactic form:

'when she /wɪksəz/ a /zen/ from me' (KC)

'they were electric /reɪdz/ with big holes in and they were just /rɛst| up and put over two /bɔɪlz/' (NS)

It seems that these pseudo verb phrases were generated without any recourse to lexical phonology, although it is of course impossible to judge whether the syntactic structures were appropriate for the target verb.

These data suggest that the syntactic processor can operate without input from the phonological output lexicon. Why then did EM's

output show so little evidence of this option? A number of explanations seem possible:

- Despite her apparently good semantic skills EM may have been concealing a subtle deficit at the functional level. In combination with her major problem in accessing phonology this may have resulted in insufficient input being available for the computation of syntax.
- The profundity of her output problems may offer further evidence of the interactive nature of lexical processing. In connectionist accounts of lexical access the higher levels of representation receive feedback from lower levels (see figure 12.1 above). EM's system had sustained damage to the connections between verbs' semantic and lexical units. This would not only impair her ability to activate the phonological form of the verb but would also limit the feedback provided to the semantic level. As a result it may be difficult for EM to sustain activation at the semantic level. This would bring about the rapid decay of verbs' argument and thematic information, without which EM would be unable to compute the functional level representation.
- EM's output may partly reflect a strategic response to her disorder. Jargon aphasics seem to apply a 'say something' strategy and therefore prefer to generate neologisms, rather than remain silent (Butterworth 1979; Buckingham 1987; Panzeri Semenza and Butterworth 1987). Their willingness to exploit 'lexically blind' syntax would be consistent with this strategy. EM's strategic response may be different. Her excellent semantic knowledge and good monitoring skills may prevent her from generating empty syntax. In other words she may prefer to abort output, rather than risk an error.

This discussion has argued that two sources of information feed the syntactic generator: information from the phonological output lexicon

and information from the functional level about the semantic relations of the sentence. While normal processing may require both forms of input it seems that syntax may be computed purely from one. PB demonstrates the generation of syntax without adequate semantic input, while some jargon aphasics seem to demonstrate syntax with inadequate phonological input. Whether subjects generate syntax from just one input may depend upon the functioning of the rest of their system or on their personal response to their deficit.

This account of the generation of syntax has difficulty explaining subcategorisation errors, where a correct verb form is combined with an inappropriate syntactic structure. While such errors were rare in PB's output they did feature. They have also been recorded in other subjects:

- i) 'the man is chatting to say that the .. slipped over the banana' (PB)
- ii) 'the woman is putting the mouse and a horse' (PB)
- iii) 'I think he's sunning' (Butterworth and Howard 1987, p 14)
- iv) 'She was handled to look at the books a bit' (ibid, p14)

Here the verbs' phonological representations have apparently failed to supply appropriate prosodic forms. Why might this occur?

It may be that the speaker has not accessed a true lexical item at all. In other words these 'verbs' may be neologisms which simply sound like real verbs. Almost half of PB's subcategorisation errors occurred with 'put' and 'throw'. These verbs seemed to have a special status for PB. They were heavily (and often anomalously) used and tended to appear within aborted verb phrases. Despite this PB often failed to access them when their use would be appropriate. It was therefore concluded that 'put' and 'throw' were effectively verb neologisms which were produced whenever verb search failed.

As 'neologisms' they would fail to supply PB with information about possible subcategorisation frames.

Some subcategorisation errors may be akin to blends, in that they are the result of contradictory information being supplied to the syntax generator. This could explain examples (iii) and (iv). In (iii) the subject may have accessed the semantic representation of 'sunbathing' and therefore computed a one argument functional level structure. However at the positional level he retrieved the phonological representation of 'sunning', which specifies a 2 place structure. Thus the syntactic generator receives contradictory input. The functional level representation requires an intransitive structure, while the input from the phonological lexicon requires a transitive one. This account is attractive since it might also explain subcategorisation errors in normal slips of the tongue.

Clearly these accounts remain tentative. Butterworth and Howard (1987) suggest that much more theoretical work is needed before subcategorisation errors can be adequately explained.

This section has argued that both the semantic and phonological representations of verbs supply structural information during sentence creation. This invites a re-evaluation of the possible relationships between verb and sentence disorders. In section 3.3 it was suggested that only a semantic verb deficit might significantly impair sentence production and this was supported by previous studies demonstrating just such a relationship (McCarthy and Warrington 1985, Mitchum and Berndt in press). However EM shows that an inability to access verbs' phonologies might similarly devastate output. It seems that sentence production requires the integrity of all levels of verb processing.

12.7 Dissociations between Production and Comprehension

This study has applied separate production and comprehension models, although section 7.6 suggested that elements of these models may be shared. There is considerable evidence that one central semantic system subserves lexical production and comprehension (eg Caplan 1987 for review), whereas the more peripheral areas of the systems may be distinct. Patients' assessment and therapy data may help us determine the relationship between production and comprehension processing.

EM supports the broad separation of production and comprehension, since she displayed a profound output deficit but only minimal input problems. Furthermore, despite her problems in accessing output phonology, EM showed no evidence of poor phonological processing on input.

This evidence alone does not support the separation of the models. EM's output deficit was apparently very focal. Yet the impact of this deficit was profound. This might have been due to a personal strategic response which favoured abortion over error, or because the interactive nature of output processing makes it difficult to sustain information at one level when another is failing. The impact of a focal deficit on input may be different. When comprehending, the abortion strategy would not apply. Furthermore, here the processing interactions may be facilitatory (rather than inhibitory). In other words EM may have been able to use her good semantic skills to compensate for a subtle phonological problem in input.

There is some on-line evidence to support this view. Tyler (1992) describes a subject, BN, with apparently good comprehension. He performed well on the comprehension element of the Boston Diagnostic Aphasia Examination and on most sections of the Test of the Reception of Grammar. He could also judge the grammaticality of passive sentences. However on-line testing revealed an inability to process the ends of words in sentences. This problem was not confined to

inflectional endings. For example he could not distinguish word pairs like 'attack' and 'attach' and 'college' and 'collar'. BN had a significant difficulty in processing the phonological forms of words. Yet this had only a very minimal impact on his comprehension. Tyler accounts for this by suggesting that BN may depend less on sensory input and more upon context when interpreting speech.

This argues that the identification of errors within components of the system offers only a partial account of a patient's language deficit. Clearly we need to understand how the system as a whole functions, and in particular how a deficit in one area might affect that overall functioning. Thus BN's input phonological deficit apparently left his overall comprehension system relatively unscathed; whereas EM's inability to access verbs' phonologies had widespread consequences for her production system.

PB and MM revealed some interesting associations between comprehension and production. PB's input and output were both severely impaired. Yet it seemed that his difficulties lay largely with the processing of semantic, rather than syntactic, information. A sentence judgement task (section 11.3) indicated that he could parse even complex sentence forms and an analysis of output showed that the syntactic structures of his verb phrases were largely correct (section 11.16). Furthermore his speech retained many features of grammatical morphology (see Table 11.5). It seemed that PB could engage a level of syntactic processing on both input and output. In contrast his semantic processing was very poor. On input, this resulted in lexical semantic errors, poor comprehension of reversible sentences and an inability to detect verb argument anomalies. In his output, it caused 36% of his analysed utterances to be anomalous (see section 11.17).

MM also revealed a semantic impairment which spanned both comprehension and production. She made semantic errors in single word comprehension tests and was poor at understanding reversible sentences; while her output showed an almost total inability to

signal meaning relations and some lexical semantic errors. Unlike PB her speech was syntactically impoverished. In samples of spontaneous speech and picture description (Tables 10.1 and 10.3) there were very few closed class words and virtually no syntactic elaboration. It is difficult to know whether MM showed a similar problem in processing syntactic information on input, since she was not asked to judge the syntactic integrity of sentences.

Thus PB and MM revealed semantic impairments which were common to both production and comprehension. In addition, PB displayed some retained syntactic skills which were evident in both modalities.

Interpreting such parallels is problematic. Input and output semantic difficulties may be the manifestations of one central deficit, or the product of two. Similarly we cannot use PB's data to conclude that one syntactic processor subserves both comprehension and production. His abilities may simply reflect the integrity of two separate systems. Such interpretive problems have led to the claim that dissociations (rather than associations) are a more reliable source of evidence about the architecture of processing systems (Coltheart 1984).

Dissociations between input and output sentence processing skills are common (eg Berndt 1987; Parisi 1987). However concluding that these necessarily signal different systems may be premature. For example several subjects have been identified with reduced grammatical morphology in their output but unimpaired input, which suggests that separate systems process morphology in the two modalities (eg Linebarger et al 1983). However alternative accounts are possible. For example some subjects may be able to compute grammatical morphology but be unable to realise it, owing to late phonological or phonetic deficits. Others may retain the syntactic processor but only be able to access it during comprehension, possibly because spoken input provides prosodic cues which facilitate parsing. Once again it seems that we need to understand how each area of processing impacts upon the performance of the entire system before strong

conclusions about the relationship between comprehension and production can be made.

Further evidence about the relationship between comprehension and production may come from the results of therapy.

