Therapy for naming disorders (Part I):
principles, puzzles and progress

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Abstract
This paper takes the form of a selective review of studies of therapy for aphasic-naming disorders. There is a bias in the literature towards studies involving the use of semantic tasks (particularly word-to-picture matching) in therapy and therefore this is reflected here. These studies provide clear evidence that aphasic naming disorders can be remediated but it remains difficult to ascertain the precise mechanism by which this improvement in naming is achieved. Several issues are discussed which pertain to this problem: the effectiveness of 'semantic' and 'phonological' tasks; the relevance of each component of the therapy task to the outcome of the therapy; the relationship between the type of deficit and the effectiveness of a task; when generalization can be expected as opposed to (treated) item-specific improvement; and the importance of patient success on the task to the success of the therapy. Finally, the paper concludes with suggestions for the possible direction of further research into this important area.

Introduction

'I often had the impression that I had the letter, syllable or word within my power but through a tempestuous cleavage another element would come and take its place and this would give my speech a quality often incomprehensible and fantastic.'

Quoted in Critchley (1970)

This description by a man with (resolved) aphasia of his word production problems typifies the complaint of so many aphasic patients. It is their difficulty with speech production and word finding that is so often the main cause for concern and therefore often a primary focus for therapy. This is a paper in two parts; here, in part I of the paper, we shall concentrate on a subset of the issues involved in therapy for naming disorders. This will take the form of a selective review of the literature related to this issue, whereas in the sister paper to this (part II; Nickels and Best 1996) we present some previously unreported data from therapy recently carried out with three patients.

This paper (part I) focuses on the limitations of what we know at present regarding therapy methods used in the treatment of naming disorders and their effectiveness, together with possible avenues for further research. We consider that there is now clear...
evidence that therapy can be effective (see for example, Basso et al. 1979; Broida 1977; Franz, 1924). However, what is lacking is a detailed analysis of exactly which tasks are effective with which patients, and how they produce their effects.

Recently several authors (e.g. Behrmann and Byng 1993, Caramazza 1989, Caramazza and Hillis 1993, Coltheart et al. 1994, Wilson and Patterson 1990) have pointed out that whilst cognitive neuropsychology has forwarded our understanding of language processing and the ways in which this may break down which may provide a focus for treatment, it does not (currently) tell us what to do in therapy. A theory of therapy remains to be developed.

We agree with this basic point, but would claim that in the same way that aphasia or even anomia are not unitary phenomena, so a single 'theory of therapy' will not emerge as the correct answer. Complex multifaceted questions necessitate complex answers. We have come a long way since Coltheart (1983) pointed out the lack of convincing detailed single-case therapy studies. The existence of studies in many areas of language combined with replications and the fine-grained analysis of each case suggested by Caramazza and Hillis (1993) provide one strand of the progress towards a theory of therapy. There are other crucial components necessary to further this progress, such as detailed analysis of the interactions occurring during the therapy process (Byng and Jones 1993), and the continuing development of models of language processing.

This review of selected interventions and the case studies in our sister paper do not claim to provide a theory of therapy, but we hope to help provide another strand in the complex process of looking at the relationship between deficits, strengths, treatment tasks and outcomes.

The structure of the paper is as follows: first, we briefly address the different approaches to the treatment of naming disorders. This leads on to a review of experiments on facilitation of naming in aphasia, followed by a discussion of therapy for word retrieval disorders primarily based on this approach. Within this therapy section we begin by describing studies reported in the 1980s, first using group methodologies and then moving on to those studies where a single case design is employed. Then we examine more recent studies (therapy in the 1990s) once again discussing group studies first, followed by single-case studies. Finally, we attempt to draw some conclusions and suggestions for further research.

**Therapeutic approaches**

There are a number of approaches to treatment of disorders of naming (Howard and Patterson 1989). One of these, reorganization, aims to make use of intact processes to compensate for those processes which are impaired. For example, after de Partz (1986) retaught her deep dyslexic patient S.P. letter-sound correspondences (which resulted in a marked improvement in his ability to read words aloud by 'sounding-out' each letter in the word and then blending the resulting list of phonemes to produce a complete word), Bachy-Langedock and De Partz (1989) capitalized on his improved reading ability to assist spoken naming performance. When he was unable to say the name of a word, S.P. was on occasions able to find the written form of the same word. Therefore, when this happened he was encouraged to visualize the written form in his head and use his improved reading skills to read the word aloud. Nickels (1992) also succeeded in improving spoken naming and reading aloud in her patient T.C. by following the treatment techniques of De Partz (1986). However, as T.C. was unable
to blend phonemes together to produce a complete unit his therapy was successful in a different way. When unable to read a word he would (like S.P.) 'sound-out' the initial phoneme of the word, this phoneme would then act as a (self-generated) phonemic cue, enabling T.C. to produce the word. When unable to say the name of a word, he could often visualize the written form of the same word and then use self-generated phonemic cues to say the word. Berman and Peelle (1967), Bruce and Howard (1988) and Cook (1991) also describe studies using phonemic cues as an effective treatment for naming deficits (see Hillis, 1992, 1993 and Hillis and Caramazza 1994, study 1) for a similar approach.

Re-organization of function can clearly be a highly effective way of improving spoken naming. However, it has not altered the deficit underlying the naming disorder but rather used other skills to circumvent the problem. Unfortunately there are many patients for whom these skills simply are not present and such reorganization is not possible.

For these patients there are two main therapy approaches. First, reteaching of the missing information, and secondly, improving the functioning of defective access routines. Although the assumptions underlying the two techniques and the predictions with respect to generalization are different, the distinction between these two therapeutic methods is not as easy to maintain as it might at first appear. In particular, as we shall see, techniques aimed at improvement of the functioning of general processes may result instead at reteaching specific items.

Ideally, therapy aimed at improving access to a small set of items can result in improved naming performance generally and not just on those items which have been remediated. Although generalized naming improvement may be the ideal, we do not underestimate the power of item-specific improvement, particularly when this improvement is of functionally relevant items and has a robust, long-lasting effect.

Two studies from the 1970s are taken to show that general techniques for eliciting picture names can be effective in enhancing word retrieval. Wiegel-Krump and Koenigsknecht (1973) worked with four anomic aphasics using a variety of stimulation techniques to enable the subjects to name pictures. After 18 hourly sessions the results showed an improvement on the treated items and on items which had not been included in therapy. The generalization to untreated items allowed the authors to argue that therapy enhanced 'the general retrieval process' rather than teaching vocabulary via rote memorization. Unfortunately, however, the participants were only 'at least three months' post-onset at the time of the study and no control tasks were incorporated to demonstrate that improvement was not simply a result of spontaneous recovery.

Seron et al. (1979) contrasted two approaches to the treatment of word-finding difficulties. For four patients treatment focused on using strategies to retrieve a small number of words. A second group were taught a much larger set of items. Only one of the second group of four improved significantly. This contrasts with the former group, three of whom showed significant change. Seron et al. argue that, at least for some patients, therapy focusing on a small number of items will be most effective.

These studies suggest that treatment can improve word retrieval. What is not clear

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1 Re-teaching assumes that the stored information has been lost or at least access to it damaged beyond repair, whilst therapy aimed at improving access routines assumes that the stored information is still present but that the cause of the naming deficit is an access impairment (Howard and Hatfield 1987).
is which single (or perhaps combination of) techniques is essential in effecting change. For example the multiple repetition of ‘stimulation’ used by Wiegel-Krump and Koenigsknecht may not be necessary (Helmick and Wipplinger 1975). The tasks used in therapy need to be broken down to show which aspects are crucial to success. This is the focus of this paper.

In our review of this field, then, we shall limit ourselves to studies of remediation of aphasic naming excluding those which employ a reorganization strategy. The studies we report will be those where spoken picture naming is the primary task which is used to evaluate the effectiveness of therapy for word retrieval disorders, and where the therapy uses ‘phonological’ and/or ‘semantic’ techniques. Additionally, for inclusion the studies must be published since 1980. They must have some methodological controls for spontaneous recovery and non-specific therapy effects (this is not to say that every study is methodologically ideal), and ideally a design which allows comparison between treated and untreated items. Finally, in the case of those studies where the nature of the naming deficit is to be related to therapy outcome we include studies which used a single clearly defined treatment task. We shall begin with studies examining ‘facilitation’ which stand as a precursor to the later therapy studies.

