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Children's Naming and Word-Finding Difficulties:

Descriptions and Explanations.

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Abstract

Purpose: There are a substantial minority of children for whom lexical retrieval problems impede the normal pattern of language development and use. These problems include accurately producing the correct word even when the word's meaning is understood; such children are often referred to as having word-finding difficulties (WFDs). This review examines the nature of naming and lexical retrieval difficulties in these and other groups of children.

Method: A review of the relevant literature on lexical access difficulties in children with word finding difficulties was conducted. Studies were examined in the terms of population parameters and comparison groups included in the study.

Results and Conclusions: Most discussions of the cognitive processes causing lexical retrieval difficulties have referred to semantics, phonology and processing speed. It is argued that our understanding of these topics will be further advanced by the use of appropriate methodology to test developmental models that both identify the processes in successfully performing different lexical retrieval tasks and more precisely locating the difficulties experienced by children with such tasks

Children's Naming and Word-Finding Difficulties: Descriptions and Explanations.

Difficulties and delays in language acquisition result in significant and often ongoing problems for children and young people. Yet the heterogeneous nature of language impairment continues to challenge researchers and practitioners. One attempt to address this issue has been to try to find subgroups of children with specific types of problems (Conti-Ramsden & Botting, 1999). Attention has been paid to problems with morphosyntax (van der Lely & Ullman, 2001), phonology (Bertollini & Leonard, 2000) and pragmatics (Bishop & Norbury, 2002). In general, however, research on lexical dimensions and specifically difficulties in retrieving lexical items is relatively scarce. Yet word retrieval plays a central role in language processing and cognitive development. These difficulties are predictive of reading problems and poorer performance at school (Wolf & Segal, 1992). Further, a population survey of language impaired children has revealed that 25% had difficulties with word finding (Dockrell, Messer, George, & Wilson, 1998) while the figure may be around 50% for learning disabled students (German, 1998).

Recently there have been advances in understanding the neurological processes underpinning word finding. Neuroimaging studies of adults and more recently children have provided information about the location of different components of the word retrieval process (see Alzheimer's Quick Test, 2002; and CELF-4 manuals, 2003). In addition, the neurological basis of word retrieval has been discussed in relation to more general theories of cognitive functioning. Nicolson and Fawcett (1999) have speculated that the slow picture naming speed in children with dyslexia is one of several impairments that could be attributed to dysfunction with the

cerebellum. Ullman (2004) makes a similar suggestion about children with SLI. He argues that the mental lexicon depends on temporal lobe substrates involving declarative memory while difficulties in lexical retrieval are due to the procedural memory system, which involves specific frontal basal ganglia, parietal, and cerebellar structures (but see Thomas, 2005).

In this review we argue that advances in our understanding of children with word finding difficulties will be achieved by making better use of cognitive models in the design of the research (Levelt, 2001). Findings from such research can help the identification of correspondences between behavioural processes and brain substrates. A greater understanding of the component processes of word retrieval in children will assist practitioners by allowing a more precise localisation of the cognitive processes giving rise to the difficulty and address the question of whether word finding difficulties can be viewed as an isolated difficulty or a by product of other language disabilities.

The review begins by discussing the characteristics and identification of children who have problems with lexical retrieval. We outline current models of adult lexical production to provide a context to discuss research findings about children. The children we consider include both those identified as having lexical retrieval difficulties by standardised tests, and other related populations where naming difficulties are prevalent (low achieving children, children with specific language impairment and children with dyslexia). The last section discusses the limitations of current data sets and considers new avenues of research.

Characteristics and Identification of Word Finding Difficulties

The term *word finding difficulties* (WFDs) is often used to refer to children who have naming or word-retrieval problems that are severe enough to cause concern. All children, on occasions, are unable to produce words and their naming is influenced by a range of factors such as word frequency, age of acquisition and lexical neighbourhood (Newman & German, 2002). In some cases the failure to produce a word is simply due to its absence from the child's vocabulary. This section focuses on studies of children diagnosed as having lexical retrieval difficulties. These are children who have greater difficulty producing words that they can identify in comprehension assessments, compared to their chronological age peers (see Dapretto & Bjork, 2000).

Word finding difficulties often are evident in discourse. German (German, 1987; German & Simon, 1991) reports that in a story telling paradigm, children with WFDs in comparison to chronological age (CA) matched children produced significantly fewer word tokens and had significantly more difficulties with lexical access (e.g., reformulations; unnecessary repetitions; fillers such as *ah, er,* or *uhm*; empty words such as 'thing' or 'stuff'; long pauses; and target word substitutions). Thus, the clinical pattern involves both an inability to find the appropriate word and the use of alternative behaviours to compensate for the word retrieval difficulty. Johnson and Myklehurst (1967; p. 115-116) give the following example from a 9-year-old boy.

Well what sort of models do you make?

Oh, airplanes and ships.

How do you make them? Tell me about it.

Well,   out   of   ..im..out   of   ..oh..what-you-ma-call-em..out   of ..what..you-ma-call-ems..I can't uh..let's see..out of ..plastic Good!