MM's therapy produced significant gains only in production. The treatment encouraged her to formulate a more structured representation of the event and it was hypothesised that this helped her to 'drive' verb selection and organise the predicate argument structure. However she still made errors in comprehending reversible sentences (Jones Test), which suggested that her ability to derive a structured representation of events from spoken sentences remained impaired.

It is perhaps not surprising that the event therapy failed to bring about significant change on the Jones Test. This task requires the subject to match a spoken sentence to one of three pictures, which show the target, a reversal and a distractor. It was hypothesised that before therapy, MM may have been poor at deriving structured event concepts from these pictures. After therapy this may have improved. However she would still have to match one of these concepts to her interpretation of the sentence. Thus the task required her to compute and compare 4 event concepts, three of which were derived from the pictures and one from the sentence. It may have been this complexity of processing which still caused her problems.

MM also failed to show significant improvement on the sentence anagram test with distractors. This task also engages event processing. Take the following stimuli:

the man
the jug
the water
fills

Here the subject must infer the general event implied by the sentence fragments (and I have argued above that MM could accomplish this level of processing). Then the focus adopted over that event must be recognised. Here the verb 'fill' indicates that the goal of the event, or the jug, is in focus and is therefore mapped onto direct object. The theme is either rejected or mapped onto subject. It seemed that this more structured or verb driven event processing was impaired, even after therapy. The lack of significant change on this task after therapy may suggest that MM was still experiencing problems with the semantics of these verbs. In other words, although she was better able to adopt a specific perspective over events, she was still unclear about the particular focus expressed by individual verbs. Alternatively it may indicate that the processes which infer events from language in input are dissociable from the processes which formulate event representations for output. A replication study, possibly involving more extended therapy, might help clarify these issues. If a second subject shows benefits for both comprehension and production as a result of event therapy this might suggest that similar event processing is engaged in both modalities.

PB's therapy brought about gains in both production and comprehension, although only for the treated class of verb. However here it is difficult to comment about cross modality generalisation, since the therapy involved both production and comprehension tasks. Arguably the study might have been enhanced by incorporating an additional evaluation after the comprehension phase of therapy.

This approach was adopted in another investigation of mapping therapy (Nickels et al 1991). After the first comprehension phase of therapy there were no significant improvements in either input or output; while the second production phase saw benefits for both. These results are difficult to interpret. They may suggest that only the production therapy was effective. However the authors dismiss this, arguing that the comprehension phase was an essential precursor to the production work. Alternatively the results may indicate that the extent, rather than the focus of therapy was important. In other

words significant outcomes were seen after the second phase simply because more therapy had been offered. A third interpretation suggests that insights about the mapping process can only be imparted if tasks engage mapping procedures in both comprehension and production.

Regardless of these difficulties the Nickels et al study does suggest that therapy outcomes may not be specifically tied to the nature of the tasks. This is also supported by other therapy studies which have produced generalisations across comprehension and production (eg Jones 1986 and Byng 1988). On the simplest level such generalisations may suggest that the therapies improved one central mapping mechanism, which subserves both comprehension and production. However without a clearer view of how therapy influences cognitive mechanisms this conclusion must be guarded.

12.8 The Influence of Therapy on Cognitive Processing

It has been argued that remediation studies contribute little to our understanding about cognitive systems, mainly because we lack a theory of intervention. In particular, we do not understand how the impaired cognitive mechanism may change as a result of therapy (eg Caramazza 1989). In this final section I shall consider some of the ways in which therapy may influence processing.

Reactivation of Damaged Processing

Some therapies aim to reactivate damaged processing levels, typically through tasks which actively engage that level. In other words these therapies 'target the deficit'. However they need not, necessarily, involve the specific problem behaviour being treated. This is illustrated by some naming programmes. Marshall et al (1990) describe the therapy administered to 3 anomic subjects. Two of the subjects were diagnosed as having a semantic deficit and it seemed that this deficit was the main contributor to their naming problem. Therapy therefore aimed to enhance semantic processing. The

treatment task involved matching a picture to one of 4 semantically related written words. Picture naming per se was not entailed, although the subjects did read some words aloud. Thus the therapy was targeting the deficit in the sense that it was engaging conscious semantic processing, rather than practising naming. Furthermore the semantic processing was stimulated by an input task. This was motivated by the belief that one semantic system subserves both comprehension and production. Enhancing its performance in one modality should therefore improve its functioning in another. For one subject, IS, post therapy gains in both naming and comprehension seemed to validate the approach.

However this account of the therapy is still far from explanatory. Firstly it is unclear exactly how (or if) the artificial therapy task improved the functioning of the semantic system, especially as we do not understand the normal activities of this system. Secondly there were inconsistencies even within the results of this study. For example IS showed generalised improvements on lexical comprehension tasks. This supported the view that therapy had reactivated semantic processing and would suggest that a generalised improvement in naming should also be seen. However this was not the case; naming improved only for the treated items. It may be that while one semantic system mediates comprehension and production the effects of change in that system are not equal across the modalities. Thus relatively minor changes may be sufficient to improve an input task, while major changes may be required before the semantic system can better drive production.

Replications of therapies with apparently similar patients may not necessarily clarify whether reactivation is possible. Nickels and Best (1993) describe a series of naming programmes with three subjects, all of whom were diagnosed as having a semantic deficit. All were given therapy which aimed to reactivate the semantic system. Despite their similarities these subjects responded very differently to the treatment, in that two benefited and the third did not. Furthermore, for the two who did benefit the nature of the task

seemed crucial. For example one subject improved only minimally following a therapy using function judgements (eg 'do you eat an apple?'), but showed generalised gains following word to picture matching tasks. These authors propose several factors which might account for these variations, such as patient preferences and their accuracy in carrying out the tasks. They also suggest that the common diagnosis of a 'semantic deficit' was probably concealing important differences between the patients. Once again our ability to interpret therapy results is limited by our poor understanding of the language system. Improvements here should enable us to refine patient diagnoses and hence target therapy more effectively. This in turn may lead to a better understanding of how therapy may influence the workings of the system.

The event processing therapy offered to MM might be interpreted as a reactivation therapy. It was assumed that MM was failing to compute structured event representations and as a result was unable to express verb argument relations. Therapy aimed to reactivate message level processes by asking MM a series of explicit questions about the meaning relations within an event. This seemed to bring about some gains, at least in a picture description task. However, as with the semantic naming therapies, it is very difficult to know exactly how (or if) this task re-instated the damaged processing. Furthermore if this level of processing had been restored, greater generalisation might have been expected. As it was, MM was only able to describe the type of event which she had encountered in therapy, and then only in very constrained conditions. (Other explanations for the therapy are considered below).

Reaccessing Blocked Processing Levels

Several therapies aim to overcome access problems. These are differentiated from reactivation therapies through the treatment 'target'. Reactivation treatment uses tasks which directly engage the problem area of processing, whereas access therapies typically exploit intact skills in order to restore a route to the blocked

processing level. This account was offered by Marshall et al (1990) for one of their single cases. RS had a severe naming problem. However semantic skills, at least for concrete items, appeared intact. He could also read aloud all categories of words, including abstract ones which he could not understand. This suggested that phonological representations were retained and could be accessed via the direct lexical reading route. It seemed that RS's naming deficit lay in the connections between the semantic system and the phonological output lexicon. Therapy exploited his residual skills. Semantic processing was engaged through a word to picture matching task and he was required to access phonology by reading the target word aloud. It was hoped that this conscious exploitation of intact processing might enable RS to overcome the access problem between lexical semantics and phonology. Evidence of post therapy naming gains, at least for the treated items, seemed to support this hypothesis.

However, as for reactivation, this account remains opaque. It is unclear exactly how therapy re-instated access, and in particular whether the combined phonological and semantic processing was crucial. Other therapy accounts suggest that semantic tasks alone may enable subjects to regain access to phonological representations (Howard, Patterson, Franklin, Orchard-Lisle and Morton 1985). Jones (1989) argues that such therapies may boost higher levels of processing, in this case semantic, in order to increase the drive through to the blocked level.

The therapy offered to EM aimed to restore damaged access. EM's ability to access the phonological representations of verbs was impaired. Like RS, she seemed to retain these representations, since her reading aloud was virtually unimpaired. Furthermore her semantic knowledge was also largely intact. Therefore the deficit seemed to lie in the connections between semantics and phonology. The first therapy programme aimed to restore access by exploiting semantic tasks. Like Jones (1989) it was assumed that this might increase the drive through to phonology. However improvements were confined to

the treated items (and possibly their semantic partners). It seemed that only the specific links for treated verbs had benefited. Furthermore EM could only exploit these links in constrained tasks.

A second therapy introduced a gestural strategy. This seemed to improve verb access within spontaneous speech. Connectionist lexical models offered a possible interpretation of how this was achieved. It was suggested that EM's blocked access was both hindering phonological activation and reducing the feedback to the semantic level. As a result semantic activation was fading rapidly. Gesture acted like a picture cue and enabled EM to re-supply activation to the semantic nodes. This delayed the decay at this level and gave her time in which to accomplish phonological access.