The facilitation of picture-naming in aphasia

Howard et al. (1985a) studied the effects of facilitation, which they define as the effects of the single application of a technique with a view to assessing its specific effects at a later time. (This contrasts with ‘therapy’ which is defined as the repeated application of one or more techniques in order to produce long-term effects on word retrieval.) Their experiments were inspired by Weigl’s (1961) ‘de-blocking’ technique, where use of a word in a relatively unimpaired modality (e.g. in a comprehension task) subsequently makes it available in an impaired modality (e.g. naming). This effect is relatively short-lasting (less than 10 minutes (Weigl and Kreindler 1960)). However, if, during this period the ‘de-blocked’ task (e.g. naming) is successfully performed then the patient will remain capable of performing the task again for a much longer period (between two days and two years (Weigl 1961)). For example, Weigl (1961) studied an aphasic who could always repeat words correctly, but made errors in picture naming. The patient was asked to repeat the names of six pictures that he could not name; after a short interval the pictures were presented again, together with other pictures whose names had not been repeated, and he named all the de-blocked pictures successfully. Weigl (1961) reports that he remained able to name them ‘after the end of the experiment’. (According to Weigl (1961), in order for de-blocking to be successful, the patient must be unaware of the relationship between the de-blocking task and the task to be de-blocked.)

Howard et al. (1985a) examined the facilitation of naming by comprehension tasks that require semantic processing of picture names, and compared this with the effects of techniques that provide patients with information about the phonological form of the name. They were careful to adhere to Weigl’s condition that the patients were unaware of the relationship between the facilitating tasks and naming by embedding treatments items in sets containing ‘filler’ items.

They found that tasks which provided the patient with information regarding the phonological form of the word (repetition of the target words; attempting to name pictures given cues comprising words which rhymed with the target; and judging whether pairs of words (including the target) rhymed) facilitated intermediate naming
(6 items after the facilitating task) but failed to improve naming performance approximately 10–15 minutes later (Expt 4). This confirms the results of Patterson, et al. (1983) who found no effects of repetition or (naming following) initial phoneme cues on naming performance 30 minutes later.

In contrast, Howard et al. (1985a) found that comprehension tasks that require semantic processing of picture names did result in a significant improvement in picture naming, 6 items after performing the task, 30 minutes later and even 24 hours later. Thus, spoken picture naming was significantly facilitated by auditory word-to-picture matching with unrelated foils (Expt 1), written word-to-picture matching (Expt 3) and by semantic judgements which involved answering a ‘yes/no’ question about the target (e.g. Does a cow eat grass?; Expt 3). However, no significant facilitation (of the target) was found from performing auditory word-to-picture matching with another member of the same semantic category as the target (e.g. Pointing on command to a picture of a dog (from a choice of four pictures) when the target is cat; Expt 2). There was also no significant effect of a second attempt at naming a picture compared with items where no such opportunity had been given (Expt 1). Thus semantic tasks did facilitate naming more than repeated opportunities for naming but only on the specific items which had been facilitated (i.e. there was no generalization).

The results are somewhat equivocal regarding whether or not output of the target is required to improve naming. There was no significant difference between performance on items which had received facilitation by auditory word-to-picture matching and naming 6 items later, and items where the match had been carried out but they were not named (Expt 1). There was a large difference between these conditions such that there was greater success in the case of the items that had been named (in addition to being matched), but this was not reliable across subjects. Thus, Weigl's claim that the deblocked task must be performed a few moments later was not clearly supported.

One explanation Howard et al. use to explain their results is priming at the level of the semantic system within the Logogen model (Morton 1970, Morton and Patterson 1980). The lack of priming of semantic co-ordinates could be due to the fact that priming of the shared semantic information common to two co-ordinates is priming of information that the patient already has available. (As demonstrated by the fact that the most common type of semantic error that aphasic patients make in picture naming is a co-ordinate error.) What produced the priming effect is the additional activation of codes that are specific to the target and distinguish this target from its semantic co-ordinates.

Barry and McHattie (1991) performed a similar experiment to that of Howard et al. (1985a) and also found significant facilitation of naming 20 minutes later from single applications of tasks requiring semantic processing for a group of ten aphasic subjects. They also found a small, but significant, facilitation effect from the repetition tasks, although this was significantly less than the effect of semantic facilitation. They interpret this result in a different way to Howard et al., suggesting that the priming effect originates in the links between the semantic system and the phonological output lexicon. However, Barry and McHattie's methodology differed in a number of

An alternative explanation is proposed in terms of priming within the semantic lexicon (Butterworth 1989) where codes from the semantic system are paired with phonological addresses for representations in the phonological output lexicon.
important ways from that of Howard et al. First, whereas the repetition and semantic conditions occurred in different experiments for Howard et al., Barry and McHattie combined semantic judgements and repetition in the facilitation phase. They argue that this may be the reason for the more long-lasting facilitation effect from repetition found in their study compared with that of Howard et al. (and Patterson et al. 1983). Perhaps the intermingling of semantic tasks with repetition, biases subjects towards semantic processing of the words which are for repetition (as well as for the semantic judgements).

Additionally, the semantic tasks used by Barry and McHattie were different from those of Howard et al., consisting of forced-choice questions (e.g. Is a bear or a tree an animal?). This task requires the patient to say the name of the target aloud as the (correct) answer to the question, whereas Howard et al.'s semantic tasks did not require the patient to say the target at the time of the judgement (Expt. 1; although for most other conditions patients were required to produce the target 6 items after the facilitating task). Thus, despite the fact that Howard et al.'s patients were not required to produce the target (Expt 1), the results obtained in the two studies were the same. Therefore, in order to maintain the argument that the facilitatory effect is due to persisting activation between the level of the semantic system and the lexicon, Barry and McHattie would be forced to argue for automatic activation at the level of the output lexicon when the semantic representation of a word is activated (during the semantic comprehension tasks of Howard et al.).

When the effects were examined for each patient individually, Barry and McHattie found that only two patients did not show the effects of facilitation. These were the two patients with the most severe (word) comprehension deficits. In contrast Howard et al. found no correspondence between the patients' performance on a test of semantic processing of pictures (Pyramids and Palm Trees: Howard and Patterson 1992) and the effects of facilitation. We shall return to this point later.

Barry and McHattie (1991) also looked at the effect on priming on 'depth' of semantic processing by using forced choice questions that required different levels of semantic knowledge in order to perform accurately. They hypothesized that questions that required activation of more detailed semantic knowledge might be expected to produce the greatest facilitation, as has been shown in experiments on memory where items that had been subject to 'deeper processing' were better recalled (Craik and Lockhart 1972). Thus, questions either required only very general semantic knowledge regarding the broad semantic category of the target (e.g. Is a table or a lemon a fruit?); or lexically specific semantic knowledge (e.g. Is a banana or a lemon a yellow citrus fruit?); or intermediate levels of semantic knowledge requiring some within category information (e.g. Is an apple or a lemon a fruit grown in hot countries?).

However, no significant differences were found between the three semantic conditions for the group of patients or for any individual patient. They interpreted this as indicating either that any degree of semantic activation, however general, produces facilitation, or that the patients tested always activated full semantic representations irrespective of the 'depth' of processing required by the question. This is also supported by the fact that Howard et al. (1985a) obtained a significant facilitation effect from word-to-picture matching where the distractors were semantically unrelated to the target. However, it could also be the case that as, in Barry and McHattie's study, the task required more detailed, item-specific semantic knowledge, that the patients' failed to answer correctly more often. In other words, perhaps the patients' ability to do the task is also important in affecting the extent of any facilitatory effect. (Data
regarding the accuracy of patients' performance during therapy would be necessary to address this issue.)

