, K.A. (1983). Object vision and spatial vision: Two
ences, *6*, 414–417.
Disorders of visuospatial analysis. In F. Boller & J.
ropsychology (Vol. 2) (pp. 333–356). Amsterdam:

H. (1987). Dissociable visual and spatial impairments
sions: Clinical, neuropsychological and anatomical
161.
Disorders of visual space perception associated with
re. *Brain*, *67*, 331–358.
nces of lower and higher visual capacities caused by
iskrantz Trans.). Oxford: Clarendon Press.
on. *Quarterly Journal of Experimental Psychology*, *32*,

J., & Rafal, R.D. (1984). Effects of parietal injury on
of Neuroscience, *4*, 1863–1874.
(1983). The effect of cueing on unilateral neglect.

(1983). Deficits in attention and movement following
prearcuate (area 8) cortex in macaque monkeys. *Brain*,

atio-motor cueing in unilateral left neglect: The role of
n. *Neuropsychologia*, *30*, 553–563.
Neuropsychological contributions to theories of part–
logy, *23*, 299–332.
emporary remission of representational hemineglect
Report, *5*, 869–872.
ur Frage der optischräumlichen Agnosie (zugleich ein
er Psychiatrie und Neurologie, *81*, 97–188.
of power: Confrontation or co-operation? *Journal of*
rception and Performance, *8*, 253–272.
89). Ipsilateral influences on contralateral processing
ychology, *6*, 475–498.
. "What" and "where" *in the human brain. Current*

natomy of unilateral neglect after right hemisphere
elation study in man. *Neuropsychologia*, *24*, 609–622.
94). Grouping reduces visual extinction: Neuropsy-
in visual selection. *Visual Cognition*, *1*, 101–129.

14 G.R., The *Prime* "Deep Dyslexic": A Commentary on Marshall and Newcombe (1966)

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G.R.—or G. to those who knew him well—and it is certain that John Marshall and Freda Newcombe came to know him very well indeed—was a big, strong man. It is easy, if perhaps a little sad, to imagine him, in 1944 during the first days of the allied landings in Normandy, as a very young man in the uniform and attitude of combat. At over six-feet tall, and as strong as an ox, he must have cut an impressive and somewhat daunting figure. He was an experienced and battle-hardened soldier of demonstrable bravery, who had already spent two years in active service, and yet he was younger than most of the students I now teach. Indeed, he lied about his age to enter the army. In 1942 it must have been easy to convince eager army authorities that one wanted to enlist, as Britain was darkly at war, and G.R.'s physical stature would have been powerfully convincing. Although G.R. told me a story of joining the army to escape being persuaded into a looming marriage, I prefer to think of him as an idealistic young man wishing to liberate Europe of fascism. Either way, his terrible injury cut him down in his prime: Not yet 20 years' old, he suffered a massive assault to his brain when a bullet was shot through his head. The injury was, in fact, a dreadful accident. He fell from the back of a lorry and a bullet, discharged from his own sten gun, penetrated his head at the front of the left ear, travelled upwards through his left cerebral hemisphere and made a large exit wound at the top left-hand side of his head (in the superior parietal region). G.R. offers a different story of the incident: He claims to have been hit by a German sniper bullet, but the upward trajectory of the bullet through his

brain makes this most unlikely. It is quite reasonable that a Royal Marine might not wish it to be known that his war injury was an accident, but I believe we should see G.R. as a hero nevertheless.

Marshall and Newcombe tested G.R. in the mid-1960s as part of Newcombe's important studies of a series of patients with penetrating missile injuries to the brain (Newcombe, 1969). Their 1966 paper, published in *Neuropsychologia*, was not the first report of a patient who makes semantic errors in reading aloud—there were previous reports, particularly in the early (and rich) German literature (see references in Marshall & Newcombe, 1980)—but it was an extremely important paper for two main reasons. First, although it was not uncommon to observe semantic substitution errors in other aspects of aphasic production (such as spontaneous speech and picture naming), Marshall and Newcombe's paper showed that the presence of semantic errors in reading aloud single words was not an isolated phenomenon but a part of a constellation of problems. They showed that these included the production of other paralexic errors (including visual and what we would now call "derivational" errors) and also claimed that there was a grammatical class effect on reading accuracy (as they observed that nouns were read more accurately than adjectives which were, in turn, read more accurately than verbs). Although they did not mention an effect of concreteness upon reading accuracy (which we now know to be very powerful) or the patient's inability to read nonwords (taken as a measure of the ability to read via assembled phonological recording), we can see that their paper laid the foundation for characterising this acquired dyslexia as a fairly cohesive *association* of co-occurring reading impairments. This variety of acquired dyslexia is now widely known as "deep dyslexia", the resonant term coined by Marshall and Newcombe (1973).