This invites a re-interpretation of other therapy studies. It is possible that RS's inability to access phonology was resulting in a similar decay of semantic information. Like EM, his semantic therapy may have enabled him to sustain semantic activation long enough to achieve access to phonology.

PB's therapy may also have enhanced access, in this case to a group of verbs' semantic representations. After therapy he was more able to retrieve both treated and untreated three argument verbs, which expressed change of possession or communication. Other verb classes showed no benefit, suggesting that the improved access was confined to just one network of related verbs. This access may have benefited from two mechanisms: increased activation between certain events and individual verbs, and greater inhibition between lexical competitors.

Processing Strategies

The account of EM's therapy suggests that an external device, in this case gesture, may supply a strategy for the impaired system. In other words EM used a voluntary action in order to influence the workings of her involuntary language system.

Processing strategies may enable the person to replace or enhance normal processing with a conscious, external procedure. This may offer a better account of MM's therapy. MM may never be able to construct normal event representations. However in some circumstances she may be able to apply her learnt event procedure and use this as input to the next level of sentence production. This would also account for the limits of generalisation. Only MM's descriptions of two argument, agentive events improved after therapy. This may be because her learnt strategic routine was confined to this type of event.

PB may also have developed a processing strategy through therapy. He was encouraged to map information from a schematic event representation onto a given sentence frame. Through such tasks he may have been able to supplement or replace normal mapping processes with a conscious routine, possibly by generating the types of event representations exploited in therapy. As with MM, this may explain the limits of generalisation. PB can only apply his strategy when the event obviously mirrors the type worked on in therapy.

The 'strategic theory' suggests that the degree of conscious reflection engaged during therapy is crucial. In other words the task itself may be less important than the explicit connections made between the task and the processing problems. This is consistent with some preliminary explorations of the interactions which take place between clinician and patient in psycholinguistic therapy (Byng and Jones 1993). This study codified the cues and feedback offered to patients during therapy. Categories included specific target cues (eg 'sailors drink it' for rum), supportive feedback (eg 'that's right') and problem solving feedback. The latter aimed to give the patient more information about the problems which they were experiencing and suggest methods for overcoming those problems (eg 'you've used a good structure there, but you've got no verb. It doesn't quite say what you want it to say'; 'cue yourself by gesturing what he is doing'). The analysis showed that the majority of therapists' interactions consisted of problem solving feedback.

Thus these clinicians were aiming to give their patients greater control over the processes of language formulation by engaging conscious, strategic skills. Certainly the therapies described here also invited the subjects to reflect on the nature of their problem and the connections between the task and that problem.

The development of conscious processing strategies cannot be the only mechanism of change available in therapy. Several studies have shown that self administered tasks can bring about improvements in naming (eg Marshall et al 1990; Nickels and Best 1993). Of course, we do not know how these subjects approached the tasks, and some may have engaged metalinguistic processes. However, it is unlikely that much problem solving reflection took place. Here the task seemed directly to reactivate the processing system.

Conclusion

This section has described three possible mechanisms by which therapy may influence the functioning or use of the language system: reactivation of damaged processing, reaccessing of blocked processing levels and the development of processing strategies. The latter encourages the patient to compensate for deficits within the language system through the application of externally mediated, conscious procedures.

We are still a long way from understanding the mechanisms of therapy. Treatment may affect processing in a number of ways - and indeed different aspects of the therapy may be responsible for different types of change. Thus the task may directly reactivate areas of the system, while feedback from the therapist may help the patient to develop conscious, problem solving strategies. Owing to the number of variables involved in the therapeutic process, replications alone may not offer further clarification. Indeed serial studies of naming treatments have tended to raise as many issues as they resolve (eg Nickels and Best 1993; Pring, Davis and Marshall 1993).

It seems that new insights must be injected into the investigation of therapy. One may come from a better understanding of the psycholinguistic system itself. This should enable us to refine our processing diagnoses. For example, currently a 'semantic deficit' means little more than the tendency to make semantic errors on tests. As a result patients with probably very different deficits are being given similar therapies. If we understood more about the normal functioning of the semantic system we should be able to improve our diagnoses of semantic impairments and therefore create treatments which target the precise skills which need to be developed. We also need a better understanding of how the individual components of the system affect the functioning of the whole. Thus we know that a semantic deficit impairs both comprehension and production. Yet the impact of this deficit may have important functional differences across the two modalities. Until we know how processing deficits affect the whole system it will be difficult to design therapies which are likely to bring about the desired functional changes.

Our understanding of the therapeutic process may be furthered by incorporating on-line investigations into therapy studies. In particular these may help us to refine our evaluation of the effects of therapy. For example improvements in on-line performance following therapy may suggest that the treatment has directly reactivated aspects of language processing, or recovered access to previously blocked levels. Exploring the extent of off-line changes may then help us clarify how the improved functioning of one area of the system affects the performance of the whole. Alternatively, on-line performance may be unchanged, despite off-line gains. This would suggest that the processing deficit remains, but that the subject has acquired a strategy to help overcome the functional effects of that deficit.

This might be illustrated by thinking about how on-line investigation could have enhanced the study of PB. It was argued that PB was unable to access verbs' thematic role information. As a result he

was poor at detecting verb argument anomalies in off-line sentence judgements. This diagnosis might have been supported using similar on-line monitoring tasks. For example the subject might be asked to monitor for the word 'money' in the following sentences:

- i) John paid the money into the bank.
- ii) John bought the money off the salesman.

Normal language users should show a monitoring delay with sentence (ii), since here the assignment of 'money' to the direct object is anomalous. PB was apparently impervious to the assignment properties of verbs. As a result his monitoring latencies should be unaffected by the anomaly.

PB's therapy improved his production and comprehension of one class of verb. However it was unclear whether this was achieved through the application of an event analysis strategy, or because he had achieved better access to the semantic representations of these verbs. On-line investigations might help clarify this issue. Improved semantic access should bring about changes in his on-line performance. In other words we would anticipate a new discrepancy in monitoring times for sentences (i) and (ii). The assertion that gains are specific to just one class of verb could also be investigated. Hence we would not expect changes in PB's monitoring when different types of verb are involved. On-line tasks, which explore immediate and automatic language processes, should be unaffected by strategies. Thus if therapy has simply introduced a processing strategy, we should see unchanged on-line performance.

Finally essential insights may come from a better appreciation of the actual content and process of therapy (Byng, Nickels and Black in press). Many therapy studies (including those reported here) describe little more than the therapy task. This obviously fails to capture the full complexities of treatment, such as the nature of the therapeutic interactions and the relationship between those interactions and the patient's deficit. As a result, our accounts of

therapy almost certainly obscure important variations between apparently similar treatments. Byng (1990) argues that until we have developed methods for analysing and describing the therapeutic process itself our understanding of how therapy works will remain minimal.

Appendices

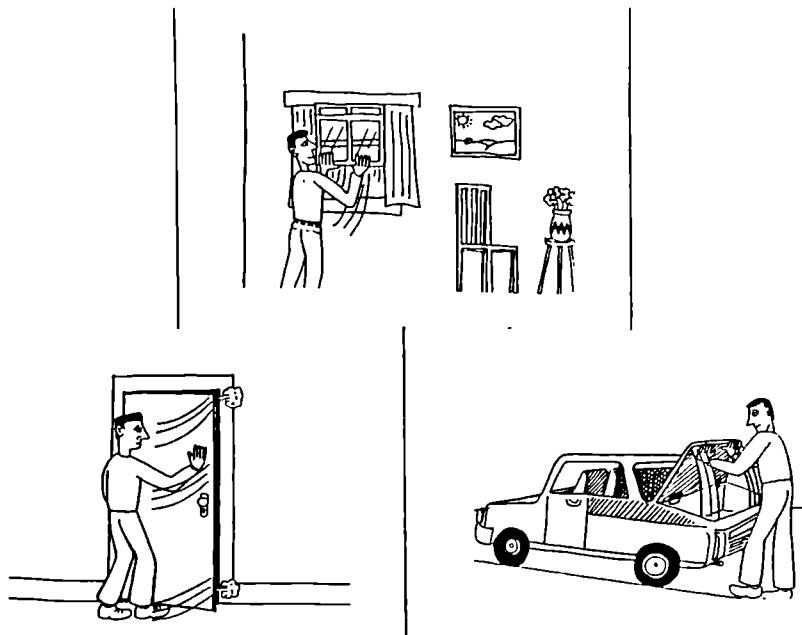
Appendix 8.1 Examples from the Event Perception Test



Analysis:

Stimulus: opening a tin
Target: opening a boot
Distractor: carrying a chair (Gross)

'Open' and 'carry' are semantically unrelated



Analysis

Stimulus: opening a window

Target: opening a boot

Distractor: closing a door (Semantic - Idiosyncratic)

'Open' and 'close' are both change of state verbs. They both focus the effect of the action, rather than the manner and differ purely in terms of the nature of the effect. This difference has no consequences for the verbs' syntactic privileges and they therefore share the same syntactic behaviours:

He opened/closed the door.