It is important, however, to note that, depending on the particular semantic theory adhered to, different predictions are made as to whether these different levels of questions do indeed require different depths of semantic access. Thus, whilst Barry and McHattie's predictions (but not results) are consistent with, for example, Warrington's (1975) semantic theory (where dictionary entries consist of hierarchical trees starting with features distinguishing categories and ending with item specific features; Warrington and Shallice 1979), other semantic theories make different predictions (e.g. Collins and Quillian 1969, Rosch et al. 1976). In fact, some semantic theories (e.g. Carnap 1952, Fodor et al. 1975; which assume a set of meaning postulates or non-hierarchically organized features) would predict precisely the result found by Barry and McHattie.

Thus, the experiments reported by Barry and McHattie (1991) serve to extend the findings of Howard et al. (1985a) and for the most part concur with their results. However, subtle differences between the methodologies used by the two groups of authors have led to differences in the explanations of the locus of the effects of facilitation. It remains to be seen which task elements are important in predicting the outcome—this theme is one which will be echoed throughout the discussion which follows.

**Summary of the results of facilitation experiments**

The principle results found in the two series of experiments reported above can be summarized as follows:

1. Large and robust facilitating effects of semantic processing have been found both with (Barry and McHattie 1991) and without (Howard et al. 1985a) production of the target at that time.
2. Effects of repetition (lasting more than five minutes) were found only when repetition tasks are presented in mixed blocks with semantic tasks (Barry and McHattie 1991, versus Patterson et al. 1983).
3. No effect has been found of 'depth' of semantic processing on magnitude of facilitation (Barry and McHattie 1991, Howard et al. 1985a).
4. There is no facilitation of target naming from semantic processing of a semantic coordinate (Howard et al. 1985a).
5. The facilitation effect does not depend on modality of stimulus input (auditory/visual) or on the presence of the picture (Howard et al. 1985a).
6. The effect of facilitation may depend on the comprehension abilities of the patients (Barry and McHattie 1991).

**Therapy for word-retrieval deficits**

(i) **Therapy in the 1980s**

(a) **Group designs**

Whilst there were large effects of facilitation from semantic tasks on the naming of aphasic subjects, these effects may be transient (Howard et al. (1985a, Expt 3) found no significant effects 2 weeks later), although this is hardly surprising given the fact
that there was only a single facilitation for each item. Nevertheless, the clinician is primarily concerned with longer-lasting effects (as is the patient). Leading on from their study of the facilitation of aphasic naming by a single application of a facilitating task, Howard et al. (1985b) studied the effects of the same tasks as treatment techniques with repeated use of the same facilitating techniques over a period of time. They aimed to discover (1) whether facilitation effects are cumulative over sessions, and (2) whether such cumulative effects, if found, will result in genuinely lasting effects on the accessibility of picture names' (p. 820).

Twelve aphasic patients were involved in the study, all the patients were at least 6 months post-onset, had no severe visual problems or visual agnosia, could repeat single words and had specific word-finding problems. Each patient was tested twice on naming a large set of pictures, and a subset of failed items (preferably failed on both presentations) were randomly selected for therapy for each patient. These items were assigned at random to each of five conditions: semantic therapy, semantic naming control, phonological therapy, phonological control and baseline control. Each block of therapy occurred either for 4 consecutive days of 1 week or for 4 consecutive days in each of 2 weeks. Each experimental target item was treated three times in each session, once with each of the three techniques included within the type of therapy (semantic or phonological). Half the patients received semantic therapy first and half phonological.

The semantic therapy techniques were:

(1) pointing to the picture from a set of four semantically related pictures on spoken request (auditory word-picture matching);
(2) matching the written word to the appropriate one in this same set of four pictures (written word-picture matching);
(3) answering a yes/no question requiring the patient to access the meaning of the name (e.g. Is a cat an animal?).

The three phonological techniques were:

(1) repeating the picture name in the absence of the picture;
(2) attempting to produce the name with the aid of a phonemic cue;
(3) judging whether the name rhymed with another word.

The order of the three treatments within any one session were randomly assigned and varied from day-to-day. Each treatment session comprised a sequence of training items and naming items with the corresponding target being presented for naming six items after treatment. The naming control items were also presented for naming three times each during the course of each therapy session, whereas other (unnamed) control items were not seen during therapy.

The results of therapy were assessed by a daily pre-test before the start of each therapy session and post-tests on the complete set of pictures 1 week and 6 weeks after the end of each type of therapy for each patient. The daily pre-test showed a significant advantage for treated items over naming controls for both phonological and semantic therapy and that significant improvement occurred as more treatments were given. At post-test, 1 week after therapy had finished, there remained a significant effect of treatment, such that both semantic and phonological treated items were better named than their respective (unnamed) controls and their naming controls. Additionally, semantic naming controls were significantly better than the semantic (unnamed) controls and the phonological naming controls. In other words there had been
generalization as a result of the semantic therapy to those items that had also been named or attempted to name (but not treated) during the semantic therapy. (The authors do not examine whether the unseen controls improved compared to pre-therapy.)

Unfortunately there were no statistically significant differences between control and treated items at 6 weeks after therapy (although the treated items did show numerically superior naming performance). Howard et al. suggest that perhaps this is due to the limited amount of therapy given to each patient (as little as four sessions and therefore only twelve facilitations for each treated item) and cite Rosenbek et al.'s (1977) suggestion that permanent effects of treatment are only found after a critical amount of treatment has been given.

The improvement was not confirmed to specific pictures as different line drawings of the same items also showed significant improvement. Analysis of individual patient performance revealed that eight of the twelve patients showed significant improvement in naming from pre- to post-therapy. The likelihood of the improvement was unrelated to length of therapy periods (1 or 2 weeks), 'category' of aphasia (Goodglass and Kaplan 1972), the patient's age or the duration of the aphasia.

Thus, in contrast to the facilitation studies (Howard et al. 1985a) both phonological and semantic therapy produced significant improvement in naming, although only the semantic therapy resulted in significant generalization to other named but untreated items. However, whilst the basic methodology of this study (Howard et al. 1985b) is similar to that used in the facilitation study (Howard et al. 1985a) there is an important difference in the timing of assessments which makes evaluation difficult. In the facilitation study the 'intermediate naming' part of the procedure (six items after task presentation) was also used as the first data point for the evaluation of results, whereas in the therapy study the evaluation rests on the daily pre-therapy tests. Thus, it is impossible to determine the effects of the semantic therapy alone, what is being measured is the effects of semantic therapy with subsequent naming. Whilst this is clearly more effective than naming alone (in the context of a semantic task) we have no way of knowing whether the semantic therapy would have been as effective if there had been no 'intermediate naming'. (Although, as discussed above, the facilitation study (Howard et al., 1985a, Expt 1) failed to show a significant difference between the effects of semantic tasks with and without naming six items later, there was a numerical difference such that when naming was also performed there was greater naming success.) Additionally, although Howard et al. (1985b) describe the significant improvement in the performance on semantic naming controls as generalization to untreated items, they are in some senses treated, that is, they were presented for naming during the therapy session.

Howard et al.'s (1985b) findings have been interpreted as having clear implications for clinical practice. Whilst semantic tasks have been widely used by clinicians in their treatment of aphasic patients, there had until then been a lack of evidence for the effectiveness of this type of intervention. Howard et al. provided clear evidence that semantic therapy was effective in the remediation of word-finding disorders (even when patients performed these tasks accurately and with ease), and the use of this type

3Howard et al. (1985b) are, however, explicit that they believe that 'intermediate naming' was probably necessary to produce the improved performance (cf. Weigl 1961).
of semantic therapy as an experimentally justified remediation for word-retrieval deficits became common.

(b) Single-case studies

Having discussed group studies in the 1980s we now move on to consider two single case studies. Scott (1987) used semantic therapy to treat a patient, A.B., who was impaired in all aspects of language which required semantic mediation as a result of a central semantic processing deficit. The emphasis throughout was on comprehension rather than expression and comprised a range of therapeutic tasks all of which were considered to require a degree of semantic processing. Tasks were graded so that they became increasingly difficult and demanded 'finer' semantic judgements. They included gross and fine picture and spoken word categorization; spoken word and picture odd-one-out tasks; spoken word (and definition) to picture matching with semantic distractors; spoken word-picture verification tasks; yes/no questions. Therapy was three times a week for 3 months. Unfortunately A.B. had a second stroke 11 weeks into the 12-week programme. Nevertheless, he showed significant improvement on a range of comprehension tasks and on naming treated and untreated items (with no improvement on control tasks). This was despite the emphasis on comprehension and not naming in the therapy (although two tasks did require an attempt at retrieving the target name and if he was unable to produce the word it was provided for him to repeat).