There are questions about the extent to which these different forms of word retrieval difficulties result in a coherent syndrome that is underpinned by a single cognitive mechanism (Tingley, Kyte, & Johnson, 2003). Despite the existence of adult processing models (see section on lexical access models) this issue has been under researched from a developmental perspective. Furthermore, there are indications that discrete picture naming (i.e. confrontational naming) and serial picture naming task (such as the Rapid Automatized Naming (RAN); Denckla, & Rudel, 1974; 1976; and Rapid Alternating Stimulus (RAS); Wolf, 1986) involve different neurological systems from those tasks involving semantic access, such as word association and sentence completion. The former processes being associated with the parietal and frontal lobes (Wiig, Zureich, & Chan, 2000); the latter processes being associated with the left anterior and inferior frontal areas (Wiig et al, 2002; Jacobsen et al, 2004). As yet it is unclear whether these constitute dissociable patterns of naming difficulties.

We believe that WFDs should be considered to occur when there are problems involving the production of words that are greater than would be expected given the children's ability to comprehend words. That is, children with WFDs have dissociation between the comprehension and production of words. This profile could occur in children who have typical levels of comprehension but whose difficulties with production are worse than average or children who have language disabilities but where the ability to produce words is further below what would be expected on the basis of their comprehension. In contrast, children who have similar delays in both the

production and comprehension of words should not be considered to have WFDs, even though their production abilities are below what would be expected in a typical child.

Identification of Children with Word Finding Difficulties

Standardized Assessments of Word Finding Difficulties. Standardised tests that include normative data have been developed to identify when a child's difficulty with production is greater than would be expected on the basis of their comprehension (Snyder & Godley, 1992). At present, German has devised the most widely used assessments (see German, 1987; 1989) and these tests are the only ones that have US national norms. These assessments include the Test of Word Finding, Second Edition, (TWF-2; German, 1986; 2000); Test of Adolescent/Adult Word Finding (TAWF; German, 1990), and the Test of Word Finding in Discourse (TWFD; German, 1991). The first two tests assess: picture naming of different word classes; sentence completion and description naming; and naming to categories. The assessment also checks that the individual can comprehend the words that he/she had difficulty in accessing. The Test of Word Finding in Discourse (TWFD) requires the child to produce stories based on pictorial stimuli. The narratives are then assessed for productivity and the presence of word finding behaviours. The TWF-2 provides the best guidance to examiners in formulating hypotheses as to the underlying nature of WFDs. A significant proportion of children with language disabilities have WFDs as identified by the TWF (German, 1998; Murphy, Messer, & Dockrell, 2003), but currently it is unclear what proportion of children without language and learning disabilities have WFDs.

Non-Standardized Assessments. Other non-standardised assessments are also available, some of which are employed in research rather than in clinical contexts. The Northwestern Word Latency Test (Rutherford & Telser, 1971) assesses the latency to produce words that the child can comprehend. The Word Naming Test (Weigel-Crump & Dennis, 1986), originally designed for children with brain injury, assesses word retrieval problems in a greater number of ways including picture naming, word definitions and rhyme prompts. The Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1976) assesses the accuracy (but not speed) of naming. The RAN involves the rapid naming of a visual array of 50 stimuli, consisting of five symbols in a given category that are presented 10 times in random order (for norms see Meyer, Wood, Hart, & Felton, 1998). The categories involve letters, numbers, colours or objects. The RAS was developed from the RAN to assess children with dyslexia. The RAS differs from the RAN in that different categories of stimuli (letters, numbers, etc.) are presented and that different types of stimuli are presented alternately (e.g. a number, then a letter, then a number, then a letter) within the same sequence of 50 items. Both the RAN and RAS are principally assessments of serial naming speed or automaticity and therefore rely on efficient lexical access. Performance has been found to be related on these two assessments (Wolf, 1986), and both measures predict literacy abilities (Wolf, 1986; Wolf & Bowers, 1999). Berninger, Abbott, and Alsdorf (1997) using a sample of typical children, report significant correlations between RAN assessment and the TWF in the range .38 to .42. Most of these measures offer little guidance as to the nature of WFDs, but can serve as useful tools for identifying a population prior to investigating the precise nature of the children's deficits.

Lexical Access models and Word Finding Processes

Lexical access involves a number of separate processing components. To understand the difficulties of lexical access experienced by children with WFDs it is necessary to delineate the potential loci of impairment and consider the ways in which these deficits might impact on the processes of naming and retrieval. As yet, no detailed developmental model of lexical access has been constructed (Dockrell & Messer, 2004). Consequently, adequate conceptualisations of the processes involved in lexical access are largely dependent on adult processing models or adaptations of such (German, 2000), but there are good reasons to suppose that adult models may not directly address developmental questions (Thomas & Karmiloff-Smith, 2002).

For adults, at least, there is a consensus that to produce a word, an initial semantic specification of the word at the lemma level occurs early in processing and that later there is more activation of phonological information at the lexeme level (see Levelt, Roelofs, & Meyer, 1999). The semantic level involves the activation of a set of lexical candidates or lemmas and the selection of the target lemma. This level involves relationships between words (Clark, 2002; Dockrell & Campbell, 1986), although no single set of semantic relations or organisational structure is adequate for the entire lexicon (Miller & Fellbaum, 1991). The stage of phonological processing includes the activation and selection of phonological forms (lexemes) (Fromkin, 1988; Garrett, 1988; Levelt, 1989). Discussions of naming include an additional process of object identification so that naming can be characterised by a three stage process of: object identification, name activation and response generation (Johnson, Paivio, & Clark, 1996).