*He opened/closed to the door.

The door opened/closed.

The door is easy to open/close.

*He opened/closed her the door.



Analysis

Stimulus: opening a box
Target: opening a window
Distractor: cutting trousers (Semantic - Structural)

Analysis

'Open' and 'cut' are both change of state verbs. They differ mainly because 'cut', unlike 'open', has a strong manner component. This has consequences for the syntactic behaviour of the verbs. For example 'cut', which focuses on how the change of state is achieved, is purely causative, while 'open' is not:

He opened/cut the box.
The box opened/*cut.

Appendix 8.2 Stimuli from the Role Video

Event	Photos
1. A hammer breaks a cup (NRI)	a broken cup (T) a full cup (ED) a broken saucer (RD)
2. A woman loads the boot of a car from a trolley (NRA)	the boot full (T) the boot empty (ED) the trolley full (RD)
3. A woman gives a man flowers (RCP)	the man with flowers (T) the man with a letter (ED) the woman with flowers (RD)
4. A knife cutting an apple (NRI)	a cut apple (T) a peeled apple (ED) a cut orange (RD)
5. A man washing a plate (NRA)	a clean plate (T) a broken plate (ED) a clean saucepan (RD)
6. A man throwing a woman a ball RCP)	the woman with the ball (T) the woman with a camera (ED) the man with the ball (RD)
7. A sheet covering a chair (NRI)	a covered chair (T) an upturned chair (ED) a covered table (RD)
8. A woman burning a newspaper (NRA)	a burnt newspaper (T) a torn newspaper (ED) a burnt box (RD)
9. A man shooting a woman (R)	the woman dead (T) the woman in a coat (ED) the man dead (RD)
10. A man saws a plank of wood (NRA)	a sawn plank (T) a broken plank (ED) a sawn chair leg (RD)

- | | |
|--|--|
| 11. A woman sells a camera to a man
(RCP) | the man with the camera (T)
the man with a letter (ED)
the woman with the camera (RD) |
| 12. Water filling a bucket
(NRI) | a full bucket (T)
a broken bucket (ED)
a full glass (RD) |
| 13. A man ironing a shirt
(NRA) | an ironed shirt (T)
a torn shirt (ED)
ironed trousers (RD) |
| 14. A woman trips a man
(R) | the man on the floor (T)
the man in a coat (ED)
the woman on the floor (RD) |
| 15. A fork mashing a banana
(NRI) | mashed banana (T)
sliced banana (ED)
mashed avocado (RD) |
| 16. A woman opening a window
(NRA) | an open window (T)
a window smeared
in polish (ED)
an open door (RD) |
| 17. A man punching a woman
(R) | the woman with a black eye (T)
the woman soaking wet (ED)
the man with a black eye (RD) |
| 18. A woman posts a letter to a man
(RCP) | the man with a letter (T)
the man with flowers (ED)
the woman with a letter (RD) |
| 19. A woman folds a newspaper
(NRA) | a folded newspaper (T)
a torn newspaper (ED)
folded trousers (RD) |
| 20. A woman punches a man
(R) | the man with a black eye (T)
the man soaking wet (ED)
the woman with a black eye
(RD) |

- | | |
|--|---|
| 21. A man sells a woman a camera
(RCP) | the woman with a camera (T)
the woman with a letter (ED)
the man with a camera (RD) |
| 22. A knife slicing an apple
(NRI) | a sliced apple (T)
a cored apple (ED)
sliced bread (RD) |
| 23. A man splashing a woman
(R) | the woman soaking wet (T)
the woman with a black eye (ED)
the man soaking wet (RD) |
| 24. A man sends a letter to a woman
(RCP) | the woman with a letter (T)
the woman with flowers (ED)
the man with a letter (RD) |
| 25. A woman closing a suitcase
(NRA) | a closed case (T)
a packed case (ED)
a closed box (RD) |
| 26. A man gives a woman flowers
(RCP) | the woman with flowers (T)
the woman with a letter (ED)
the man with flowers (RD) |
| 27. A woman throws a man a ball
(RCP) | the man with a ball (T)
the man with a camera (ED)
the woman with a ball (RD) |
| 28. A man trips a woman
(R) | the woman on the floor (T)
the woman in a coat (ED)
the man on the floor (RD) |
| 29. A peeler peeling a potato
(NRI) | a peeled potato (T)
a sliced potato (ED)
a peeled apple (RD) |
| 30. A woman shoots a man
(R) | the man dead (T)
the man in a coat (ED)
the woman dead (RD) |
| 31. A woman splashes a man
(R) | the man soaking wet (T)
the man with a black eye (ED)
the woman soaking wet (RD) |

32. A man polishes a spoon
(NRA)

a polished spoon	(T)
a bent spoon	(ED)
a polished fork	(RD)

T target picture
ED event distractor
RD role distractor

NRA non-reversible event, focus on animates
NRI non-reversible event, focus on inanimates
R reversible event
RCP reversible change of possession event

Appendix 8.3 Stimuli for the Definition Naming Test

Naming verbs and nouns to definition

1. To put something down on paper. V (write)
2. To walk behind someone. V (follow)
3. The thing that a dog wags. N (tail)
4. A leather strap used to keep your trousers up. N (belt)
5. To instruct or give lessons. V (teach)
6. To move along in water. V (swim)
7. Things worn on your feet. N (shoes)
8. What you see with. N (eyes)
9. To suspend something. V (hang)
10. To take someone's money without their permission. V (rob)
11. A route covered in tarmac for cars. N (road)
12. Clothing worn on the top half of the body with sleeves and cuffs.
N (shirt)
13. What men have to do if they meet the queen. V (bow)
14. To knock over liquid by accident. V (spill)
15. The things you stand on. N (legs)
16. What you do in church. V (pray)
17. A group of people with the same interest. N (club)
18. A four legged animal that barks. N (dog)
19. To join up two pieces of cloth with a needle and thread. V (sew)
20. To turn over the earth in the garden, using a spade. V (dig)
21. Written communication sent by post. N (letter)
22. The place where you sleep. N (bed)
23. The thing you ring in church. N (bell)
24. To make a room more attractive for christmas. V (decorate)
25. To tear something. V (rip)

26. An enclosed heated compartment used for baking and roasting food.
N (oven)
27. A machine which can copy man's movements. N (robot)
28. What men have to do if they don't want a beard. V (shave)
29. This is what happens if you cut yourself. V (bleed)
30. An entrance. N (door)
31. The foliage on a tree. N (leaf)
32. A very large town. N (city)
33. To die in water. V (drown)
34. To improve the cutting edge of a knife. V (sharpen)
35. A large box used when travelling or storing clothes. N (trunk)
36. The way you cook bread and cakes. V (bake)
37. To pass your tongue over something to taste it or wet it.
V (lick)
38. What very poor people might do to get money. V (beg)
39. This happens if ice warms up. V (melt)
40. What you do with a song or hymn. V (sing)
41. To exchange goods for money. V (sell)
42. A stick used to beat children. N (cane)
43. An animal, like Bambi, with antlers. N (deer)
44. Something you put flowers in. N (vase)
45. What you do on a chair. V (sit)
46. A stringed musical instrument played under the chin. N (violin)
47. A baby's bed. N (crib)
48. To pay money for something. V (buy)
49. What you do with a book or newspaper. V (read)
50. To work out a sum like 2+2. V (add)
51. A baked food with a pastry crust. N (pie)

- 52. A long cord used in climbing or to tie up a boat. N (rope)
- 53. The spirit of a dead person which haunts a house. N (ghost)
- 54. To kill or injure someone with a gun. V (shoot)
- 55. To consume food. V (eat)
- 56. To rub out something. V (erase)
- 57. A round object used in games for throwing and catching. N (ball)
- 58. A place with typewriters and computers where people work.
N (office)
- 59. Novels, dictionaries, atlases are all ... N (books)
- 60. A piece of enclosed ground often behind a building. N (yard)
- 61. To pay attention to what someone is saying. V (listen)
- 62. What you have to do with a suitcase or shopping bag. V (carry)
- 63. To transfer water from a jug into a glass. V (pour)
- 64. A map of the world that looks like a ball. N (globe)
- 65. The thing that shines in the sky. N (sun)
- 66. Food derived from cows used for butter and cheese. N (milk)

Frequency ratings of the targets for the Definition Naming Test

Verbs	Freq.	Nouns	Freq.
write	561	eye	524
follow	540	city	521
sit	314	door	348
carry	304	office	301
add	291	book	292
read	274	road	262
buy	162	club	178
teach	153	dog	147
hang	131	bed	139
listen	123	letter	260
eat	122	leg	126
sing	120	ball	123
shoot	117	sun	117
sell	108	yard	100
swim	55	shoe	58
pour	48	milk	49
beg	34	belt	36
dig	32	leaf	33
melt	32	tail	31
pray	30	shirt	29
shave	23	bell	23
bleed	18	rope	19
sew	18	pie	19
bake	15	vase	15
rob	15	ghost	16
rip	14	deer	13
drown	14	cane	13
lick	14	globe	14
bow	13	trunk	13
decorate	12	violin	13
spill	9	crib	8
sharpen	7	oven	8
erase	5	robot	4

Appendix 8.4 Instructions for the Imagery Rating Experiment

We would be very grateful if you could help in this experiment, it should not take more than 15 minutes of your time.