Jones (1989) used a different variation of semantic therapy for remediation of a word retrieval problem in her aphasic patient, P.C. In contrast to Scott's patient, P.C had relatively unimpaired auditory comprehension for high imageability stimuli (35/38 on high imageability synonym judgements (Coltheart 1980)). However, he was unable to name any of 25 pictures with errors comprising no responses (15/25) and neologisms (10/25). He was not helped by either semantic or phonological cues. Jones hypothesized that despite his relatively unimpaired comprehension, the cause of his naming deficit was 'inadequate semantic "drive" to address the phonological ... forms'. She therefore aimed to increase access to the phonological form by increasing access to semantic information. The method used was to demand in-depth semantic judgements using written and pictorial stimuli. The patient was required to judge whether the target (picture or written word) was related to a number of other related and unrelated words/pictures. For example, given a picture of a car P.C. was required to judge whether it was related to a picture of a bus, spanner, a garage, a picture of someone driving (all 'yes' responses), a dog, a flower, a cigarette and an apple (all 'no' responses). After the judgements had been made, P.C. was required to attempt to rearrange appropriate scrabble tiles to correctly spell the word and then attempt to say it aloud.

After 10 weeks of therapy, P.C. showed improved naming for both treated and untreated items, and a change in error types from no responses and neologisms to phonologically related responses. (Although it is important to note that the sample used was very small, and as the patient was treated very soon following the onset of his aphasia, spontaneous recovery may have played a part in his recovery.)

A contradiction is already beginning to emerge; Jones (1989) and Scott (1987) both aimed for the tasks to require little output, with the emphasis on the comprehension aspects of the task (although Jones, in particular, did include target naming in the task). They found generalization to naming of untreated items. In contrast, Howard et al.
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(1985b) found generalization of treatment effects only to items which had been named (or attempted) in the same session as the semantic therapy for the treated items (which were also presented for naming), this was not the case for the untreated items in the studies by Jones and Scott. However, Howard et al. did not find significant improvements as a result of therapy in all their patients, perhaps within their group of patients there were some who did show the same pattern as P.C. and A.B. The question is, therefore, whether the differences in the effects of therapy are a result of differences between the therapy tasks or differences between the patients.

The studies described so far show that therapy, which has as its basis the requirement of semantic processing of a treatment item, can be extremely effective in improving the ability to name that item and other items that have not been treated. However, it is still unclear exactly how the therapy works or how long the effects might last.

(ii) Therapy in the 1990s

(a) Group designs

In order to address these issues in more detail, we will first turn to a series of studies by Pring and his colleagues (Davies and Pring 1991; Marshall et al. 1990; Pring et al. 1990) which all use a variation on the picture-word matching task that was used by Howard et al. (1985b). Marshall et al. (1990) report data from a small group study with patients who read single words better than they named pictures and had mild to moderate comprehension deficits. The therapy consisted of matching one of four written words to a picture. The written words comprised the target, two semantically related words (one of which was also present in the naming set), and an unrelated word (present in the naming set). It was hoped that these tasks would reinforce links between semantics activated by the matching task and phonology activated at the level of the output lexicon from reading aloud. Each patient was given a folder containing trials of the matching task, two trials per item per day, 5 days a week for 2 weeks. Although the authors are not explicit on this, it seems that each patient was required to read each word aloud prior to selecting the word which corresponded to the picture (although the precise details of how each patient carried out the task may have varied (Pring et al. 1990)). The patients are reported to have carried out this therapy without assistance and performance was apparently error free.

Post-therapy testing revealed a significant improvement for treated items (the targets corresponding to the pictures), and for the semantically related foils, although unrelated foils and items which had not been seen during therapy did not improve significantly. However, the authors urge caution as although the improvement in naming semantically related foils reached significance and that of unrelated items did not, there is little difference between the mean change of these two classes of stimuli. Interpretation of the data would have been made easier if comparisons of significance across conditions had been performed. Unfortunately no data is provided for

*These comparisons would assist accurate interpretation of whether the improvement shown in naming the semantically related foils and apparent improvement in naming unrelated foils (as a result of treatment) was greater than any change in naming performance for control items (which had not appeared in the stimulus materials).*
performance on control tasks and no evidence shown for a stable baseline for naming performance pre-therapy.

Re-testing approximately 1 month after the end of the therapy showed that significant improvement for treated and semantically related items was maintained. Six of the seven patients were re-tested again a year after the completion of the therapy and there remained a significant improvement for the treated items over the initial scores, but there was no significant difference from the pre-test for any other of the groups of stimuli (Pring et al. 1990).

These results are a welcome demonstration that the effects of therapy can be maintained over time, even where a relatively small amount of therapy was provided, and where it was 'self-administered' by the patients, unassisted. However, there are unfortunately a number of methodological problems with these studies which do lead to some difficulty in the interpretation of the results. It would be particularly helpful to have details regarding the individual patients and especially whether every patient showed the pattern of results that is true for the group. Although data is given on the comprehension of the patients and their overall level of naming and reading performance, this is not related to the results of therapy (but see Pring et al. 1990).

Pring et al. (1990) do, however, discuss this issue with regard to the different reading deficits shown by each patient. Two of the patients are described as having reading characteristic of deep dyslexia, and as such any attempt at reading aloud will involve access to the semantic representation as well as the phonological representation (Coltheart et al. 1980). However, one other patient showed a pattern of reading consistent with surface dyslexia and is said to be deriving the phonology of the word from a sub-lexical route for reading. Pring et al. point out that the argument used in their earlier paper (Marshall et al. 1990) to account for the improvement as a result of rehabilitation was that the therapy task simultaneously (and separately) activated semantic and phonological representations and strengthened the links between them (these links having been weakened by brain damage). However, this explanation cannot hold for these three patients. For the two deep dyslexic patients the therapy task cannot involve separate access to semantics and phonology as they can only access phonology via semantics. In contrast, the surface dyslexic patient does not access stored lexical phonology for the word but rather assembles the phonology via a sub-lexical route (which is only successful for regular words). However, all three patients are reported to have shown improvements in naming, with the two deep dyslexic patients in particular showing substantial changes. This seems to lend further weight to the interpretation of the success of the therapy (at least for some patients) being due to the semantic processing that the task involves as suggested by Howard et al. (1985a) (or the combination of semantic processing and producing the word) rather than the simultaneous, but independent, activation of semantics and phonology. We would, therefore, fully agree with Pring et al. (1990) when they suggest that subsequent studies should have two aims: first, to examine which aspect of the treatment task assists naming and whether it may vary in different patients; and secondly, to seek better evidence that generalization may occur to semantically related but untreated items.

Davis and Pring (1991) aimed to address the first issue by comparing different forms of the treatment task used by Marshall et al. Thus, one task was the same as in the previous experiment—patients matched a picture to one of four semantically related written words, which they read aloud or repeated. The second task was similar except that the distractor words were unrelated to the picture. The third task involved
repetition of the word in the presence of the target picture alone. Davis and Pring argue that if a semantic element is central to improvement then the first two tasks will be more effective than the third, and on a depth of processing account the first task which used related distractors should be more effective than the second (cf. Barry and McHattie, 1991). This of course makes the assumption patients do not perform any significant semantic processing in the repetition task when the picture is present. Davis and Pring also argue that if the therapy is effective by virtue of repeated exposure to the pictures and repetition of their names then no difference would be expected between the conditions.

The design of the study used six sets of 30 pictures matched for frequency. Three of these sets comprised the treated items (one set of treated items each for (i) written word-picture matching with related distractors or (ii) with unrelated distractors or (iii) for repetition), one set was used as related distractors for the treated items and one set as unrelated distractors, and the final set comprised control items. Every patient named the pictures before therapy, immediately after therapy and at follow-up assessments 1 month and 6 months later. The seven patients included in the study 'were chosen because they exhibited clear word-finding difficulties which were confirmed by their initial scores on naming the 180 pictures used in the experiment'.