Second, it could also be said that the paper re-established a more general interest in semantic errors for their potential to illuminate notions of the nature of semantic representations (and how these are used to drive reading responses). Marshall and Newcombe offered an explanation of G.R.'s semantic errors in terms of how normal semantic representations (conceived in terms of Katz and Fodor's 1963 theory of "dictionary entries") are used to specify the phonological forms of words. Both by its neuropsychological description of G.R.'s "syntactic and semantic errors in paralexia"—the title of their paper—and its use of conceptions of normal processing to interpret these errors, Marshall and Newcombe's paper has had a deep and major influence on the development of what we now know as *cognitive neuropsychology*. The cognitive neuropsychological enterprise involves a reciprocal relationship between (1) the detailed case studies of neurological patients with acquired disorders of cognitive functions (by using focused tasks designed to assess specific aspects of processing in which there are

experimental comparisons between carefully constructed sets of stimulus material), and (2) how such patterns of intact and impaired processing may be interpreted within, and may also inform, models of normal functioning. A patient's pattern of performance, particularly in terms of the dissociations shown between functions which are impaired and those which are reasonably preserved, may be explained by appeal to functional fractionations within a model of the component processes of normal processing. However, dissociations shown by patients may also be used to motivate new hypotheses concerning the organisation of the subcomponents of normal functioning.

Cognitive neuropsychology has emerged from a *distinguished, if empirically* diverse, collection of studies of patients with acquired disorders of cognitive functions, particularly the well-established literature on aphasic *disturbances of language functioning, going back to Broca and Wernicke.* However, it is my opinion that cognitive neuropsychology in its modern guise has blossomed from two key papers. The first was Warrington and Shallice's (1969) report of the patient K.F. who showed severely impaired short-term memory performance—he had a digit span of only one item—despite appearing to have essentially intact long-term memory performance, as indicated by his normal ability to learn paired associates. The importance of this paper for the development of cognitive neuropsychology was not so much the clinical report of this rather clear dissociation but the theoretical interpretation drawn from it: the dissociation suggested that the then prevailing "modal" model of memory organisation, in which information had to enter long-term memory only via processes operating in short-term memory (S.T.M.), was wrong. The fact that K.F. could learn new information in the absence of S.T.M. suggested that he had a means of access to long-term memory which effectively bypassed S.T.M.—and that such a "route" would also be available to everyone. This study provides an example of how a dissociation shown by an individual neurological patient can be the stimulus to derive new hypotheses concerning the organisation of the components of normal functioning. This illustrates the theoretically central contribution that cognitive neuropsychology can make, as it represents the inductive use of finding a dissociation in a single patient to generate a theoretical generality.

I believe that the second major paper for the development of cognitive neuropsychology (and possibly the one which established its identity within clinical psychology) was Marshall and Newcombe's (1973) seminal attempt to offer a theoretical framework for understanding different kinds of neuropsychological patient in terms of a common model of normal reading. They presented three varieties of acquired dyslexia: visual dyslexia, in which reading errors could be described as "visual confusions" (*leg* → "leg" and *pod* → "pad"); surface dyslexia, in which oral reading

could be characterised by an over-reliance on assembled phonological recoding, which resulted in greater accuracy for "regular" than for "irregular" words and the production of regularisation errors (e.g. *island* → "izland" and *omit* → "ommit"); and deep dyslexia, to which I shall turn shortly. The importance of this paper lay in its provision of a common theoretical framework which permitted the synthesis of results from normal and impaired reading.