Words differ in their capacity to arouse mental images of things or events. Some words arouse a sensory experience, such as a mental picture or sound, very quickly or easily, whereas others may do so only with difficulty (ie after a long delay) or not at all. The purpose of this experiment is to rate a list of words as to the ease or difficulty with which they arouse mental images. Any word which, in your estimation, arouses a mental image (ie a mental picture, or sound, or other sensory experience) very quickly and easily should be given a high imagery rating; any word that arouses a mental image with difficulty or not at all, should be given a low imagery rating. Think of the words 'apple' or 'fact'. Apple would probably arouse an image relatively easily and would be rated high imagery; fact would probably do so with difficulty and would be rated as low imagery. Similarly 'kick' would probably be rated as high imagery and 'prefer' as low.

Your ratings will be made on a seven-point scale, where one is the low imagery end of the scale and seven is the high imagery end of the scale. Make your rating by putting a circle around the number from 1 to 7 that best indicates your judgement of the ease or difficulty with which the word arouses imagery. The words that arouse mental images most readily for you should be given a rating of 7; words that arouse images with the greatest difficulty or not at all should be rated 1; words that are intermediate in ease or difficulty of imagery, of course, should be rated appropriately between these two extremes. Feel free to use the entire range of numbers, from 1 to 7; at the same time, don't be concerned about how often you use a particular number as long as it is your true judgement.

Thank you very much for your help.

Appendix 8.5 Noun/Verb pairs matched for frequency and imageability.

	Freq.	Imag.
pigeon	5	6.05
strangle	6	6.24
sofa	9	5.91
sharpen	7	6.07
sword	12	6.03
spill	9	6.04
deer	13	6.43
lick	14	6.46
cane	13	5.82
drown	14	5.71
violin	13	6.00
rip	14	6.14
vase	15	5.23
chew	16	5.21
towel	17	6.78
skip	17	6.57
thief	18	5.22
soak	18	5.25
rope	19	6.00
bleed	18	6.32
curtain	21	6.61
kneel	21	6.43
skirt	22	5.53
shatter	22	5.68
bell	23	6.11
shave	23	6.39
organ	26	5.70
preach	26	5.26
leaf	33	6.02
dig	32	6.46
nut	35	6.39
wipe	35	6.07

tongue	39	6.15
stir	39	5.82
grass	55	5.73
swim	55	5.52
office	301	4.89
sit	314	5.05
club	178	5.16
win	159	5.11
army	152	5.49
hang	131	5.31
belt	36	4.88
steal	39	4.40

Appendix 8.6 Sentence Anagram Task with Distractors

Section a

the man / pours / the milk / the glass

the man / darns / the sock / the wool

the woman / drops / the child / the floor

the man / drips / the water / the sink

the woman / spills / the ink / the desk

the man / fills / the jug / the water

the woman / decorates / the trifle / the cherries

the man / covers / the bed / the bedspread

the man / mashes / the potato / the fork

the thief / murders / the vicar / the gun

the nurse / comforts / the baby / the rattle

the woman / cuts / the trousers / the scissors

the man / kills / the ant / the poison

the man / writes / the letter / the pen

the man / shovels / the earth / the spade

the man / carves / the beef / the knife

Section b

the woman / tastes / the wine / the air

the man / reads / the newspaper / the television

the man / fries / the egg / the beer

the man / burps / the baby / the dog

the woman / chews / the toffee / the milk shake

the man / squashes / the fly / the coal

the woman / leads / the horse / the saddle

the man / burns / the wood / the water

the man / eats / the cake / the wine
the woman / breaks / the window / the sand
the woman / drinks / the gin / the sandwich
the woman / tears / the trousers / the wardrobe
the man / climbs / the mountain / the field
the woman / watches / the television / the radio
the man / sharpens / the knife / the hammer
the man / flies / the kite / the boat

Appendix 8.7 Sentence Judgement Task Stimuli

Anomalies of Verb Argument Structures

The dinner eats.
The car is washing.
The trousers cut. (S)
The grass mows. (S)
The apples sliced. (S)
The man falls the stone. (S)
The thug dies the woman. (S)
The nurse laughs the baby. (S)
The bully cries the girl. (S)
The mother swims the child.
The man drips the floor.
The man pours the glass.
The woman scatters the ground.
The woman spills the floor.
The boy piles the shelf.
The man fills the water.
The man puts the jam. (S)
The woman gives the present. (S)
The boy hands the salt. (S)
The cook stuffs the breadcrumbs.

Where sentences are marked with an (S) the syntactic structure used is not permitted by the verb. The other sentences employ a permissible syntactic structure, but with inappropriate mapping of verb arguments.

Violations of Verb Selection Restrictions

The man drinks the cake.
The woman murders the table.
The woman follows the building.
The man burns the water.
The man feeds the lorry.
The man pours the brick.
The man writes the painting.
The man eats the beer.
The woman breaks the milk.
The man sang the banjo

Violations of the relationship between the verb and an optional modifier

Instrument implicit in verb:

The man kicked the ball with his hand.
The woman saws the wood with a brush.
The woman cut the trousers with a hammer.

Environment implicit in verb:

The man is swimming in the street.
The water freezes in the fire.
The man skates on the water.
The bottle floated on the table.

Manner implicit in verb:

The woman hurries slowly.
The woman shouts quietly.
The man bashed the ball gently.

Non Anomalous Sentences:

The fire is burning.
The cake cooks.
The toy breaks.
The door slams.
The boat sank.
The man mashes the potato.
The thief murders the policeman.
The nurse comforts the baby.
The bully pushes the girl.
The woman drops the child.
The man sprays the wall.
The man loads the lorry.
The woman tells her friend.
The woman bandages her leg.
The man decorates the cake.
The woman stacks the books.
The man sows the seeds.
The woman throws the ball.
The professor teaches maths.
The woman packs her clothes.
The woman tastes the wine.
The man reads the newspaper.
The man kills the ant.
The woman leads the horse.
The man fries the egg.
The man burps the baby.
The man shovels the earth.
The woman chews the toffee.
The man squashes the fly.
The woman sang the hymn.
The man shoots the bird with a rifle.
The woman stabs her husband with a knife.
The man punches the policeman with his fist.
The woman is skiing on the snow.
The man is diving in the sea.
The kite flew in the sky.
The child paddled in the sea.
The woman hummed quietly.
The man ran quickly.
The man hit the boy violently.

Appendix 9.1 Snow White Pre Therapy Sample

(Analysed utterances shown in bold)

JM: What happens at the beginning?

EM: **king and queen** and its er I don't know I don't know (2 sec)
dear its um oh dear um (5 sec) /**lɔdə** / **woods woods**

JM: we missed a bit there. There's something about a mirror isn't there.

EM: oh yes yes yes **the queen is** um I don't know (2 sec) think its (2 sec) I don't know **this** / **dʒaɪm**/ **rhyme**

JM: yes good there's a rhyme

EM: um /**kɔ** / /**kɔ** / **queen and king** and its **magic mirror** and um oh I don't know um (3 sec) um the /**wɪmɪ**/ **no mirror on the wall** um I don't know um

JM: yes that's ok

EM: and um er /**wɪ** / um /**kɔm**/ oh I don't know I don't know um oh (2 sec) oh dear **the way** um **woods** and um its um **eight** /**dɔv**/ **dwarfs** and er its um **cleaning** and um **cooking** and um the I don't know um **prince** I don't know um **the er marriage er the loveliest woman in the land**

JM: well done that's good. So he wants to marry the prettiest woman in the land. What happens next?

EM: I don't know um (5 secs) **the queen is um um changed as the wicked witch**

JM: Right ah ha.

EM: yes er **fruit**

JM: Yes you're right go on

EM: and er **knock on the door** and um /**ækɪ**/ um **apples** and um its um **beautiful apples** and um its um **bite**

JM: So yes she's bitten the apple and what happens next?

EM: **sleeps**

JM: I think the prince comes along and he kisses her

EM: I don't know I don't know its um **sleeping beauty**

Total analysed words: 54

Snow White Analysed Utterances

king and queen	NP
woods	NP
the queen is	NP
this rhyme	NP
queen and king	NP
magic mirror	NP
mirror on the wall	NP
the way	NP
woods	NP
eight dwarves	NP
cleaning	Verb only
cooking	Verb only
prince	NP
the marriage	NP
the loveliest woman in the land	NP
the queen is changed as the wicked witch	NP ₁ V PP
fruit	NP
knock on the door	V PP (or NP)
apples	NP
beautiful apples	NP
bite	Verb only
sleeps	Verb only
Sleeping Beauty	NP

Appendix 9.2 Cinderella Pre Therapy Sample

(Analysed utterances shown in bold)

EM: **man and er (5 sec) lady and er two daughters and er one man is work and er the daughters** um (6 secs) /s> /

(EM writes 'Cinderella')

JM: yes Cinderella

EM: **man and woman and daughters** and um (4 secs) **clean** and um **cook** and er **sew** and **all the things** um **mouse** and um I don't know (7 sec)

JM: Are you thinking about the bit with the fairy god mother?