Davis and Pring report that 'initial testing of each patient included a variety of tasks to assess the degree to which their semantics for single words and pictures were affected'. This information is of interest as it reveals a wide range of performance. Unfortunately, no data are given regarding the nature of the naming errors produced by the patients which, when combined with the detailed results of the tests of comprehension, would be most useful for determining a possible level of naming deficit for each patient. (For example, do either of those patients who show little evidence of a central semantic comprehension deficit produce exclusively phonological errors which could be the result of phonological deficits subsequent to lexical retrieval? These patients would therefore be unlikely to be affected by this therapy (Lesser 1989)).

As the patients' ability to read aloud (and read for comprehension) varied, therapy for all but one of the patients involved a therapist reading aloud the written words for the patient to repeat before selecting the appropriate word to match the picture. The remaining patient read aloud the words unaided. Every patient had therapy on the same items in each condition and every session involved treatment of each item twice, with every treatment condition occurring in each session.

This study was timely, the comparison of the effects of different therapy tasks is essential to any progress in the identification of the precise mechanisms which result in improvements in naming. However, there are some elements of the design which, we feel, lead to difficulties in interpretation of results. In particular, the fact that every patient received the same type of therapy on the same items regardless of their performance on that particular set, could lead to an imbalance in the number correct in different sets for each patient and for the group as a whole. Without careful balancing of number correct within each set for each patient, there is a danger of ceiling and/or floor effects coming into play. (That is, pre-therapy performance on one set might have been very good, leaving little room for change, and in contrast, if one set proved particularly difficult, for any one patient or for the group, then these items may also be more resistant to change.) It is difficult to tell whether these factors were affecting the results from the data given. (Mean change scores are presented for the group as opposed to exact pre- and post-therapy scores for the group and the individual
patients.) Also, by intermixing the tasks within sessions, it becomes more difficult to determine the effects of each task independently as opposed to effects of the interactions between tasks. In particular, it becomes more likely that the repetition task involves semantic processing when all the other tasks in the session involve semantic processing (Barry and McHattie 1991). In this case semantic processing is already more likely due to the presence of a picture (rather than repetition being of the word alone).

Bearing these concerns in mind, the pattern reported was a significant improvement in terms of mean change for treated items in all three treatment conditions, and for the unrelated foils, but strangely not for the related foils. There was also no change on the control items which had not been seen during therapy. However, as in the Marshall et al. (1990) study, it would have been useful if comparisons had been reported for whether performance in each condition was significantly better than in the control condition. A particularly useful element of the design of this study was the inclusion of spontaneous speech (in a composite picture description task), which showed improved performance following therapy. The improvement on the unrelated foils but not on the related foils is of concern to the authors (as it is to us) and a replication is currently underway to investigate this further (Davis and Pring, personal communication). However, the validity of this finding is thrown into doubt as a subsequent study by Pring and his colleagues (Pring et al. 1993) found no improvement for unrelated items present in the array but did find an improvement for items semantically related to the target (although this was less than the improvement found for the targets).

The conclusions drawn by Davis and Pring echo the points made above; 'it could be argued that the distinction between the semantic and phonological (repetition) therapy tasks has been overstated' (p. 143). They also wisely suggest that 'future research may demonstrate that different therapy tasks are appropriate for patients with differing forms of naming deficit. This possibility, although much discussed, has not, to date, received the experimental attention it warrants' (p. 143). Thus, the group therapy studies reported, although encouraging with respect to long-lasting item-specific effects of therapy, have advanced our knowledge little regarding the mechanisms which cause the long-term facilitation of naming beyond that gleaned from the Howard et al. (1985b) study.

As Davis and Pring suggest, what is necessary is to examine in detail the interactions between the nature of the naming deficit and the effect of the therapy. This can clearly be performed most effectively on the basis of a series of single-case studies. However, one of the reasons why Howard et al. (1985b) primarily reported their data as a group study rather than as a series of single-case studies was because of the difficulty in obtaining sufficient data from a single subject to show any significant changes, although many patients show trends towards an improved performance (Howard, personal communication). Nevertheless, despite these difficulties this is clearly the direction that research into therapy for naming deficits must progress, as without details of individual naming performance, evaluation of the effects of therapy on individual patients becomes difficult. In particular, the key question of whether the therapy worked in different ways for patients who differed (in terms of, for example, their comprehension, overall naming success and locus of naming deficit) remains unanswered.

\[^5\] However, Pring et al. (1993) seem to differ, suggesting that 'the therapies appear to be effective for whatever variety and severity of naming problems those subjects have had'.
(b) Single-case studies

'Semantic' therapy. In addition to their group study, Marshall et al. (1990) report the results of three single-case studies using the same therapy technique. The first of these three studies was with patient R.S., who seemed to have functionally intact comprehension but his speech was handicapped by a general anomia, with omissions predominating and no semantic errors. R.S. was found to perform normally in the comprehension of high imageability items but did demonstrate a deficit in the comprehension of low imageability words (synonym judgements, Coltheart 1980). He could be phonemically cued but not miscued (with the initial phoneme of a semantic co-ordinate; cf. Howard and Orchard-Lisle 1984) to assist picture naming, and his reading aloud was almost unimpaired. These results were used to argue that the locus of the naming deficit for R.S. was not at the semantic level (he had good comprehension) nor at the level of the phonological output lexicon (he could access phonology in reading) but was a problem with the route connecting these two.

Therapy therefore involved matching a picture with one of five written words which were to be read aloud. Thus, Marshall et al. argue (as discussed above for the group study) that this task, which involves accessing semantics and phonology, will be reinforcing the links between the two. R.S. had therapy on half of a 50-item set of low-frequency words such that both treated and untreated sets contained eight items that he had named correctly pre-therapy. R.S. was given 3 hours of therapy spread over a 2-week period. Re-test at the end of this period showed a significant advantage for treated over untreated items (20/25 treated; 10/25 untreated) this advantage was maintained one month later (18/25 versus 9/25). Thus, there seems to be an item-specific effect of treatment for this patient on this task.

The second single study presented by Marshall et al. (1990) involved patient I.S., who showed a different pattern of deficits from R.S. Her naming errors comprised equal proportions of semantic and phonological errors, and her comprehension was severely impaired for both auditory and written presentation and on a test of retrieval of semantic information from pictures (Pyramids and Palm Trees, Howard and Patterson 1992). Nonetheless, her reading aloud was relatively good, showing no effect of regularity or imageability. I.S. received two blocks of treatment over two, 2-week periods, each block involved treatment of a different set of words and consisted of approximately 2½ hours of therapy in each block. Two tasks were used. In each task, four semantically related written words were presented and I.S. was required to select the correct word to match either a drawing or a spoken definition. In each, errors were pointed out and she was asked to correct herself. Although it is not made explicit whether I.S. was required to read the words aloud prior to selecting the correct word, it appears that only the chosen word (target or an error) was read aloud (Pound, personal communication).

Each treated group of items showed significant improvement following treatment which was maintained. However, untreated items also showed some slow (non-significant) improvement over the course of therapy. The authors do not discuss the issue, but this change in the untreated items may reflect general 'spontaneous' recovery as opposed to any specific effects of therapy. However, I.S. also showed marked improvement on the various tests of comprehension used. Marshall et al. seem surprised by this and seem reluctant to attribute it to the effects of therapy. As the therapy involved semantic judgements it seems highly probable that comprehension should improve as a result of this task, just as Scott's patient A.B. showed improvements...
in comprehension. Although the authors do point out that a general improvement of semantic processing could not explain the item-specific effect of therapy on naming, if the slow improvement on untreated items is a therapy effect then a combination of a general effect on semantic processing and an item-specific effect similar to that shown for R.S. might explain the data.