The findings from research studies with adults have led to three different models of the process. In the modular view (Levelt at al., 1999) naming is seen as a serial process, moving from the lemma to the lexeme. Phonological encoding is assumed to start only after the target lemma is selected and to comprise the phonological encoding of the target lexeme alone. In contrast interactive processing models (Dell, Burger, & Svec, 2002) allow for a bidirectional spread involving positive feedback from lexeme to lemma. Finally, cascade models suggest that activation spreads from lemmas to the phonological level, and that activation of the target lemma occurs as well as partial activation of alternative forms (Blanken, Dittman, & Wallesch, 2002). Each model points to the importance of both the lemma and lexeme level in fast and accurate lexical selection. In addition, the role of competitive items in influencing error patterns has been noted at both the lemma (Blanken et al., 2002) and the lexeme level (Gaskell & Dumay, 2003).

Children with Word Finding Difficulties

Recently researchers have drawn more explicitly on the lemma and lexeme framework (German, 2000; 2002) to examine the word finding behaviours of children (Faust, Dimitrovsky, & Davidi, 1997). Adult models of naming indicate that research with children should focus on the levels of semantic and phonological representation as barriers to fast and accurate lexical retrieval. This can be achieved by considering the accuracy of the children's responses, the patterns of errors and the speed at which items are retrieved. However, in addition there are specific developmental factors which indicate that a broader conceptualisation of the process is needed (Thomas, 2003). These include the speed of information processing and developmental

parameters of lexical acquisition. In the following sections, we evaluate the competing explanations about semantic and phonological representations as causes of WFDs and in the final section we return to developmental considerations.

Semantic Representations as the Locus of WFDs

The lemma level in models of adult lexical production involves the processing of semantic information (Levelt et al., 1999). Several sets of investigations are relevant to the issue of whether WFDs can be attributed to difficulties involving this part of the word production system. The investigations have studied semantic errors, semantic priming, producing definitions, and semantic fluency.

In the case of naming errors, it often has been assumed that incomplete semantic representations are likely to result in semantic errors, and incomplete phonological representations are likely to result in phonological errors, but as we will see this rationale may be too simplistic. Semantic errors are typically found to be the most frequent type of naming error (Rubin & Liberman, 1983). For example, McGregor (1997) found that semantic errors were the most common type in both children with WFDs and CA controls; although the WFDs group produced a much higher overall rate of errors. McGregor suggested that this indicates that impoverished semantic representations are a cause of WFDs. However, because children with WFDs are likely to have a less developed language system than CA controls, and because children with less developed language produce more errors than older children, these data may simply indicate that language level predicts semantic errors rather than children with WFDs being especially vulnerable to these errors. Such caution seems to be justified. Dockrell, Messer, and George (2001) report that there are similarities in

the errors of children with WFDs and those of LA and CA peers. For object naming, the proportion of errors was similar in the WFDs and LA groups, and all these groups performed worse than CA controls. Further analyses of the types of errors when naming objects revealed, as in previous studies, that semantic errors were the most frequent type across all groups of children, and there were no significant differences between groups in the proportion of semantic errors.

Thus, it would seem that although semantic errors when naming objects are frequent in children with WFDs, these errors also are frequent in typical children, and the proportion of semantic errors for object words in children with WFDs does not appear to be significantly higher than in LA control groups. In fact, a higher proportion of phonological errors has been reported (Dockrell et al., 2001) and a lower proportion of semantic errors (McGregor, 1997). Another issue is that semantic errors could occur because of a failure to access the target phonological representation, and a semantically related phonological representation is activated instead (McGregor, 1994). As a result, these semantic errors could be produced when the cause of the retrieval difficulties are at the lexeme level. Consequently, these studies of errors when naming objects do not provide decisive evidence about the location of children's lexical retrieval difficulties.

For naming actions, Dockrell et al. (2001) found differences between children with WFDs in comparison to LA and CA groups. Children with WFDs produced fewer errors where the verbs were similar or related to the target, instead there was a tendency to produce general all purpose verbs or inappropriate verbs. In addition, McGregor (1997) also reports fewer "don't know" responses when children with WFDs were naming actions. Verbs pose particular challenges in naming and the

conceptual complexity of actions is one of their important characteristics (Szekely et al., 2005). Thus the particular difficulties in verb naming of children with WFDs implicates the lemma level of representations. Other methodologies have been used to investigate the processing of semantic information. McGregor and Windsor (1996) studied the effects of semantic priming. Both WFDs and CA groups were more accurate when primes were given, and no differential effect of semantic priming was detected. In another study, McGregor and Waxman (1998) used an ingenious technique of questioning to investigate the hierarchical nature of semantic representations. However, again no differences were found between children with WFDs and CA peers in accuracy or the pattern of errors, although children with WFDs produced more 'don't know' errors in both the naming and the acceptance task. Both these studies failed to find convincing support for children with WFDs having an impaired semantic system in relation to CA controls, but this could be partly attributable to the small sample sizes.

It is known from studies of children with SLI that naming errors are associated with less detailed representations when assessed by the drawing of target objects (McGregor & Appel, 2002). Related to this is evidence of semantic differences in the definitions of children with WFDs. In a study by Dockrell, Messer, George, & Ralli (2003) children with WFDs produced as many definitions as their CA peers for object words, and as their naming age peers for action words; thus, their generation of definitions was similar to that of control groups. However, the children with WFDs gave significantly less accurate definitions of object names than CA control group and a group matched on the Test for Reception of Grammar (TROG; Bishop, 1993), but as might be expected were equivalent to a naming age matched group. The children with

WFDs retrieved the lowest proportion of features referring to the semantic category of the object in their definitions, but the highest proportion of descriptions of the objects perceptual appearance. This pattern of response differed from age matched comparisons. There was evidence of a delayed pattern of semantic organisation in children with WFDs that may be similar to younger children. Further research is needed to check that the findings are not because of the oral nature of the required responses, but we can have a degree of confidence in the findings because they involve differences in proportions rather than in frequencies.