EM: no **birds** and its the er (3 sec) and er (8 sec) / m> / /mə / **magic** yes er (7 sec) **god mother** and **she's prettied up** and er **coach** (5 sec)

(EM writes 'Prince Charming')

JM: yes prince ..

EM: charming yes and it um (5 sec) **chimes** chimes **twelve o clock** and um (4 sec)

(EM gestures running away)

JM: yes that's right

EM: and **shoe** and um and I don't know it um (8 sec) oh

JM: you've got the twelve o clock and the shoe

EM: and **the next day all um female females** (2 sec) **shoe the shoe** and er **then Cinderella** its um (5 sec) **fits**

Total analysed words: 46

Cinderella Analysed Utterances

man and lady	NP
two daughters	NP
one man is work	NP ₁ V
the daughters	NP
man and woman and daughters	NP
clean	Verb only
cook	Verb only
sew	Verb only
all the things	NP
mouse	NP
birds	NP
magic	NP
god mother	NP
she's prettied up	NP ₁ VP
coach	NP
chimes	NP (or VP)
twelve o clock	NP
shoe	NP
the next day	NP
all females	NP
the shoe	NP
then Cinderella	Non argument XP NP
fits	Verb only

XP stands for any phrase category

Appendix 9.3

The verbs used in the first therapy programme + Matched control verbs
(frequency ratings are provided in parentheses)

Therapy Verbs		Control Verbs	
Non Action Verbs			
confuse	(52)	frighten	(51)
notice	(84)	please	(94)
bore	(26)	shock	(23)
envy	(8)	comfort	(11)
pity	(3)	astonish	(6)
Change of Possession/Communication Verbs			
show	(640)	tell	(759)
ask	(612)	write	(561)
learn	(254)	send	(253)
read	(274)	pass	(298)
buy	(162)	teach	(153)
lend	(29)	beg	(34)
sing	(120)	sell	(128)
pray	(30)	borrow	(31)
feed	(132)	throw	(150)
post	(13)	exchange	(13)
Locatives and Verbs of Removal			
cover	(202)	fill	(184)
clean	(58)	sweep	(54)
pack	(44)	pour	(48)
pile	(26)	paint	(24)
spray	(14)	drip	(14)
stuff	(10)	mop	(9)
steal	(39)	load	(30)
peel	(14)	decorate	(12)
prune	(1)	shovel	(2)
scrub	(9)	spill	(9)
Change of State Verbs			
cut	(254)	open	(259)
cook	(50)	tear	(58)
melt	(32)	squeeze	(30)
iron	(8)	slice	(7)
mend	(6)	mash	(4)
Verbs of Motion			
drive	(203)	rise	(199)
slip	(47)	sink	(40)
shake	(107)	arrive	(108)
spin	(31)	bounce	(28)
follow	(540)	turn	(566)

Appendix 9.4

Stories used in the evaluation of the first and second therapy programmes.

Story 1 (untreated verbs)

Bob's wife was away in America. Bob wanted to please her. So he decided to decorate the living room. He borrowed a ladder and some brushes. A friend sold him some paint. First of all he painted the ceiling. As he came down the ladder there were two disasters. He tore his trousers on a nail and he spilt the paint all over their new carpet. He mopped up some of the paint, but the carpet was badly stained. Luckily a local shop could exchange the carpet for a new one. It was very expensive. Next he painted the walls. This time the paint dripped onto his wife's favourite rug. He turned it over to hide the mark.

The next day Joan arrived home. At first she was pleased. Then Bob told her the whole story. She begged him never to decorate the house again.

(146 words)

Story 2 (treated verbs)

Peter decided to drive home for christmas. He packed his case, put it on the roof rack and covered it with canvass. Finally he set off. On the motorway a police car followed him for ten miles. Luckily he was not speeding.

After he left the motorway he had to stop at a garage to ask the way. The attendant showed him directions on a map. He set off again. At the next bend his car spun off the road. Peter cut his hand in the crash. He went back to the garage. They cleaned his hand and agreed to mend the car. They also took him to the nearest station. In the ticket hall a thief stole Peter's wallet. He had no money or credit cards. Then he noticed an old friend on the opposite platform. The friend lent him £30. Now Peter could buy his ticket. He finally got home at three in the morning.

(157 words)

Questions for Story 1 (untreated verbs)

1. What did Bob decide to do?
2. Why?
3. How did he get a ladder?
4. How did he get the paint?
5. What did he do first?

6. What 2 disasters happened when he came down the ladder?
(2 propositions)
7. What did he try to do about the paint?
8. How did the local shop help?
9. What was the next accident?
10. How did Bob try to cover it up?
11. What happened the next day?
12. Why did Joan stop being pleased?
13. What did she do?

Questions for Story 2 (treated verbs)

1. What did Peter decide to do?
2. What did he do before he set off? (2 propositions)
3. What happened on the motorway?
4. Why did Peter stop at the garage?
5. How did the attendant help?
6. What happened at the next bend?
7. How was Peter hurt in the crash?
8. How did the garage help? (2 propositions)
9. What happened in the station ticket hall?
10. What happened to raise Peter's hopes?
11. How did the friend help?
12. What did Peter do with the money?

Appendix 9.5

Pre and Post Therapy Utterances Produced by EM in the Story Retelling Task

The analysis of each utterance is presented in brackets. * denotes the absence of an obligatory determiner. XP denotes any non argument phrase. Utterances discontinued after the auxiliary 'is' are analysed as noun phrases, as the main verb is judged to be absent. False starts, hesitations and the therapist's contributions are omitted.

Story 1 (untreated verbs)

Pre Therapy

the wife (NP) .. the way (NP) .. living room (NP*) .. painting (V) .. ceiling (NP*) .. stripped (V) .. stained (V) .. back (PP) .. new one (NP*) .. walls (NP*) .. dripped on the rug (V PP) .. going (V) .. the wife is coming back (NP₁ V PP) .. nice (AdjP) .. carpet (NP*) <26 words>

('stripped' was probably a phonological error on 'ripped')

Post Therapy

the man and wife is away (NP₁ V PP) .. pleased (V) .. the decorated (NP) .. the living room ceiling (NP) .. two /stəsəz/ (NP) .. ripped trousers (V NP₂) .. the paint on the carpet (NP PP) .. the carpet man is (NP) .. new one (NP) .. back (PP) .. the walls (NP) .. splash paint on the rug (V NP₂ PP) .. turn the rug around (V NP₂ PP) .. the lady was coming back (NP₁ V PP) .. the story (NP) .. the lady was (NP) .. the man is going (NP₁ V) .. painting no way (?) <55 word>

(/stəsəz/ is interpreted as an attempt to say 'disasters')

Story 2 (treated verbs)

Pre Therapy

the pack (NP) .. a car (NP) .. roof rack (NP*) .. going to (V) .. drive (V) .. the policeman (NP) .. followed the motorway (V NP₂) .. speeding no way (?) .. garage (NP*) .. go home (V PP) .. motorway (NP*) .. the car (NP) .. cut (V) .. back in the garage (PP XP) .. the car is damaged (NP₁ V Adj P) .. is going to the station (V PP) .. the man (NP) .. friend (NP*) .. thirty pounds (NP) .. home (NP) <43 words>

(the marking of 'home' as NP is arbitrary as this could equally be analysed as a prepositional phrase)

Post Therapy

Peter (NP) .. go home Christmas (V PP XP) .. bag (NP*) .. roof rack (NP*) .. covered them /p l n/ (V NP₂ XP) .. drive (V) .. the cop (NP) .. drive ten miles (V NP₂) .. speeding (V) .. the garage (NP) .. the garage man is the way on a map (NP NP PP) .. car is skidded (NP₁ V) .. the hand is (NP) .. back to the garage (PP) .. bind (V).. the car is mended (NP₁ V) .. ride to the railway station (NP) .. wallet stolen (NP₁ V) .. friend is (NP*) .. thirty pounds to buy the ticket (NP V NP₂) .. three morning (PP) <60 words>

Appendix 9.6

Analysed Utterances Produced in the Cinderella Task After the First Therapy Programme

Cinders is (NP)
mother and two sisters (NP)
Cinders scrubbing and sweeping (NP₁ V V)
the footman (NP)
the palace (NP)
the invitation (NP)
the ball (NP)
the ugly sisters (NP)
the mother (NP)
to ball (PP*)
the sisters gone (NP V)
the fairy god mother is change the dress (NP₁ V NP₂)
fine (AdjP)
the pumpkin (NP)
the mice (NP)
glass coach (NP*)
twelve o clock change the rags (XP V NP₂)
the ball (NP)
dancing (V)
prince (NP*)
twelve o clock run away (XP V PP)
glass shoes (NP*)
slipped (V)
the prince find the slippers (NP₁ V NP₂)
the prince finds the shoe (NP₁ V NP₂)

the shoe (NP)

wife (NP*)

Cinders (NP)

shoe (NP*)

too small (AdjP)

too narrow (AdjP)

Cinders fits (NP₂ V)

Utterances discontinued after the auxiliary 'is' are analysed as noun phrases

* denotes the absence of an obligatory determiner

XP denotes any non argument phrase

Appendix 9.7 Utterances Produced by EM in the Story Retelling Task following the Second Programme of Therapy.