The final patient, F.W., also showed a marked semantic deficit in addition to her severely impaired naming performance. Her naming errors comprised semantic errors, phonological errors, neologisms and unrelated words. Phonological cues and initial letter cues both increased naming success. F.W. received treatment on half of a 50-picture set with approximately equal numbers of items which had been named correctly occurring in each of the treated and untreated sets. Treatment comprised matching pictures to one of four written words (target and semantically related distractors). It is not clear in this case whether F.W. was required to read the words aloud selecting the picture, nor whether feedback was given regarding her performance. She received around 33 hours of treatment over a 3-week period, this was followed by a retest and then a further 3 weeks of treatment. After 6 weeks of therapy there was no difference between control and treatment groups but overall performance was better than at the pre-test. Unfortunately these results are difficult to interpret in the absence of either more than one pre-therapy baseline or data from control tasks, and comprehension tasks. It may be, as Marshall et al. conclude, that this therapy simply ‘failed to help F.W. . . . (because of . . . ) her poor adjustment to her disabilities and her fluctuating emotional state’ (p. 178). Alternatively, the significant improvement may be a result of a generalized improvement in naming as a result of the therapy just as Jones (1989) and Scott (1987) found with P.C. and A.B.

Thus, the single case studies of Marshall et al., show that this task can produce item-specific effects but may also produce more general effects on naming and comprehension. The occurrence of more general effects are supported by the studies reported above of Scott (1987) and Jones (1989). It is also of note that it was the patient with the best comprehension (R.S.) that showed the best response to therapy. A similar pattern was found by Barry and McHattie (1991) in that the two patients who failed to show improvements with their task were the two who had the worst comprehension. It would be interesting to know whether in the Howard et al. study (1985b) the four patients who failed to improve were those with the poorest comprehension.

'Phonological' therapy. Although Marshall et al. use a semantic task, their patients also produced the stimuli within the therapy. However, they do not address the issue as to whether output of the phonological form of the stimulus (i.e. reading aloud in their task) could be crucial for the observed improvement. We will now describe two studies that use therapies that focus on phonological rather than semantic tasks.

Miceli et al. (1994) describe therapy for anomia in two cases, R.B.O. and G.M.A. In both cases they argue that difficulty in naming stems from ‘selective damage to the phonological output lexicon’ (either damage to the lexicon itself or in access to it). They claim that the lexical-semantic system and sublexical conversion mechanisms remain relatively unimpaired. In both cases they selected a set of items that the patient was unable to name but was able to understand for treatment. Both patients were more than a year post-onset at the start of treatment.

R.B.O. received treatment on two sets of stimuli each for five, 1-hour sessions. The first treatment consisted of reading aloud and the second of repeating the target
items. At the end of each treatment session the pictures were presented for naming. On post-treatment reassessment there was an item-specific improvement immediately following each intervention with no change on a control set of items. There are, however, two problems with the data from R.B.O. First, the three sets of items were not matched for naming performance before treatment 1, and secondly there appears to be an unexplained improvement in performance on the untreated sets between the end of the first treatment and start of the second treatment. The latter improvement could reflect a delayed generalization and if so poses a problem for the claim that there is no generalization (which is central to the paper).

The data from G.M.A. do not suffer from these problems. He was given treatment on three sets of items, each involving hourly sessions over 7 days. Each session was followed by an attempt at naming the treated items. The first treatment was reading aloud the name with the picture present. The second involved reading aloud without the picture present. Finally, the third set were trained by G.M.A. attempting to name the pictures and if unable being presented with progressive phonemic cues (initial sound, initial syllable, etc.) until he produced the target. All three treatments resulted in item-specific improvement whilst performance on a fourth set of untreated items remained stable. Miceli et al. note that the first and third treatments (i.e. those where the picture was present) improved naming performance faster, but all three treatments were effective and repeated assessments showed that effect maintained for at least 17 months.

Thus, in both cases there was item-specific improvement immediately after treatment as the authors predicted from the claim that the impairment involved the phonological output lexicon. In R.B.O.'s case this clear-cut finding is somewhat confused by the tendency to unexplained improvement in untreated items between the two treatments. Nevertheless, the studies show very clear effects of a small amount of intervention and, in the case of G.M.A., that such improvement is very long lasting. It would be interesting to know whether these patients could also have benefited from semantic treatments and if so whether generalization would have been observed.

Raymer et al. (1993) use a slightly different task based on picture naming with a hierarchy of cues (see also, Thompson and Kearns 1981, who also use this hierarchy). Thus, the patient attempted to name a picture, if they were unsuccessful the subject was presented with a word that rhymed with the target, then an initial phoneme cue, and finally, if they had still failed to produce the word, the therapist gave them an auditory model. No matter at what level of the hierarchy the patient produced the target, they were then required to repeat the word five times and then attempt to name the picture once more. Raymer et al. conclude that all four patients show improved performance on the treated items and that two of the subjects showed carryover to naming of untreated items (the patient described by Thompson and Kearns failed to show any evidence of carryover). They also argue that there is evidence for generalization to written naming and/or oral reading for some patients. Unfortunately, interpretation of the results of this study is not clear cut. The number of items involved in therapy was small (10 items in each of 2 sets) and the patients' performance variable. Whilst the design is sound—using multiple baselines and crossover—unfortunately the baselines were not always stable, nor the treated and untreated sets matched for pre-therapy performance. As the authors did not perform any statistical analysis on their data it is sometimes difficult to be sure that the patterns of improvement claimed are genuine. Nevertheless, it does appear that at least some of the patients do show some lasting improvement as a result of this therapy. This contrasts with the results
of the facilitation studies (Patterson et al. 1983) which found only very short-lasting effects, it may be that the duration and intensity of treatment is crucial to the magnitude and stability of improvement as a result of therapy.

The studies described above demonstrate that 'phonological' tasks can be effective in improving word retrieval (see also Hillis and Caramazza 1994, described below), although it is clear that some of the tasks also involve semantic processing (in, for example, picture naming with cues, or reading aloud in the presence of the picture). Could it be that provision of the lexical item is also the key to the success of semantic therapy? LeDorze et al. (1994) address an issue related to this by comparing the effects of 'formal-semantic' therapy with 'semantic' therapy in a single-case study. The formal-semantic tasks were those used by Howard et al. (1985a) and involved the patient being given the (auditory or written) 'form' of the word, this contrasted with the purely semantic tasks where the word was replaced by a definition. For example, if the patient was required to select the target 'octopus' from four pictures where the foils were lobster, crab, shellfish (related), mouth and leaf (unrelated), the stimulus would be the spoken or written word 'octopus' in the formal-semantic therapy but the spoken or written definition 'the mollusc with long arms' in the semantic therapy. As each target was only 'treated once this study is strictly speaking a facilitation study. Le Dorze et al. found that, in post-tests immediately after a block of 20 facilitations, there was significant improvement for the items given formal-semantic therapy but no change for the items given semantic therapy. However, all effects of facilitation had disappeared 48–72 hours later. Unfortunately, no data is given regarding the patient's accuracy on the facilitation tasks and the difference could have been due to the difficulty of the semantic therapy rather than the provision of the word form per se. Nevertheless, this type of study where two types of therapy are carefully contrasted is clearly a much needed avenue of research.

Relating deficits to therapy and to outcome. So far we have described a number of studies which have demonstrated that therapy that focuses on either semantic or phonological tasks can improve word-retrieval in aphasic subjects. Some of these studies do discuss the relationship between the therapy and the hypothesized level of breakdown (e.g. Pring et al. 1990; Miceli et al. 1994) and begin to attempt to relate the nature of the outcome to the deficit (e.g. Raymer et al. 1993). In this final section we will describe studies which take this approach.

Nettleton and Lesser (1991) aimed to test whether 'model-motivated' therapy was effective. Thus, they selected patients thought to have naming breakdown at three different loci within a cognitive neuropsychological model: semantic system, phonological output lexicon, and phoneme assembly. Patients received different therapy according to the hypothesized level of deficit. In each case sessions lasted 1 hour, and were twice a week for eight weeks. Three criteria were used to assess the level of deficit. P.D. and F.F. were classified as having a semantic deficit as they (i) made more than a single error on the PALPA word to picture matching test (Kay et al. 1992); (ii) made semantic errors on naming attempts; and (iii) were miscueable (i.e. they produced a semantic coordinates of the target picture in response to that coordinate's initial phoneme).