It is noteworthy that deep dyslexia had a presence in both papers. Although not made prominent in Warrington and Shallice's paper (1969), their patient K.F. was deep dyslexic in addition to his impaired short-term memory (see Shallice & Warrington, 1975). Marshall and Newcombe (1973) described two deep dyslexics, G.R. and K.U., whose semantically mediated reading, particularly when contrasted with the phonologically mediated reading of surface dyslexics, provided important support for their model of reading. In my estimation, the subsequent development of cognitive neuropsychology owes a great deal to studies of and reflections upon deep dyslexia. The important book, *Deep Dyslexia*, edited by Coltheart, Patterson, and Marshall (and published in 1980) has been widely cited and has provoked considerable interest. Semantic errors have certainly aroused the attention of a wide audience and continue to do so, as can be seen in the importance deep dyslexia has for the recent developments in connectionist accounts of impaired reading (Plaut & Shallice, 1993).

The remainder of this chapter will focus on G.R. as a classic case of deep dyslexia. I submit that G.R. is a "prime" deep dyslexic, in the sense that he is a major and salient case of the pattern of impairments, as we now understand and appreciate them. As already mentioned, G.R. was not the first deep dyslexic to be reported and it might be argued that he cannot be considered to be a "pure" case. He certainly has other impairments arising from his extensive left hemisphere brain damage and has, in particular, poor spontaneous speech and imperfect picture naming. It is not clear to what extent any such general word production problems constrain his reading attempts (or whether the proposal that he has a possible "output block" may impinge upon any theoretical accounts of his reading), but it cannot be claimed that his impairments are necessarily specific to the domain of reading. Neither can it be argued that G.R. is in any sense a "prototypical" deep dyslexic, a term which implies that we can accept that there is a unified "syndrome" of deep dyslexia. Both Shallice and Warrington (1980) and Friedman and Perlman (1982) have argued convincingly that there are subvarieties of deep dyslexia. A patient may be included in the general "category" of deep dyslexics if they produce semantic reading errors, but the members of the group are not at all homogeneous in all other respects. Nevertheless, G.R. is a fascinating deep dyslexic patient and certainly one worthy of discussion. I shall now review the data presented in Marshall and

Newcombe (1966) and also say something more about G.R.'s reading from the privileged position of having been able to test him in the early 1980s under the benevolent supervision of John Richardson (Barry, 1984; Barry & Richardson, 1988).

Marshall and Newcombe's (1966) paper contained an extremely short introduction (of only 13 lines) which was concerned, quite rightly, to announce the interest of semantic errors. Their case report of G.R. provides a good deal of clinical (and anatomical) information and it may be of some interest to compare both the content and the style of this with what one would expect in a contemporary paper reporting a single case study. Perhaps we are now either more sensitive or simply more squeamish, but Marshall and Newcombe's clinical report of G.R.'s injury seems somewhat gory: They say that the bullet "ploughed up" the left temporal and parietal cortex and they quote from the report of the surgeon who notes (as if he could fail to miss it) that G.R.'s brain was "bulging out" from the exit wound, which was a "tear about 6 cm" in diameter. The general background of G.R.'s post-injury life is provided in a tone which would probably not be heard commonly today, e.g. "His post-war interests seem to have been limited to football pools, television, two pints of beer in the local public house in the evening and fruitless attempts to read paperback books of the Cowboy and Indian genre." (I now find the expression "public house" to be charmingly nostalgic.) Their case report also contains the results of quite a lot of informative background tests, such as non-verbal I.Q. and memory tests, although some of the tests used, such as the Graham and Kendall Memory-for-Designs Test, might perhaps only be found now where one could also obtain G.R.'s Cowboy and Indian "paperback books".

Marshall and Newcombe's paper then gives a very useful description of G.R.'s "selective language impairment". His spontaneous speech was "telegrammatic" and they inferred a "slight loss" of the ability to understand speech from the fact that instructions for the Token Test had to be paraphrased occasionally. However, there was no formal testing of G.R.'s comprehension, especially of words he was unable to read aloud, an omission that is, regrettably, not uncommon today. G.R.'s oral repetition was perfect, even for "foreign words". This finding has important implications; it tells us that it cannot be the case that G.R.'s reading impairments result from a global inability to produce items in speech. His object naming was described as being "fairly good". When I tested him some 15 years later he produced some semantic errors in naming pictures but a lower rate than the production of such errors in reading the same object names. Marshall and Newcombe also found this: He produced 6 errors naming 53 line drawings, and spontaneously corrected all but one, whereas he produced 17 errors reading 60 words (which included the names of the pictures) and spontaneously corrected only 4. Marshall and

Newcombe reported that G.R.'s short-term memory span was reduced—it was only three items—and that his spelling was also impaired (despite good copying and cross-case transcription). Coltheart (1980a) noted that reduced memory span and dysgraphia are common features in deep dyslexia.