Assessing children's serial free recall or fluency is a further way to investigate the role of semantic (and phonological) representations in the retrieval process. In these tasks children have to name as many items as possible that correspond to an identified target (e.g. words beginning with a certain sound or in a particular category), and this is likely to provide an indication of the strength of links between elements of the lexical system. Messer, Dockrell and Murphy (2004), and Simmonds (2004), using items from the PhAB (Phonological Assessment Battery; Fredrickson, Frith, & Reason, 1997) required the children with WFDs to produce as many items as possible within a two minute frame for items in the same semantic domain (semantic fluency), with the same initial phoneme (alliteration fluency) and the same rhyme (rhyme fluency). At 7 years, only 6% of the children with WFDs scored within 1 standard deviation of the mean on semantic fluency, the comparable figure at 9 years was 10%. In contrast, there was higher performance on phonological tasks with the figures for alliteration fluency being 20% (7 and 9 years) and for rhyme fluency 27% (7 years) and 69% (9 years). The most direct explanation of the findings is that children with WFDs perform poorly because the networks of connections between

semantic elements in the lexicon are less sophisticated than those of other children, and less developed than for phonological representations. The presence of vulnerability with semantic fluency, but not alliteration or rhyme fluency, suggests the findings are not simply the result of a general retrieval difficulty (but see Faust et al, 1997; German & Newman, 2004 for a different interpretation).

A related body of research concerned with semantic deficits has been conducted by Snowling, Nation and their colleagues with a group of children they term 'poor comprehenders' who produce similar patterns of responses to children with WFDs. This is a group of children who have normal phonological skills, but are slow and inaccurate on discrete picture naming (especially low frequency names; Nation, Marshall, & Snowling, 2001), they perform poorly on reading comprehension (Nation & Snowling, 1998), contextual facilitation in reading (Nation & Snowling, 1998) and poorly on semantic priming in a lexical decision task (Nation & Snowling, 1999). Thus, children with semantic based comprehension difficulties, also appear to have slower and more inaccurate naming. The characteristics of poor comprehenders are similar to those of a group of children identified as having WFDs who were studied by Messer et al. (2004). The children with WFDs had relatively high standardised scores on the decoding of written words and on phonological awareness, but had low scores of semantic fluency and of naming. This is suggestive of similar underlying deficits in children with WFDs and poor comprehenders.

To summarize, at present there are indications that the problems of children with WFDs could be located at the lemma level. The children appear to have subtle problems with the use of verbs, are worse than typical children at defining words, and in semantic generation tasks. However, children with WFDs do not appear to make

proportionally more semantic errors than LA controls, and semantic priming does not appear to confer marked benefits. These uncertainties indicate a need for more investigations using a range of assessments of semantic representations and the processing of this type of information during lexical production. Care needs to be taken in future studies to eliminate the possibility that the children's difficulties with verbal responses have an effect on the data that is obtained (German & Gellar, 2003). Thus, investigators should look for patterns of differential responding, and some of the work on 'poor comprehenders' provides suggestions about other methodologies to assess semantic abilities.

Phonological Representations as the Locus of WFDs

A number of studies have pointed to the lexeme level as a locus of the problems experienced by children with WFDs. Constable, Stackhouse, and Wells, (1997) report a single case study of a 7 year old boy with severe word finding difficulties and reading delay. Using Stackhouse and Well's (1997) psycholinguistic model to guide their assessments these authors argue that the naming difficulties arose directly as a result of imprecise phonological representations of particular words, rather than as a result of motoric, semantic or other deficits. The role of phonological factors in children's naming has also been supported by findings about the efficacy of phonological interventions (McGregor, 1994). McGregor provided two children with a phonological intervention, which reduced both phonological errors and semantic errors. In addition, German (2002) in an intervention study focused on the access of phonological representations and found that naming errors could be reduced when learners with WFDs were provided with metalinguistic reinforcement, phonological

mnemonics, and rehearsal specific to evasive target words. These results suggest that problems with phonological storage and phonological output representations cause the children's word finding problems.

Recently these single case studies have been extended by two larger studies examining lexical access (Newman & German, 2002), word substitutions and error patterns (German & Newman, 2004). The findings from the studies indicated that lexical factors such as neighbourhood density and neighborhood frequency influenced learners naming accuracy, the substitutions that were selected and the error patterns that were demonstrated. There is also evidence that the children had accessed the lemma level of representation but, for some reason, were experiencing difficulties at the lexeme level. The difficulties may have occurred as a result of faulty or impoverished phonological representations or, as German and Newman (2004) suggest, because of organisational features of the phonological lexicon that prevents access to the complete phonological form of the target word. These failures to access words correspond to processes discussed in relation to tip of the tongue phenomena and would also locate children's difficulties at the lexeme level of representation or access to this level rather than the lemma level. These blocked responses appear to be more common in words from sparse neighbourhoods and "might indicate that such errors occur when listeners fail to gain access to the appropriate region of lexical space" (German & Newman, 2004, p. 631).