On the basis of this classification they were given semantic therapy. This consisted of (auditory and visual) word to picture matching, moving from unrelated to related distractors, Yes/No judgements for categorical and attributive information and categorization tasks. None of the tasks in the therapy programme required the
patient to say the picture name. The first patient P.D. significantly improved on treated items. Unfortunately two factors mean that spontaneous recovery cannot be ruled out as an explanation for the improvement: the significant trend towards improved naming on the pre-therapy baseline and the fact that P.D. was only 6 months post-stroke at the start of the study. 'It was therefore not shown unequivocally that there was a significant increase during the therapy phase' (Nettleton and Lesser 1991, p. 149) in P.D.'s naming performance. The second patient to have received semantic therapy (F.F.) did not improve when the total number of items correct was compared pre- and post-therapy. He did, however, make paraphasias that tended to be more closely related to the target, although this was not a dramatic effect (paraphasias rated as closely related to the target: pre-10%, post-16.5%). Thus, neither of these patients can be used to claim clear cut effects of semantic therapy.

Two further patients, D.F. and M.C., were classified as having a 'disorder related to the phonological lexicon' on the grounds that they made one error or less on word to picture matching, their naming attempts included many circumlocutions and their repetition was better than their auditory comprehension. They were also given 'model appropriate therapy', which consisted of repetition of the target names, naming with progressive phonemic cues and judging whether the name of a picture rhymed with a word said by the therapist. The results of this study were more encouraging, with both patients improving significantly on naming the treated items. This result confirms that of Howard et al. (1985b) who also found item-specific improvement using these types of tasks. However, M.C. also showed (unpredicted) improvement on the untreated items and unfortunately there is no data to suggest that the effect was due to the specific therapy task as opposed to non-specific effects (e.g. 'therapist charm').

Finally, Nettleton and Lesser gave two patients with a 'disorder related to the phonological assembly buffer' therapy that was 'model inappropriate' (semantic therapy), and as predicted the patients failed to improve. However, the key test here is whether 'model appropriate' therapy would have benefited these patients, without this it is impossible to reject the possibility that these two patients are simply not able to benefit from treatment.

We are wholeheartedly in support of the approach used by Nettleton and Lesser in attempting to link therapy tasks and therapy outcome to locus of deficit. Phonological therapy would seem to be effective for (at least some) patients with phonological deficits. It is unfortunate, however, that the results of the semantic therapy are not clear cut. It is interesting that at no time were these patients required to say the items which were the target of semantic therapy (except, of course, pre- and post-therapy assessments). This contrasts sharply with the majority of other studies where some production has been involved—even if this has not occurred at the same moment as the semantic task (Howard et al. 1985b), or has occurred only with a small number of the therapy tasks used (Scott 1987).

Hillis and Caramazza (1994), Hillis (1989) also attempted to look at the effects of therapy for spoken output with respect to the participants' different deficits. In study 3, Hillis and Caramazza describe two patients, J.J. and H.W., both of whom had impaired spoken naming and made frequent semantic errors. The first patient, J.J., made semantic errors on both spoken and written naming and word to picture matching (except to animals). Hillis and Caramazza argued that J.J., had a semantic deficit (with selectively spared semantic representations of animals). The second patient, H.W., made semantic errors only on spoken naming and reading aloud.
She was perfect on the word to picture matching task. Writing, whether to dictation or in response to pictures, did not contain semantic errors. It was argued that H.W. had a deficit at the level of the phonological output lexicon (either damage to the lexicon itself or in access to it).

Both patients were given two types of therapy: (written) word-to-picture matching (from an array of 40 pictures) with feedback and correction of incorrect responses and cued reading aloud where a correct reading response was elicited with the help of a phonemic cue (5 times per treatment session). The extent of facilitation of naming was measured by testing naming of the treated items in the next session prior to treatment. Items were randomly assigned to the reading and word-picture matching conditions before each treatment session (i.e. most items will have been treated with both techniques at some point during the therapy). The mean facilitation of the treatments differed significantly for the two patients. Thus, J.J. showed significant facilitation from the word-picture matching therapy but no effect of the reading therapy. In contrast H.W. showed significant facilitation from the reading therapy but not from the word-picture matching therapy. In a very similar study involving the same reading therapy, Hillis and Caramazza (1994, study 1) also found the treatment to be effective and to maintain over at least the next three sessions. However, this improvement was restricted to treated items.

They conclude that the (beautifully neat) results of their study (study 3) are consistent with the hypothesis that word/picture matching tasks can be used to improve naming of patients, such as J.J., whose naming errors arise at the level of the semantic system (possibly by teaching distinctions, or activating features that distinguish between semantically related items). (Unfortunately they do not describe whether either or both patients read the word aloud whilst performing the word-picture matching task.) In contrast, facilitated production of names (here in reading aloud) can facilitate naming when it is disrupted at the level of the output lexicon, as in the case of H.W. (perhaps by lowering the threshold of activation of the phonological representations for the treated items). They do, however, note that many patients may benefit from both types of intervention as many have impairments at both levels of the naming process.

Hillis (1990) describes another type of semantic therapy used with a patient, H.G., who had a semantic deficit (and a deficit in retrieval of the phonological form). In this task H.G. had to attempt to write the name of a stimulus picture, if she produced a semantic error, the referent of her response was drawn and contrasting semantic features between her response and the target pointed out (e.g. if she wrote 'lemon' for cherry, a lemon was drawn and the differences between them pointed out—yellow/red, sour/sweet, etc.). This therapy improved H.G.'s performance on written naming of the treated items and also generalized to spoken naming (and repetition, writing to dictation and word-picture matching). There was no generalization to untreated items which were semantically unrelated to the treated items. However, generalization was observed to untreated items that were semantically related to the targets (Pring et al. 1993). Hillis argues that this is due to the learning of semantic distinctions between treated items and related items which benefits both. It is unclear whether the 'untreated' related items occurred in therapy; in other words whether these may have comprised any of H.G.'s semantic errors.

In another study (study 2), Hillis and Caramazza (1994) describe a slightly different therapy with one of the patients described above, H.W. (held to have a deficit at the level of the phonological output lexicon), this time comparing her performance with
therapy for naming disorders (Part I)

another patient K.E. Like J.J., K.E. made a high proportion of semantic errors across a variety of tasks: spoken and written naming, reading aloud, writing to dictation, and word to picture matching. His semantic errors were also attributed to a semantic deficit. Despite the differences between the patients, both H.W. and K.E. were able to use cues (e.g. initial phonemes) to assist naming. The therapy used took this into account, and used a cueing hierarchy for picture naming, including a sentence completion cue, an initial phoneme cue and the spoken word for repetition until the patient produced a correct response. When the patient had produced a correct response, each of the cues was presented again in reverse order until they had produced the name independently in response to the picture alone. H.W. once again showed item-specific improvement on treated items but no generalization to untreated items. In contrast K.E. showed improved naming both for the treated items but also for untreated items within the same semantic category (but not to verbs). He also showed cross modality generalization to written naming, consistent with the hypothesis that a single deficit underlies his performance in both modalities. Hillis and Caramazza suggest that this multi-component therapy could be working at different levels for the two patients. The production of the target may have been the important aspect of the task for H.W. (as suggested by the similar pattern of improvement in study 3), whereas for K.E. it may have been the semantic information provided in the sentence completion cue that was vital. Of course it may be the case that it is the mix of both semantic and phonological aspects of the task that are essential for K.E., within the context of such a complex multi-component task it simply is not possible to say.

Hillis (1989, 1992) describes a similar therapy with the same two patients, but this time concentrating on written naming. As described above, K.E. produced semantic errors in both written and spoken naming, whereas H.W.'s written naming errors included many letter deletions, with a strong effect of length of performance. Therapy again used a hierarchy of cues (Scrabble tiles with and then without distractor letters; initial letter cues; writing to dictation; delayed copying). K.E. improved on both spoken and written naming nouns, with generalization to untreated nouns. But, as predicted (and as with the therapy for spoken naming described above) there was no change on written naming of a set of verbs used as a control measure. H.W. improved on written naming of trained items, but this did not generalize to untrained items or to spoken naming (again a similar pattern to that for the spoken naming therapy). Hillis explains the different results neatly with respect to the different deficits. Thus, as K.E. has a unitary impairment in semantics she argues one would expect improvement to generalize across modalities (and possibly items). H.W., in contrast, was held to have two separate deficits: impaired ability in retrieving the correct phonological form for output, and difficulty in maintaining the graphemic form of the word while it was being written; a more peripheral writing disorder. In her case writing therapy would not have been expected to improve spoken naming as this deficit has a different source.