The fulcrum of all characterisations of deep dyslexia is the presence of the semantic error. Indeed, semantic paralexias in reading (such as G.R.'s *canary* → "parrot") could be said to be the signature of deep dyslexia. Marshall and Newcombe tested G.R. on the same set of items in a variety of different tasks and found many semantic errors in reading and some in writing (even if some responses were also mis-spelled, e.g. "cousin" written as NEPHIL). However, there were no semantic errors made in the visual copying of words or in the immediate written recall of printed words. He also made no semantic errors in the oral repetition of spoken words (and so was not "deep dysphasic"). They note (p. 173) that his semantic reading errors "ranged from almost pure synonymity to cases where the stimulus word and the response error had only one or two semantic markers in common", with examples from their paper being: *ill* → "sick", *city* → "town", *bush* → "tree", and *cheer* → "laugh". Some of my own favourites from those he produced in the 1980s include: *little* → "small", *foot* → "shoe", *lion* → "tiger", *poetry* → "Shakespeare", and the wonderful *bitter* → "pints".

The substance of Marshall and Newcombe's paper is the report of G.R.'s reading of "approximately" 2000 individual words, a substantial empirical exercise (and one which excuses the lack of precision of the number of words presented). Like all deep dyslexics, G.R. was able to read some words correctly but he omitted others (either by saying "no" or "don't know"). He also made a variety of errors. Marshall and Newcombe classified his paralexic errors using only five categories: semantic (e.g. *liberty* → "freedom"); visual (e.g. *next* → "exit"); visual completion (e.g. *gentle* → "gentleman"); visual + semantic (e.g. *sympathy* → "orchestra"); and indeterminate (which accounted for only 6% of the sample).

The classification of deep dyslexic reading errors has been elaborated since their original study. What they called "visual completion" errors are now known as derivational errors (although they would be more appropriately called morphemic errors), in which the response word shares the same root morpheme as the stimulus (e.g. *painting* → "painter"). What they called "visual + semantic" errors are better described as visual–then–semantic errors, where the response word is semantically related to a putative intermediary word which is itself visually similar to the stimulus word (e.g. *foster* → "cold", via *frost*), the detection of which engages the imagination most pleasingly. There can also be true semantic and/or visual errors (e.g. *home* → "house") which share both visual and semantic similarity. There are also function word substitution errors (e.g. *his* → "she"). As with many

natural taxonomies, there are always some unclassified errors (such as *carpet* → "letters"). Some authors separate errors that involve the production of a single word as an error response and various kinds of "circumlocution" errors (e.g. *bride* → "getting married, wedding").

Deep dyslexic patients differ in terms of the relative frequency of the production of errors in these categories, as well as in their overall levels of reading accuracy. It is difficult, however, to make straightforward comparisons between patients if they have been tested on different samples of words that vary along dimensions which may affect reading accuracy. Barry and Richardson (1988) were able to compare G.R.'s reading of the set of Brown and Ure (1969) words (which he attempted to read in 1980) with K.F.'s reading of the same words (using the data supplied by Shallice and Warrington and presented in Coltheart et al., 1980). The percentages of the main response categories for each patient are shown in Table 14.1. G.R. is a prolific producer of semantic errors: Not only does he make very many semantic errors in absolute terms—and indeed he produces almost as many as correct responses—he is unlike a number of other deep dyslexics, including K.F., in that he produces more semantic than visual errors. Marshall and Newcombe found that G.R. tended to make more semantic errors to nouns than to verbs (and that his error responses to both nouns and verbs tended to be nouns) but, as we will now see, they may have overestimated the effects of grammatical class in deep dyslexic reading.