There are marked changes in phonological representations during development; children move from more holistic representations to segmental representations. The lexical restructuring hypothesis suggests that, in typical

development, lexical representations gradually become increasingly segmental between one and eight years of age (Walley, 1993; Metsala, 1997). This restructuring is thought to occur on an item-by-item basis, with high frequency words in dense neighbourhoods undergoing restructuring first (Metsala, 1997). From this perspective each act of retrieval should strengthen the connections involved and consequently, the errors experienced by children at the lexeme level may reflect reduced experience in retrieving lexical items. Indeed as more words are learned lexical representations become less wholistic and more segmented. Thus interpretation of lexeme errors requires further study; appropriate comparisons groups to identify the locus of the problem are important. This is especially important as Messer et al. (2004) report that phonological awareness (and decoding) is a relative strength in children with WFDs, most children having scores within the normal range; a finding that casts doubt on the claim that impaired phonological processing and impaired phonological representations are the sole causal mechanism of the children's difficulties.

Slower Speed of Processing as a Cause of WFDs

The importance of speed of processing as an integral factor in learning and performance has been discussed in relation to a range of children with language impairments. Several studies have reported that children with WFDs are slower at naming than control groups. For example, German (1987) compared children with expressive language problems with CA matches, and found they were significantly slower when naming. Similarly, Dockrell et al. (2001) found that children with WFDs had the longest latency of all the groups tested on picture naming tasks. They were significantly slower than CA peers (for high frequency object names and for action

words), and also were slower in naming than age matches for high frequency object words. However, it does not seem that children with WFDs have generally slower speed of responding to all stimuli. Several studies have examined naming of pictorial stimuli and non-pictorial stimuli that have minimal semantic content. German (1985) found that children with WFDs, in comparison to CA matches, were slower at naming colours, which can be considered to have complex semantic representations (Braisby & Dockrell, 1999), but not slower at naming letters or numbers which are generally accepted as having minimal semantic content. In addition, the children had more errors and secondary characteristics when naming colours and letters, but not numbers. Dockrell et al. (2001) also found no significant difference in the accuracy or latency to name numbers or letters between children with WFDs and CA or LA matched children, but there were differences when naming pictures. However, in an older group of children Simmonds (2004) found that the naming of letter and numbers was slower in children with WFDs than in control groups. Thus, the available evidence points to children with WFDs being slower at naming than LA comparison groups, and they are slower with semantically complex stimuli rather than all stimuli, although further studies to confirm these findings and to examine developmental trajectories would be useful.

Summary of Findings about Children with WFDs

A common view in the literature is that semantic representations of children with WFDs are less well developed and this makes retrieval inaccurate, slower or unsuccessful. However, semantic errors do not seem to be more prevalent than in control groups, and investigations have not always produced unequivocal evidence of

less complex semantic representations. Part of the reason for this could be that there are considerable uncertainties about the best way to assess the semantic system, and so null findings could be a result of either failing to assess the critical processes or of measurement error. Findings from online tasks involving priming and errors have not revealed marked differences with control groups. The strongest supporting evidence for semantic difficulties in WFDs comes from the ability of the children to name digits and letters (items which have no appreciable semantic content) as accurately and as quickly as their language and chronological age peers; their difficulty with semantic but not alliteration and rhyme fluency tasks, and from the nature but not the amount of information in the children's definitions.

The nature of phonological representations in this group of children is still not clear. The work of McGregor (1994) points to impoverished lexical representations suggesting that the children's difficulties reside at the lexeme level of representation. However, not all children demonstrate poor phonological representations. Rather word finding problems may be due to vulnerable links between a word's semantic representation and phonology (e.g. tip of the tongue phenomena) (Faust et al., 1997; German & Newman, 2004).

In relation to these discussions it is important to bear in mind the possibility of multiple causal influences in patterns of naming. The challenge is to produce a model of naming development that explains how these processes work together, which cognitive processes might give rise to difficulties in naming and in what ways children can compensate when one process is compromised (relevant intervention studies are, German, 1992; 2002; Kiernan & Gray, 1998; McGregor, 1994; McGregor & Leonard, 1989; 1995; Wing, 1990). As such it is important to consider different populations

who have been reported to experience naming difficulties to help identify the relevant cognitive parameters in children's naming processes.

Studies of Lexical Access in Children with learning disabilities, specific language impairment and reading difficulties

Given the relative paucity of investigations of lexical retrieval and the importance of considering comparative data, the following sections contain reviews of three further groups: children with learning disabilities; with specific language impairment (SLI), and with literacy difficulties. At present there are uncertainties about the extent to which these are three distinct groups. Developmental factors impact on the patterns of problems manifested by the children as do policy directives (Lindsay, Dockrell, Mackie, & Letchford, 2005).Furthermore, recent findings suggest that many children with dyslexia have SLI and vice versa (see McArthur, Hogben, Edwards, Heath, & Mengler, 2000; Snowling, Bishop, & Stothard, 2000), but this is a matter of debate (Bishop & Snowling, 2004).

Nonetheless, it is the case that lexical access problems have been examined in populations that have been a priori identified from different diagnostic groups. Our aim is to show that lexical access problems occur in a range of children, to consider whether different groups of children with word production problems have similar profiles of language abilities, and discuss the way findings across these different groups extend our understanding of the processes underpinning WFDs. In this section we include studies where target populations have been operationally defined and measures of naming or lexical access have been obtained. Where appropriate the

sections are sub-divided according to the type of assessments and attention is drawn to the implications the findings have for understanding the causes of naming difficulties.