The analysis of each utterance is presented in brackets. * denotes the absence of an obligatory determiner. XP denotes any non argument phrase. Utterances discontinued after the auxiliary 'is' are analysed as noun phrases, since the main verb is judged to be absent. False starts, hesitations, exclamations and the therapist's contributions are omitted.

Story 1 (untreated verbs)

Bob (NP) .. wife in New York (NP PP) .. Bob pleased him (NP₁ V NP₂ .. decorate the living room (V NP₂) .. step ladder (NP*) .. paint (NP) .. paint the ceiling (V NP₂) .. Bob tore the nail (NP₁ V XP) .. spilled paint on the carpet (V NP₂ PP) .. back to the carpet shop (PP) .. changed (V) .. the walls (NP) .. paint dripped on the favourite rug (NP₁ V PP) .. rug turned (NP*₁ V) .. the wife home (NP PP) .. fine surprise (NP) .. Bob told her story (NP₁ V NP₂ NP*₃) .. wife (NP*) .. decorate the house (V NP₁) .. no life (?)

Story 2 (previously treated verbs)

today (NP) .. home to holiday (PP XP) .. pack the bags (V NP₂) .. roof rack (NP*) .. cover (V) .. canvas (NP) .. open the car (V NP₂) .. get in the car (V PP) .. drive (V) .. the motorway (NP) .. drive the car for twelve miles (V NP₂ PP) .. the police chased the car (NP₁ V NP₂) .. speeding no way (?) .. drive to the garage (V PP) .. Peter was (NP) .. map (NP*) .. the man is showing the way (NP₁ V NP₂) .. drive the motorway (V NP) .. skidded to stop (V PP*) .. cutting the hand (V NP₂) .. back to the garage (PP) .. bandaged the hand (V NP₂) .. build the car (V NP₂) .. the man is driving to the station (NP₁ V PP) .. burglar (NP*) .. wallet (NP*) .. the ticket and money all gone (NP Adj P) .. old friend on the platform (NP PP) .. thirty pounds for the ticket (NP PP) .. three o'clock in the morning go home (XP V PP)

Appendix 9.8 Analysed Utterances Produced in the Cinderella Task
After the Second Therapy Programme

Cinderella is scrubbing the floor (NP₁ V NP₂)
the step mother and two sisters (NP)
the invitation for the ball in the palace (NP)
tells her no way (V NP₂ NP)
the Cinderella is crying (NP₁ V)
ball (NP*)
step mother (NP*)
ball (NP*)
two sisters going to the ball (NP₁ V PP)
god mother is going to the ball (NP*₁ V PP)
the pumpkin is changed to the glass coach (NP₁ V PP)
rags into the ball gown (NP PP)
Cinderella is going to the ball (NP₁ V PP)
dance the prince (V NP) #
twelve o clock running out of the palace (XP V PP)
horses galloping through the streets (NP₁ V PP)
tatters (NP)
magic is stopped (NP*₁ V)
the valet is slipper (NP NP)
dropped the shoe (V NP₂)
the valet is found the glass slipper (NP₁ V NP₂)
the valet is (NP)
the country (NP)
the glass slipper is small (NP₁ V Adj P)
Cinderella is (NP)
lift shoe on (V NP₂ Particle)

fits (V)

lived (V)

Kissing (V)

married (V)

ever after (PP)

*denotes the absence of an obligatory determiner

marks a subcategorisation error

Appendix 10.1 Pre Therapy elicitation of the Cinderella sample

MM **crying** ... (gestures crying) .. yes ... **nice**

JM what happens next?

MM (writes '12' on pad) /lɛ vɔn/ o clock .. yes

JM what about that?

MM er **dance** n er **wine** er **cherio**
(gestures running) .. oh

JM what happens?

MM (gestures running)

JM what's that?

MM er .. er .. er .. er .. /tɔsɪs/ .. n er /tɔsɪs/ n er **twelve**
finish

JM then what happens?

MM **shoe** n er **no** .. **no** .. **no** (gestures trying a shoe on)
ah ... er **ball** .. n ... **shoe** .. yea .. **shoes** ... **no** ..
.. **no** .. **no** .. **big ones** (gestures size of feet)

JM so all these have big ones (both laugh) what happens next?

MM ah .. er .. ah yes **shoes** yes **me** er **Jim**

JM so the shoe fits and then what happens?

MM er .. er n er fits .. n er oh .. er no .. no .. oh yes .. er ..
wedding wedding

JM can you tell me again what happens at the beginning of the story?
how does it start off?

MM (holds up three fingers)

JM three?

MM **children** .. er **girls** (gestures face) n .. er (repeats gesture)

JM can you tell me what that is?

MM **nose** (gestures a big nose) .. er **hair** er .. **teeth** ../dɜ/
no ... /sɛn dɜ / **nice**

JM what is Cinder's life like?

MM **working** er **plates** (gestures washing up) ..

MM **working** er **plates** (gestures washing up) ..

JM what else?

MM **ball** .. **no** (gestures wagging finger)

JM what happens then?

MM **crying**

Appendix 10.2 MM Pre Therapy Spontaneous Utterances

Account of Cinderella

crying	Verb
nice	Adj
eleven o clock	NP
dance	Verb
wine	N
cherio	
twelve	Adj
finish	Verb
shoe	N
no	negative marker
no	"
no	"
ball	N
shoe	N
shoes	N
no	negative marker
no	"
no	"
big ones	NP
shoes	N
me	pronoun
Jim	N
wedding	N
children	N
girls	N

nose	N
hair	N
teeth	N
no	negative marker
Cinderella nice	N Adj
working	Verb
plates	N
ball	N
no	negative marker
crying	Verb

Account of an Episode of Home and Away

children	N
nice	Adj
house	N
dinner	N
nice	N
drinking	Verb
man	N
police	N
drinking	Verb
policeman	N
one	Adj
beer	N
dances	Verb
machining	Verb

Account of her weekend

dancing	Verb
arm	N
leisure centre	NP
Mother's day	NP
Nicola	N
meals	N
flowers	N
chocolates	N
thinking	Verb
shopping	Verb
cup of coffee	NP

NB: isolated negative markers have been included for analysis as MM seemed to use them propositionally, eg to signal that the shoes did not fit.

Appendix 10.3 Post therapy utterances from a Cinderella sample

sisters	N
polish floor	V N
cloth	N
letter	N
post	V
sisters no floor	N + Comp
ball	N
Cinderella	N
pumkin	N
mum	N
Pumkin	N
horses	N
chair	N
car	N
pumkin	N
nice	Adj
Cinders nice	N Adj
gown	N
pince	N
one	Adj
ball	N
twelve o clock	NP
shoes	N
finish	Verb
twelve o clock	NP
horses	N

pumkin	N
shoe	N
twelve o clock	NP
finish	Verb
sorry	Exclamation
running	Verb
shoes	N
shoes	N
one	Adj
sisters	N
no	negative marker
no	negative marker
Cinders	N
Cinders and prince married	NP V

Appendix 11.1

Verbs used in Sentence Anagram Task (2) - PB

with total frequency ratings (Francis and Kucera 1982)

non-agentive verbs

dread	2
pity	3
astonish	6
amuse	12
delight	20
admire	32
impress	36
frighten	51
fear	53
threaten	67
surprise	76
notice	84
please	91
hear	433
see	1513

agentive verbs

scold	2
congratulate	7
tease	8
assault	8
applaud	11
mock	11
photograph	12
embrace	18
grasp	23
dismiss	23
weigh	33
assist	36
attack	63
protect	72
wash	83

Appendix 11.2 Spontaneous Speech Samples - PB

Cinderella:

(What happens in the play? There's Cinderella isn't there and she lives in a house)

and er the Prince Charming tried the shoe/ er one two girls / big big tarts / with a dress / tried the shoe

(What happens before that, right at the beginning? Cinderella's living in this house isn't she? with two sisters and a step mother. What happens at the beginning?)

Cinderella is working / cleaning / washing up / cooking the meal / and tired / er the cat is listening no the cat is sleeping / one two girls and er man is walking to dancing /

(What dancing is that? do you remember. Its a big ball isn't it? who threw the ball?)

prince or king and queen er the fairy / night time / with a stars / and then the dress / and the girl Cinderella / and one man with er horses drive to the Prince Charming / the dancing / and Cinderella is trying the shoe / gold shoe

(There's a special rule. She's at the ball and 12 o clock strikes and what happens?)