Marshall and Newcombe (1966, p. 171) claimed that the "grammatical category of the stimulus word was a major variable" in determining G.R.'s reading success. They reported that he was able to read 45% of unambiguous nouns, 16% of adjectives, and only 6% of verbs. They went on to note that G.R. was able to read virtually no grammatical function words (i.e. words from the closed-class vocabulary): he read no prepositions, adverbs, determiners, or question markers (such as "where" and "when"),

TABLE 14.1
The Percentage of Reading Responses (to Words from Brown & Ure, 1969) Produced by G.R. (Barry & Richardson, 1988) and K.F. (Shallice & Warrington, 1980, pp. 429–433, in Coltheart et al., 1980)

	G.R.	*K.F.*
Correct	20.7	32.6
Omitted	35.5	45.7
Semantic errors	20.2	2.5
Visual errors	9.0	9.6
Derivational errors	4.0	3.1

and he was able to read only one personal pronoun ("I") and one conjunction ("and"). It is common to see modern descriptions of the characteristics of deep dyslexia include this claimed part-of-speech effect on reading accuracy (e.g. Hinton, Plaut, & Shallice, 1993). However, it now appears that much of the difference between nouns, adjectives, and verbs is due to confounded effects of stimulus word concreteness. Concreteness (and/or imageability, with which it is very highly correlated) exerts an extremely powerful effect on the reading accuracy of deep dyslexics—and it is quite surprising that Marshall and Newcombe (1966) did not remark upon it! (Indeed, I see Marshall and Newcombe's failure to report a difference between concrete and abstract nouns as being the only serious shortcoming of their paper. However, it was one which was soon corrected: Marshall, Newcombe, and Marshall (1970) found that G.R. could read nine of 10 concrete mass nouns but only one of 10 abstract nouns.) Barry and Richardson (1988) found that there was a substantial difference between the concreteness values of the Brown and Ure words G.R. read correctly (mean = 5.52) and those he omitted (mean = 4.16). G.R. is a man who was able to read the word "chrysanthemum" but not the word "good". Concreteness is a very potent variable indeed—and it is also involved in G.R.'s visual errors, which tend to be made to words that are less concrete than those read correctly. Barry and Richardson found that visual errors involve the production of a more concrete word (e.g. *deep* → "deer" and *anger* → "angel"): independent judges rated 64% of G.R.'s visual errors as being more concrete, 27% as being equal in concreteness, and only 9% as being less concrete. These results assist in the provision of an explanation of visual errors as reflecting a "central" rather than a perceptual impairment of reading (discussed later).

In order to see whether there exists an affect of part of speech over and above that of concreteness, Barry and Richardson (1988) compared G.R.'s correct responses with his omissions in an analysis of covariance in which syntactic class was the single independent variable and concreteness, word frequency and the other of the Brown and Ure ratings were included as covariates. Syntactic class had no effect at all upon reading accuracy when other variables were statistically controlled. Allport and Funnell (1981) matched thirty nouns and thirty verbs on both concreteness and word frequency and found that five deep dyslexic patients showed no differences in their reading accuracy of the two sets. Thus, both the multivariate analysis of G.R.'s reading and Allport and Funnell's factorial study have shown that syntactic class—at least among content words—has no independent effect upon reading accuracy. The reason Marshall and Newcombe "found" an apparent syntactic class effect was due to the fact that nouns tend to be more concrete than adjectives or verbs. However, there remains the distinct but quite open possibility that deep dyslexics have

a special difficulty with function words, which are frequent but among the most abstract in the language.

The final empirical section of Marshall and Newcombe's paper reports a preliminary examination of the consistency of G.R.'s reading. Following an interval of one week, G.R. was re-presented with 100 words he had previously read correctly and 100 words to which he had produced a semantic error. G.R. showed moderate reliability: For those words initially read correctly, he was correct on 61 and made semantic errors to a further 21; for those initially eliciting a semantic error, he was correct on 18, produced the identical semantic error to 37, and produced a different semantic error to 27. These data show that a simplistic "output" explanation of G.R.'s semantic errors cannot easily be maintained: It seems unlikely that there were certain words that G.R. could not access or produce and so produced semantic errors as "the next closest" word. (This is further supported by Barry and Richardson's observation that G.R. produced words as errors that he could not read correctly, e.g. *sick* → "bandage", *bad* → "sick".) Barry (1984) reports a more detailed analysis of G.R.'s reading consistency, stimulated by Marshall and Newcombe's report. He presented the Brown and Ure set of words twice and found a similar pattern of reliability, which is summarised in Table 14.2. Although, as Marshall and Newcombe say (1966, p. 174), "the same response patterns do not rigidly persist", there is a fair degree of consistency for all major response categories. For G.R.'s correct reading responses and semantic errors (i.e. his meaning preserving responses), this consistency is also linked to the concreteness of the stimulus words. Thus, words G.R. read correctly on both occasions are significantly more concrete