Lexical access Problems and Naming Difficulties in Children with learning disabilities

In this section we consider the WFDs of children who have been selected on the basis of their lack of progress at school or because of the presence of a learning disability. Despite the range of selection criteria used in these studies, a common message is that WFDs are a feature of a significant proportion of these children.

Some of the first investigations of children with lexical access difficulties concerned pupils who had IQs that were at the lower end of the average range and who were making poor progress at school. These children had low school achievement, poor verbal fluency (Johnson & Myklebust, 1967; Wiig & Semel, 1975), narrow understanding of word meanings and limited imagery (Johnson, 1968).

A comparison study conducted by German, that involved 7- to 11-year-olds who had scores within the normal range on tests of intelligence and of receptive language, but were achieving below their grade (usually by 1-2 grades), showed that this sample had a range of WFDs compared to typically developing children of the same age and cognitive ability. These included more errors, longer latencies to produce words (German, 1979; 1985), differences in the types of errors (German, 1982), and more lexical difficulties in spontaneous speech (German, 1987). Wiig and Semel (1975) also compared the speech of low achieving adolescent pupils (of more than 2 grades in more than two academic areas) with children matched for age, IQ, grade level, and socio-economic status. The former children had a range of word

retrieval problems: more agrammatical sentences; longer latencies to produce sentences; more incorrect definitions of words, and were both slower and less accurate at naming pictures and verbal opposites.

Thus, it would appear that children who are making poor progress at school are at greater risk for lexical difficulties compared to chronological and IQ matched peers. Most of these studies did not employ LA control groups or standardized assessments, and as a result, there are uncertainties about whether these low achieving children had general difficulties with language that also involve lexical skills or whether they had specific WFDs.

Lexical access in children with Specific Language Impairments (SLI)

Early studies about lexical access in children with SLI indicated that discrete naming, in comparison to age matched peers, was slower, contained more errors (Anderson, 1965; Fried-Oken, 1984; Wiig, Semel, & Nystrom, 1982), and involved naming difficulties (Menyuk, 1975; Rapin & Wilson, 1978). It is generally accepted that these children are heterogeneous with a range of abilities (Conti-Ramsden & Botting, 1999; Tager-Flusberg & Cooper, 1999), and that SLI may be caused by a variety of mechanisms (Leonard, 1998). As a result, investigations of children with SLI are highly likely to contain some children who have WFDs and some who do not. Consequently, there is uncertainty about the relation between studies of SLI and studies of children who are identified by standardised tests as having WFDs. Despite these concerns the study of Children with SLI can provide an indication of the nature of WFDs within this relatively large population, and suggestions about why such difficulties occur.

Kail and Leonard (Kail, Hale, Leonard, & Nippold, 1984; Kail & Leonard, 1986) explicitly argued that children with language difficulties have a less developed language system than CA controls, and as a result their language system has less elaborate semantic entries, which in turn effects word retrieval. On this basis one would expect the naming of children with language difficulties to be similar to LA controls. However, in many of the studies on which these claims were based, there was an absence of LA controls and children with SLI sometimes performed similarly to CA controls. Thus, the claim should be treated with caution until further data are obtained.

McGregor, Friedman, Reilly, and Newman (2002) have returned to this issue and suggested that naming errors are the result of less elaborate semantic representations (see also Lahey & Edwards, 1999; Rubin & Liberman, 1983). McGregor found that the errors of naming in children with SLI and typical children were associated with items that they drew in less detail, they provided fewer information units in definitions and they were less accurate on comprehension tests. There was a similar pattern of error related performance in both children with SLI and CA controls. McGregor et al. (2002) argue that these findings suggest that sparse semantic representations result in naming failures in both groups. This argument has been taken further in a case study, which revealed fewer features in drawings for those items where the child produced semantic based naming errors (McGregor & Appel, 2002).

A different explanation for the word finding difficulties of children with SLI has been advanced by Kail (1994) who suggests these children are slower in responding to all types of stimuli and that this general reduction in processing speed accounts for their slow naming. This hypothesis is supported by the findings from several studies that have compared Children with SLI and CA peers across a range of tasks (Kail, 1994; Lahey & Edwards, 1996; Montgomery, 2002; Windsor & Hwang, 1999). Many of the tasks used in these studies involve linguistic processing or linguistic responses, but importantly some studies also found slower responses to non-linguistic stimuli (Miller, Kail, Leonard, & Tomblin, 2001; Windsor & Hwang, 1999). Recently, Montgomery (2002) has suggested that a slower speed of identifying target words in sentences by children with SLI is due to limitations in carrying out cognitive operations such as those involving working memory.

In a review of whether slower responses in children with SLI are due to specific or general processing limitations, Windsor (2002) argues that we still do not have sufficient evidence to draw a firm conclusion. In some cases there has been a failure to find differences in the reaction time to *non-linguistic* stimuli between Children with SLI and control groups (Crosbie, Howard, & Dodd, 2004; Edwards & Lahey, 1996). Furthermore, there have been findings of non-significant differences involving the processing of *linguistic* stimuli. For example, Leonard, Nippold, Kail, and Hale (1983) found that Children with SLI had discrete naming speeds between those of CA and LA controls. They suggest this was due to a complex set of influences with Children with SLI having a less developed language system than CA controls, but having faster reaction times than the younger LA controls because of the general decrease in latency

to respond with age. In addition, Wiig et al. (2000) report similar serial naming speeds for colours and shapes for children with primary language disorders and typical children across most ages between 6 and 16 years, although on the serial naming of coloured shapes (i.e. involving more complex labelling), children with a language disorder were slower than age matches except at 15 and 16 years (see also Wiig et al. 1982).