In summary, Hillis' (1989, 1990, 1992) and Hillis and Caramazza's (1994) attempts to link level of breakdown and tasks with outcome (and particularly patterns of generalization) have been illuminating. Generalization occurred when the patient was held to have a central semantic deficit. In contrast, item-specific effects were found with more peripheral deficits. Nevertheless, some of the tasks used were multi-component and it remains unclear precisely which aspects may be important for improvement to occur.

Finally, another study which examines generalization across both items and
modalities is that of Deloche et al. (1993) which also describes therapy exclusively for written naming. This study also used a cueing technique, the patients were required to attempt written naming (typewritten on a computer keyboard) with the help of one of two types of cue. The first patient, R.B., was given either an anagram cue or a sentence completion cue, whereas the second patient, G.C., was given either an anagram or the first written syllable of the target as cues. Both patients showed marked improvements to written naming of both trained and untrained items and carryover to oral naming (although G.C. is claimed not to show significant improvement on oral naming of the items that had been untrained). The improvement was maintained for both patients with follow-up testing 1 year later. Additionally, the authors investigated the effects of feedback regarding performance in combination with the cues—no effect was found. The extent of the improvements are impressive with both patients reaching near ceiling for both oral and written naming, unfortunately the design of the study does not prove beyond all doubt that the results are the specific effects of therapy. The widespread improvement over items and modalities is difficult to interpret without stable pre-therapy baselines or control tasks. Nevertheless, Deloche et al. do present a careful analysis of each patient's level of deficit and relate this to the pattern of change.

Conclusions

What conclusions can be drawn regarding the nature of the effects of the therapy tasks from the studies discussed? The picture is far from clear. For example, therapy involving semantic judgements incorporating reading aloud appeared to benefit two patients who both had comparable, relatively unimpaired semantics for high imageability words, P.C. (Jones 1989) and R.S. (Marshall et al., 1990). However, R.S. showed item-specific effects, whereas P.C. showed general improvements in naming. Additionally H.W. (Hillis and Caramazza 1994, study 3), who also has good understanding of high imageability items, did not benefit from a semantic task. Why should they show different effects from similar semantic tasks?

One factor which has been neglected in many of the studies that we have described is how well the patients perform the therapy task—P.C. was reported as having 'rarely made any errors in making the correct judgement' and H.W. performed the task 'flawlessly', but it also seems unlikely that R.S. made many errors on the task as he performed almost perfectly on a task which requires very similar skills (word-to-picture matching from PALPA, Kay et al. 1992). Similarly, both R.S. and P.C. were required to read target words aloud as part of the therapy. However, R.S. was reported as having

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6 Although G.C. is many years post-onset, and R.B. over 10 months and therefore spontaneous recovery seems unlikely, it is nevertheless possible that non-specific effects of therapy (e.g. 'therapist charm') may be responsible. Similarly, perhaps repeated assessment (attempts at naming) has improved naming rather than the therapy task per se. Unfortunately for G.C., there appears to be a contradiction between the text and their table 3 with regard to generalization to untrained items—the data in table 3 show a significant improvement in oral naming of untrained items too, although the text asserts that there was no change. This discrepancy is crucial for interpretation of the data, if there was indeed no carryover to untreated items in oral naming then this provides some control for the cause of the improvement being non-specific effects of therapy or practice effects (of successive naming attempts). For R.B. the fact that there is some suggestion that there were differential effects of the two types of cue may provide some control for non-specific effects.

7 It is unclear whether H.W. read aloud the words during therapy, however if, she had done so it is likely that she would have made errors as she was reported to produce similar proportions of semantic errors in reading as in spoken naming.
an ability to read aloud single words that was almost unimpaired and so seems likely to have had a high success rate. In contrast, P.C. had demonstrated great difficulty with any kind of spoken word output with both naming and repetition resulting in either neologisms or no response. It therefore seems unlikely that P.C. had a great deal of success in producing the target words. This possible difference in production success could be one reason for the difference in the patterns shown by the two patients (Wilson, 1992).

Alternatively, perhaps the difference in nature of the semantic tasks affected the results. Whereas Marshall et al.'s patient, R.S., had to select the correct written word to go with a picture (from a choice of four), and H.W. (Hillis and Caramazza 1994) had to match a written word to the correct picture (from a choice of 40), Jones' patient P.C., was required to make relatedness judgements. Perhaps the relatedness judgements resulted in a more general change in semantic processing than word-to-picture matching (leading to generalized naming improvement).

Therapy involving semantic judgements also appeared to benefit patients with marked semantic deficits, A.B. (Scott 1987), J.J. (Hillis and Caramazza 1994), I.S. and possibly F.W. (Marshall et al. 1990), P.D. (Nettleton and Lesser 1991) although not the similarly impaired F.F. (Nettleton and Lesser 1991). However, these patients also seem to show different effects with A.B. showing generalization to untreated items (which may also be true of F.W.) whereas I.S. primarily demonstrated item-specific effects. Both A.B. and I.S. showed improvements on comprehension tasks, which (at least for A.B.) are due to the effects of therapy. What appears to be emerging is a pattern of item-specific effects for those items that are produced during therapy, with general effects of the semantic processing task on naming and comprehension even when no production is required. However, there are so many (undefined) differences between the patients and the tasks that it remains difficult to be confident of these conclusions.

Studies which have focused on phonological rather than semantic tasks have also shown beneficial effects. However, these seem almost exclusively to result in item-specific improvements (e.g. Hillis and Caramazza 1994, Miceli et al. 1994) although Raymer et al.'s study may show a possibility of generalization. In the written analogue where graphemic information alone is given (although in the context of a picture-naming task), Deloche et al. (1993) appeared to find generalization within modality (for patient G.C.) Of course, it is not possible to rule out a semantic element in any task, even when a judgement is not required. Reading a word aloud may be possible without semantic activation but it seems unlikely, particularly for a patient like H.W. (Hillis and Caramazza 1994) where reading aloud by necessity occurs via semantics.

In summary, in recent years a number of papers have been published which address the important issue of the effectiveness of particular tasks in remediating word retrieval disorders. These range from the initial facilitation studies of Howard et al. (1985a), where clear effects on subsequent naming attempts were observed from a single semantic judgement, to a number of therapy studies where a range of tasks have produced a range of effects in different patients. These papers have used a variety of methodologies, both group and single case studies, and a variety of patients with different strengths and weaknesses.

It is clear that therapy can produce significant improvements in name retrieval and that these can be very long-lasting (Deloche et al. 1993, Miceli et al. 1994, Pring et al. 1990). However, crucially, we remain unclear exactly how these effects are produced and it is still difficult to predict precisely which patients will benefit and in what way.
What have emerged are some key issues which should serve as a focus for further research, these are listed below; however, we also need to ask broader questions regarding interactions between therapist, patient and therapy (a 'theory of therapy'), an area not covered in detail here.

(1) Single case studies are the optimal means of evaluating therapy, as they allow results to be related to individual patterns of performance. (Ideally there needs to be a series of single case studies where both positive and negative results of therapy are reported.)

(2) For some patients 'semantic' tasks seem to result in more generalization to untreated items than 'phonological' tasks (e.g. repetition, rhyme judgements), although this may depend on the level of breakdown.

(3) It is unclear how far the production of the target at the time of performing the semantic task (or shortly afterwards) is necessary to produce a positive effect.

(4) What role does the precise nature of the semantic task (e.g. judgement versus matching tasks) have in producing the facilitatory effect?

(5) What effect does the presence of other tasks within the session have on the outcome (e.g. intermixing semantic tasks and phonological tasks versus phonological tasks alone).

(6) What role does the success of the patient with the task (error-free versus error-full) have in affecting the outcome of the therapy?

(7) What variables affect whether improvement is item-specific or generalizes across items and, functionally, into spontaneous speech?

And finally, and perhaps crucially:

(8) What role does the precise locus (and degree) of the naming deficit have on the success of any particular therapy task?

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