TABLE 14.2
G.R.'s Reading Consistency (Barry, 1984) of 643 of the 650 Brown and Ure (1969) Words

	Percentage of reading response on second presentation					
First presentation	*Correct*	*Omissions*	*Semantic errors*	*Visual errors*	*Derivational errors*	*All other errors*
Correct	66	4	20	2	5	3
Omissions	2	58	10	14	1	15
Semantic errors	13	6	65	5	5	6
Visual errors	3	21	15	59	0	2
Derivational errors	8	0	27	4	54	8
All other errors	4	27	11	20	4	33

For each major response category on the first presentation, the rows show the percentage of the words in each response category on the second presentation.

(mean = 5.65) than those to which he produced the identical semantic error (mean = 5.05), which were, in turn, more concrete than those to which he produced different semantic errors (mean = 4.20).

Patients with deep dyslexia—and G.R. in particular—present an empirically rich (and intuitively interesting) set of observations. Most contemporary theoretical interpretations of deep dyslexic reading have suggested that it results from a complex (but necessarily co-occurring) set of impairments to the cognitive processes that underlie normal reading, a simplified modular model of which (based on Morton & Patterson, 1980) is presented in Fig. 14.1. There is not space here to evaluate the alternative account of deep dyslexia, which is that it reflects the operation of a right hemisphere reading system (Coltheart, 1980b) not necessarily involved in normal reading. However, it could be argued that the interpretation to be advanced here (in terms of a restricted set of normal reading processes) will provide a functional description of deep dyslexic reading which will be useful wherever the neural mechanisms subserving the reading process turn out to be localised.

Figure 14.1 proposes that normal readers are able to call upon three routes to power oral reading: (1) assembled phonological recoding (which is the route used to pronounce nonwords); (2) direct lexical reading, using word-specific connections between visual word recognition units and spoken word production units; and (3) semantically mediated reading, in which recognised words activate their corresponding semantic representations which then drive word production. To cut a long story short, deep dyslexics are able to use only one of these procedures, the semantically mediated route—and even this is flawed as a means of supporting error-free reading.

Assembled phonological recording is inoperative in deep dyslexia. Marshall and Newcombe (1966) did not have the theoretical motivation to test G.R. for "nonlexical" phonological recoding (and it is difficult to chastise psycholinguistic researchers for not inventing "nonsense words" to present to a patient who was producing a torrent of intriguing and linguistically "deep" semantic errors). Phonological recording is totally abolished in G.R. When presented with nonwords to read aloud in the 1980s, he omitted 87%, although he occasionally (and insightfully) said "don't mean a thing"! To the remaining 13% he either produced a visually similar word (e.g. *laks* → "lake") or made a visual–then–semantic error (e.g. *tob* → "pipe", via *tobacco*?). It is probably true to say that G.R. has not read a nonword since 1944. He was also hopelessly unable to perform any task requiring "phonics"; for example, he could not match a simple printed nonword (*nis*) to one of two spoken nonwords ("pog–nis"). However normal subjects perform phonological recoding (either by a set of nonlexical rules or by a process of analogy), deep dyslexics are unable to use it to assist their oral reading.