Children with SLI also experience difficulties in accessing the phonological form of a word (McGregor & Appel, 2002). Faust et al. (1997) have investigated tip of the tongue phenomena in Children with SLI who have word retrieval problems. The children had more tip of the tongue responses than CA controls, they also gave proportionally more incorrect phonological information when probed about the inaccessible target word, were less likely to spontaneously name the target word, and less accurate in reporting whether they knew the word or not (assessed in a later recognition test). However, since there were no language controls and the children were, on average 18 months delayed in their language skills it is difficult to know whether the weakened connections between the semantic and phonological codes were simply a feature of developmentally less mature language system or specific difficulties in retrieval.

To summarize, the studies of naming in children with SLI have highlighted slower and less accurate naming processes. One explanation of these behaviours is that the children have less elaborate semantic representations in the lexicon. This has been coupled with the suggestion that naming difficulties are simply a result of a either a less developed language system or a delay in vocabulary development (see Dockrell & Messer, 2004). Alternatively it has been argued that slower and less

accurate responses are due to slower information processing. These are different, but not necessarily incompatible hypotheses. The absence of LA control groups from many studies, and because there only have been a few systematic investigations of information processing means that at present it is difficult to come to a robust conclusion about the reasons for slower naming in Children with SLI. Detailed information about the skills of the cohorts tested would help address the alternative hypotheses (Bishop & Snowling, 2004), this is especially important given the strong possibility that samples of children with SLI contain a proportion of those with and without WFDs.

Lexical access abilities in children with dyslexia

In this section we draw attention to the word finding problems of children with dyslexia and discuss the reasons for these difficulties. The studies we discuss generally involve children in the age range of 8 to 12 years. We suggest that current findings indicate that different mechanisms may be responsible for slower naming in children with dyslexia and with WFDs.

A large number of studies have reported that children with literacy difficulties, in comparison to typical children, are slower on serial naming tasks (Rapid Alternating Naming, see review by Wolf & Bowers, 1999, and subsequent publications by Manis, Doi, & Bhadha, 2000; Wolf, Bowers, & Biddle, 2000), even when reading age matches or receptive vocabulary matches are employed (Jorn, Share, Maclean, & Matthews, 1986; Wolf, Bally, & Morris, 1986; Wolf & Goodlass, 1986; Wolf, 1999). Similar findings also have been reported in languages with more regular orthographies (German: Wimmer, 1993; Wolf, Pfeil, Lotz, & Biddle, 1994;

and Dutch: van den Bos, 1998), and in these languages naming speed appears to become a more important predictor of literacy abilities than in English (Wolf & Bowers, 1999).

There are several, potentially conflicting, explanations about the reasons for slower serial naming of the children: whether the slower naming is due to the difficulty of accessing imprecise phonological representations, or whether this is part of a general impairment to the speed of information processing. The phonological difficulties in children with dyslexia are well known (Bishop & Snowling, 2004; Snowling, 2000), and two key studies address this issue in relation to lexical retrieval. Snowling, van Wagtendonk, and Stafford (1988) compared the discrete naming of children with dyslexia and normal readers who were matched on their definitions of words and had similar scores on receptive vocabulary. Even though both groups appeared to have similar levels of semantic knowledge, the children with dyslexia were less accurate than the controls in naming pictures. Snowling et al. (1988) suggest that the problems are to due to 'faulty or impoverished' phonological representations (p. 80). Goswami and her colleagues have extended this line of argument and report that children with dyslexia had a pattern of errors indicative of less precise phonological representations. The children with dyslexia had more phonological errors when picture naming and had greater difficulty recalling longer than shorter names (Swan & Goswami, 1997).

Naming difficulties are also central to the 'double deficit' hypothesis of Wolf and Bowers (1999) who have come to the conclusion that dyslexia can be the result of two deficits. One deficit involves phonological processing and is not believed to have a major impact on naming processes. The other involves problems with the speed of

processing information, which affects serial naming tasks and reading comprehension with no significant impairment in phonological processes and decoding. Children who experience both sets of problems in development are considered to have a double deficit, but children can have problems in only one of the two areas and have less severe disabilities.

The double deficit explanation draws on a large body of findings about naming speed (see above). In addition, support for this claim comes from findings indicating that performance on the RAN has low correlations with phonological awareness (Denckla & Cutting, 1999), and from a factor analysis which identified an 'extraphonological' factor involving speed of responding in children with literacy disabilities (Catts, Gillespie, Leonard, Kail, & Miller, 2002; Cardoso-Martins & Pennington, 2004). These findings suggest that phonological abilities and naming speed are separate dimensions of performance (but see Compton, DeFries and Olson, 2001; Schatschneider et al. 2002). However, there are challenges to the claims made by Wolf and Bowers. Share (1995) suggests that the discrete naming of children with dyslexia has a similar latency to that of control groups, but tends to be more error prone (e.g., Rubin, Zimmerman, & Katz, 1989; Snowling et al. 1988; but see Felton, Naylor, & Wood, 1990). Velluntino, Fletcher, Snowling, and Scanlon (2004) have also questioned the more general claim in the double deficit model that slower speed of processing contributes to literacy difficulties. This challenge has been based on both methodological issues and findings from previous studies (see studies of these processes by Ackerman, Holloway, Youngdahl, & Dykman, 2001; Compton et al., 2001; Schatschneider et al., 2002).