Cinderella is rushing to the horses / galloping home / the prince is no Cinderella no / so the prince is running the horses to the house / prince knocking up the door / Cinderella walking to the door / and then kiss

Account of Car Crash

one year ago / Mark is sleeping / about seven o clock / Christopher is in the bedroom shaving / in London / and I myself / cup of tea / transport / at Monday / the man driving the car / drinking whiskey / and tape / a vauxhall car / he's crashed the road / Spareleaze Hill / and off in the car / well the policeman station / make a claim to Mark and myself / I'm angry / drove um night time / drive a car / Rock Road / one house / so Mark and myself walking to the knock at the door / and the man / I'm sorry / I drinking

Analysed utterances in bold

Appendix 11.2 Cont.

Pre Therapy Analysis of Spontaneous Utterances - PB

the Prince Charming tried the shoe	NP ₁ V NP ₂
two girls	NP
big tarts	NP
with a dress	PP
tried the shoe	V NP ₂
Cinderella is working	NP ₁ V
cleaning	Verb only
washing up	Verb only
cooking the meal	V NP ₂
tired	Adj P
the cat is sleeping	NP ₁ V
two girls and man is walking to dancing	NP ₁ V PP
the fairy	NP
night time	NP
with a stars	PP
the dress	NP
the girl Cinderella	NP
one man with horses drive to the Prince Charming	NP ₁ V PP
the dancing	NP
Cinderella is trying the shoe	NP ₁ V NP ₂
gold shoe	NP
Cinderella is rushing to the horses	NP ₁ V PP
galloping home	V PP
the prince is no Cinderella no	NP + comp

the prince is running the horses to the house	NP ₁ V NP ₂ PP #
prince knocking up the door	NP ₁ V PP
Cinderella walking to the door	NP ₁ V PP
kiss	Verb only
<u>Car Crash</u>	
one year ago	PP
Mark is sleeping	NP ₁ V
about seven o'clock	NP
Christopher is in the bedroom shaving	NP ₁ V S
in London	PP
I myself	NP
cup of tea	NP
transport	NP
at Monday	PP
the man driving the car	NP ₁ V NP ₂
drinking whiskey	V NP ₂
tape	NP
a vauxhall car	NP
he's crashed the road	NP ₁ V NP ₂ #
Sparelease Hill	NP
off in the car	PP XP
the policeman station	NP
make a claim to Mark and myself	V NP ₂ PP #
I'm angry	NP ₁ V Adj P
night time	NP
drive a car	V NP ₂
Rock Road	NP

one house	NP
Mark and myself walking to the knock at the door	NP ₁ V PP #
the man	NP
I'm sorry	NP ₁ V Adj P
I drinking	NP ₁ V

denotes utterances with verb argument and mapping errors
 XP stands for any phrase category

Appendix 11.3 Story Retelling Task (PB)

On January 1st Paul got a letter from his solicitor. The letter said that his uncle had died and left him all his money. Paul decided to use the money to sail around the world. The next day he bought a yacht and all the equipment he needed. He sold his car to a friend and told his brother that he could borrow his flat while he was travelling. His sister agreed to look after the cat. On January 30th he set off from Southampton.

What happened on January 1st?
What did the letter say?
What did Paul decide to do with the money?
What did he do next?
What did he do with his flat?
What did he do about the cat?
What happened on January 30th?

Bob is at university. He is a very good boy. Every Tuesday he writes to his mother and every month he sends his grandmother flowers. He helps at a local school for the handicapped by reading to the blind children. He has a fine tenor voice so every Christmas he goes to a local nursing home and sings carols to the old people. He helps his neighbours a lot, for example during the holidays he feeds their cat. Bob is a very good boy.

What does Bob do every Tuesday?
What does Bob do for his grandmother?
How does Bob help at the school for the handicapped?
What does Bob do at Christmas for the old people?
How does Bob help his neighbours?

Bob and Joan were planning to travel by car on the continent. Unfortunately Bob did not know how to drive so his sister gave him lessons. He passed his test first time. Joan already had a car but it was old and they were worried that it would break down. As they were students they could not afford a new car. Bob's dad offered to lend them some money, but they didn't want to get into debt. They then got some news. Joan's distant aunt in Australia died and left her £10,000. With this money she bought a car from the local showroom. Luckily she was able to sell her old car to her next door neighbours. As soon as their exams were over they set off for France.

What were Bob and Joan planning to do?
What was Bob's first problem?
How did his sister help?
Why didn't they want to use Joan's old car?
Why couldn't they afford a new car?
What did Bob's dad offer to do?
Why didn't they accept?
What was Joan's lucky news?
What did Joan do with the money?

What did she do with her old car?
How does the story end?

Appendix 11.4 Post Therapy Cinderella (PB)

Cinderella is working / sweeping / the er horrible sisters / and the man / the letter to the party to say (counts sub vocally) eight o clock night time / but Cinderella is in the house / sweeping / and cooking the meal / he is crying / the horrible sister went to the party in the palace / the wand woman the wand woman / sisterel Cinderella has started with a white dress and gold earrings / and er gold er dress / blond hair blond hair / and one two slippers / or s s

(slippers?)

slippers one two cat er / mouse / swing / no the woman is putting the mouse and a horse / one horses and carriage / with a er

(pumpkin?)

and one mouse with a horse sets off to the palace / the prince and Cinderella is dancing /(counts sub vocally) eleven no twelve twelve / Cinderella is running to jump in the horses and the carriage / and rush rushing the house /houses in the morning / the prince and the er bat batman batman knock at the door / to try to trying to the foot / the slipper er one s foot /one slipper / hung er hunger er/old aunt is trying the ... foot no slipper / one two slippers er two slipper / er s s s sisters is trying the foot with a slippers / no Cinderella is trying a gold slippers / and the prince and Cinderella went to the church to marriage / hooray

Post Therapy Car Crash

Christopher is washing in the bedroom in the bathroom / about er (counts sub vocally) eight in the morning / one two years ago / Christopher is wanting to walk to the station / but Mark is in the bedroom sleeping / the man ..boy I think boy

(a young bloke?)

is drinking whiskey / and looking at the television er radio

(fiddling around with his radio?)

yes and crashed the car with a beetle / um Beetle b b no

(he crashed his car?)

Christopher and Mark went running to the crash / the boy is .. heart a oh ..

(unconscious?)

unconscious yes but now **one year / Mark and myself / we went to ..**
Upsire to the garage to fix the car / with a Beetle / Beetle

(Beetle? It's your car which is the beetle?)

no Mark

(right you went to the garage to fix the Beetle)

yes and then **It's finished**

(Immediately after the crash there was this boy unconscious in the car, what did you do then?)

er I'm myself no speech at all

(so you weren't very involved, what did your sons do?)

but I'm thinking about well running no **punching the the chest**

(Oh right you thought he might need resuscitation?)

that's right but no speech

(so what did your sons do?)

Mark is in the car / no tax / Mark live in the boat in Ipswich with
Melany

(analysed utterances in bold)

Appendix 11.4 Cont.

Post Therapy Analysis of Spontaneous Utterances - PB

Cinderella

Cinderella is working	NP ₁ V
sweeping	Verb only
the horrible sisters	NP
the man	NP
the letter to the party to say eight o clock night time	unanalysed
Cinderella is in the house	NP ₁ V PP
cooking the meal	V NP ₂
he is crying	NP ₁ V
the horrible sister went to the party in the palace	NP ₁ V PP
the wand woman	NP
Cinderella has started with a white dress and gold earrings	NP ₁ V XP
gold dress	NP
blond hair	NP
two slippers	NP
mouse	NP
swing	Verb only
the woman is putting the mouse and a horse	NP ₁ V NP ₂ #
one horses and carriage	NP
one mouse with a horse sets off to the palace	NP ₁ V PP PP
the prince and Cinderella is dancing	NP ₁ V
twelve	NP
Cinderella is running to jump in the horses and the carriage	NP ₁ V S

rushing the house	V NP ₂ #
in the morning	PP
the prince and the batman knock at the door	NP ₁ V PP
trying to the foot	V PP #
one slipper	NP
old aunt is trying the .. slipper	NP ₁ V NP ₂
two slipper	NP
sisters is trying the foot with a slippers	NP ₁ V NP PP #
Cinderella is trying a gold slippers	NP ₁ V NP ₂
the prince and Cinderella went to the church to marriage	NP ₁ V PP XP
<u>Car Crash</u>	
Christopher is washing in the bathroom	NP ₁ V XP
eight in the morning	NP
two years ago	PP
Christopher is wanting to walk to the station	NP ₁ V S
Mark is in the bedroom sleeping	NP ₁ V S
the boy is drinking whiskey	NP ₁ V NP ₂
looking at the radio	V PP
crashed the car with a beetle	V NP ₂ PP #
Christopher and Mark went running to the crash	NP ₁ V PP
one year	NP
Mark and myself	NP
we went to Upsire to the garage to fix the car	NP ₁ V S
with a Beetle	PP
it's finished	NP ₁ V Adj P

punching the chest

V NP₂

Mark is in the car

NP₁ V PP

no tax

NP

Mark live in the boat in
Ipswich with Melany

NP₁ V PP XP XP

marks utterances with verb/argument and mapping errors
XP denotes any non argument phrase

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