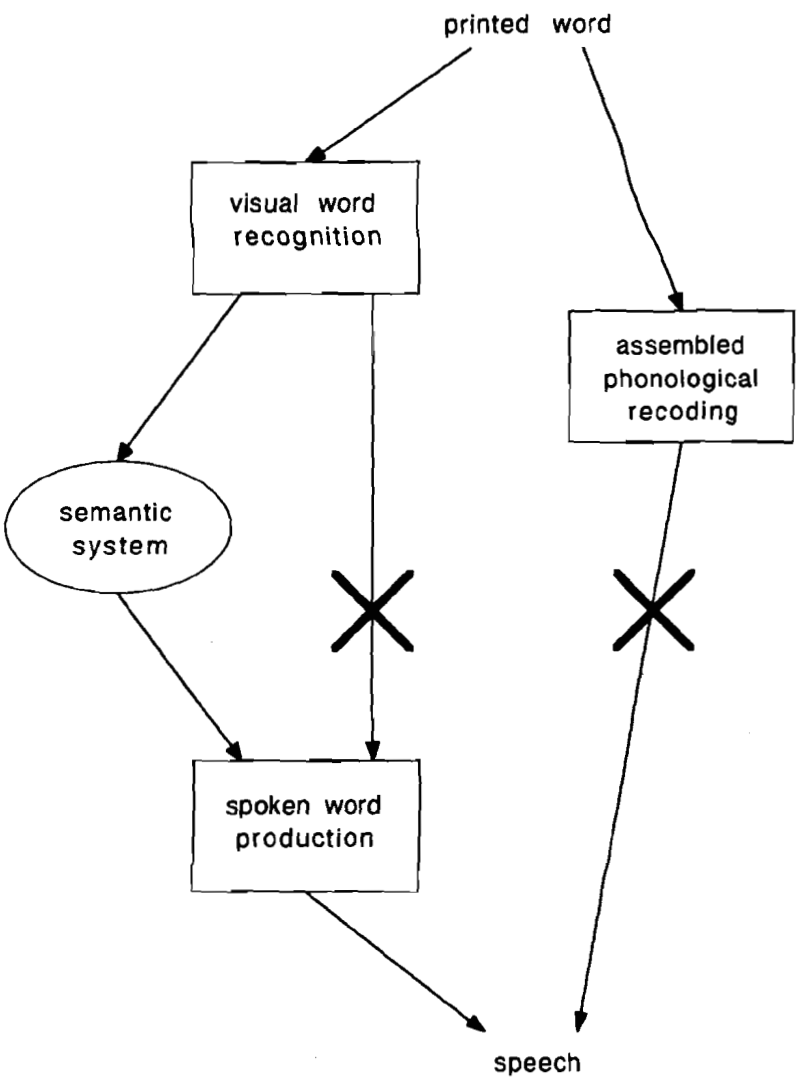

FIG. 14.1 A simplified modular model of the component processes involved in oral reading. The crosses indicate the routes not available to deep dyslexic patients.

Reading in deep dyslexia cannot proceed via the "direct" route either: If lexically specific recognition-to-production connections were available, then patients would make no reading errors at all. The arresting fact that deep dyslexics make semantic errors demands the conclusion that their reading is semantically mediated but it also persuades us that this route is either

additionally damaged or that, operating in isolation, it is intrinsically unstable. Two major suggestions have been offered to account for the core characteristics of deep dyslexic reading in terms of impairments within the semantically mediated route. First, it has been proposed that there are problems with the process whereby semantic information is used to activate entries in the spoken word production system. It is fairly easy to see how perturbations or instability in this meaning-to-word mapping procedure would result in semantic substitutions such as *little* → "small". If one also entertains the idea that spreading activation among the representations of related items takes place within the semantic system, then semantic errors of a more associative kind (e.g. *kissing* → "love") also become explicable. Second, a deficiency of the semantic representations for abstract words within the semantic system has been proposed (or at least there is a selective problem in how abstract semantics are used to activate entries in the word production system).

The combination of these two proposals enables accounts to be offered for both semantic errors and the effect of concreteness on reading accuracy. If one were also to allow the possibility of interactive processing between the components of the semantically mediated route, then visual errors to abstract words may be accounted for as a "second attempt" by the word recognition system to activate a semantic representation that is able to generate a response, which will be likely to be a concrete word (Morton & Patterson, 1980). If one further allowed the possibility that a syntactic processing component exists within the reading route, which is additionally impaired in deep dyslexics, then derivational errors too become explicable, as might the severe difficulties with function words (and function word substitution errors).

Marshall and Newcombe (1966) suggested that G.R.'s semantic errors arise from a breakdown of the process by which semantic representations (conceptualised in terms of Katz and Fodor's dictionary entries) are encoded into appropriate phonological forms (i.e. words) in reading. The example they use is the dictionary entry for the word *bush*, which G.R. read as "tree". They suggested that this error represented the phonological encoding of the key semantic markers of BUSH (< plant > and < with branches >) but not its distinguisher (< arising from or near the ground >). It is noteworthy that this example is for an error to a concrete word. It may be less easy to imagine how the "normal" dictionary entry for an abstract word, such as *idea*, can uniquely specify a word. (The representation < plan or thought formed in the mind > might apply to very many words, such as *idea*, *plan*, *notion*, *thought*, *concept*, *hypothesis*, etc., which might cause the lexical selection process to become overburdened and effectively to collapse.) It is therefore highly likely that any general problems of meaning-to-word mapping will affect abstract words severely.

Deep dyslexia still holds consideration and substantial theoretical interest (see, for example, Plaut & Shallice, 1993). G.R. is most certainly a classic deep dyslexic but is also a classic neuropsychological case in general. Marshall and Newcombe's (1966) paper (despite its silence on the effects of concreteness) revealed simulating and important features of a major variety of acquired dyslexia and has had a profound influence. Marshall and Newcombe must be applauded—by which I mean justly acknowledged and warmly thanked—for introducing us to G.R. and for their attempt to provide the foundation of an account of impaired reading in terms of conceptions of normal processes.

REFERENCES

Allport, D.A. & Funnell, E. (1981). Components of the mental lexicon. *Philosophical Transactions of the Royal Society London, B295*, 397–410.

Barry, C. (1984). Consistency and types of semantic errors in a deep dyslexic patient. In R.N. Malatesha & H.A. Whitaker (Eds.), *Dyslexia: A global issue*. The Hague: Martinus Nijhoff.

Barry, C., & Richardson, J.T.E. (1988). Accounts of oral reading in deep dyslexia. In H.A. Whitaker (Ed.), *Phonological processes and brain mechanisms*. Berlin: Springer-Verlag.

Brown, W.P., & Ure, D.M.J. (1969). Five rated characteristics of 650 word association stimuli. *British Journal of Psychology, 21*, 233–249.

Coltheart, M. (1980a). Deep dyslexia: A review of the syndrome. In M. Coltheart, K. Patterson, & J.C. Marshall (Eds.), *Deep dyslexia*. London: Routledge & Kegan Paul.

Coltheart, M. (1980b). Deep dyslexia: A right-hemisphere hypothesis. In M. Coltheart, K. Patterson, & J.C. Marshall (Eds.), *Deep dyslexia*. London: Routledge & Kegan Paul.

Coltheart, M., Patterson, K., & Marshall, J.C. (Eds.). (1980). *Deep dyslexia*. London: Routledge & Kegan Paul.

Friedman, R.B., & Perlman, M.B. (1982). On the underlying causes of semantic paralexias in a patient with deep dyslexia. *Neuropsychologia, 20*, 559–568.

Hinton, G.E., Plaut, D.C., & Shallice, T. (1993). Simulating brain damage. *Scientific American, 269*(4), 58–65.

Katz, J.J., & Fodor, J.A. (1963). The structure of a semantic theory. *Language, 39*, 170–210.

Marshall, J.C., & Newcombe, F. (1966). Syntactic and semantic errors in paralexia. *Neuropsychologia, 4*, 169–176.

Marshall, J.C., & Newcombe, F. (1973). Patterns of paralexia: A psycholinguistic approach. *Journal of Psycholinguistic Research, 2*, 175–199.

Marshall, J.C., & Newcombe, F. (1980). The conceptual status of deep dyslexia: An historical perspective. In M. Coltheart, K. Patterson, & J.C. Marshall (Eds.), *Deep dyslexia*. London: Routledge & Kegan Paul.

Marshall, M., Newcombe, F., & Marshall, J.C. (1970). The microstructure of word-finding difficulties in a dysphasic subject. In G.B. Flores d'Arcais, & W.J.M. Levelt (Eds.), *Advances in psycholinguistics*. Amsterdam: North-Holland.

Morton, J., & Patterson, K. (1980). A new attempt at an interpretation, or, an attempt at a new interpretation. In M. Coltheart, K. Patterson, & J.C. Marshall (Eds.), *Deep dyslexia*. London: Routledge & Kegan Paul.

Newcombe, F. (1969). *Missile wounds of the brain: A study of psychological deficits*. Oxford: Oxford University Press.

Plaut, D.C., & Shallice, T. (1993). Deep dyslexia: A case study of connectionist neuropsychology. *Cognitive Neuropsychology, 10*, 377–500.