To summarize, the current research on lexical access and children with dyslexia indicates that these children are slower at sequential naming and also appear to make more errors on discrete naming tasks than control groups. Explanations of naming problems have focussed on inadequate phonological representations in the lexicon that result in children having difficulty identifying the appropriate phonological form. Another explanation has focussed on slower speed of response; this being used to account for the slower serial speed of naming in tasks such as the RAN; but this account has been challenged and is less satisfactory in explaining the presence of naming errors. Thus, there are different suggestions about the mechanisms responsible for the lexical access problems of children with dyslexia and children with WFDs. Furthermore, these explanations help to account for the different profiles of abilities in the two groups; in children with WFDs, literacy is an area of relative strength (Messer et al., 2004).

Building on the Present Data Sets: Summary and Future Directions

Lexical retrieval difficulties are not confined to a small group of children; these are a common problem in children seen by services concerned with language and literacy development. Moreover, these difficulties occur both in relatively abstract tasks used for research, and in everyday conversation. Current findings suggest that children are differentially impaired on the processes underpinning lexical retrieval and that these differences vary across populations.

Studies of word finding require a careful choice of control groups if advances are to be made. The research has now largely gone beyond the need to use only CA

matched control groups. However, only a limited number of studies have compared children who have WFDs with LA or reading age controls (Dockrell, Messer, & George, 1999; Dockrell et al. 2003; Kail & Leonard, 1986). Thus, there is a pressing need to include LA control groups to better understand the nature of lexical retrieval difficulties. An alternative methodology is to adjust scores between groups to take account of, for example, differences in the general speed of responding.

In relation to the use of LA control groups, it needs to be acknowledged this design is not without criticism. A general concern is whether the assessment used for matching is appropriate for the research question. Thus questions about naming speed require valid matches to address changes in normative naming speed (Kail et al., 1984). Such problems are more acute when overall assessments of language ability are made because the children with WFDs will have, by definition, an uneven profile of performance. The alternative of using sub-tests, or more specialised assessments can help to answer such criticisms, but has its own complications.

All this emphasises the need for investigators to ensure that the design they adopt is carefully aligned to the type of questions that are being posed about the differences between children with WFDs and other groups. The use of these more appropriate methods of comparison holds out the prospect of a clearer and more secure understanding of this disability.

The use of these more sophisticated methods can usefully be positioned within a developmental framework. A significant gap in current theorising about WFDs is the lack of such a perspective. For example, there is a lack of investigation of whether the problems with the lexical acquisition could cause difficulties with the word retrieval process; an important topic to consider in children (unlike adults). We already know

that children with language difficulties are less able to acquire new words (Dollaghan, 1987) and have difficulties with the processing of speech sounds (see Bishop, 1997; Leonard, 1998). There also has been much interest in the way that restricted capacity at the initial stages of processing speech input and restricted phonological short term memory could have adverse effects on vocabulary acquisition (Baddeley, Gathercole, & Papagno, 1998; Montgomery, 2002). However, it is worth remembering that WFDs are unlikely to be caused by input processes simply resulting in a less developed language system. Instead, there is a need to account for the uneven profile of children with WFDs where lexical retrieval is worse than expected on the basis of the children's comprehension abilities.

There also are likely to be developmental changes that alter the processes involved in lexical retrieval. For example, Funnell and her colleagues (Hughes, Woodcock, & Funnell, 2005; Funnell, Hughes, & Woodcock, in press) have demonstrated changes across age in the relations between naming and semantic knowledge (knowing). Names of early acquired items appeared to be associated particularly with the physical properties of objects and for younger children their ability to name exceeded their object knowledge. In contrast for the older children the pattern was reversed suggesting that for later acquired words knowledge is more conceptually based. Funnel and her colleagues argue that older children develop their knowledge of objects in contexts where the object is not present. Thus, an older child may have a rich semantic representation for the word 'yacht' but be unable to name a picture of a yacht. Factors such as these need to be better understood by the greater use of cross-sectional and longitudinal designs.

We have also argued that future investigations will benefit from using cognitive models of lexical access and production to more precisely locate the areas which give rise to difficulties. Current models point to the importance of clarifying children's competencies at both the lemma and the lexeme level. Already steps have been taken in this direction. There are three important, but general hypotheses, about the mechanisms that are responsible for lexical retrieval problems: semantics, phonology and speed of processing. In the case of children with WFDs there are indications that their difficulties are attributable to processing information at the lemma level of word production. These children perform less well on tasks involving semantic fluency and the production of definitions, and their performance is similar to language age controls when naming items like digits and letters that are not semantically complex. Furthermore, there is no evidence of a high rate of phonological based problems in this group, and phonological awareness appears to be an area of relative strength. However, since much of this work is based on a methodology that requires an oral response, caution needs to be exercised as this could result in the underestimation of skills of children with WFDS, and consequently, there is a need to explore other methodologies which can inform us about children's semantics through other types of responses (German & Gellar, 2003).

Many studies of children with WFDs, with SLI and with dyslexia have found slower naming than in control groups. This has been associated with an interest in whether these effects only occur with language related tasks or occur because of a generally slower speed of information processing. In the case of children with WFDs the evidence that their speed of naming of digits and letters is similar to LA controls, suggests that their slower naming is a language based deficit. In the case of Children

with SLI, the latency to respond in language based tasks seems to be slower than that of controls, however, it is still unclear whether slower processing occurs only with language tasks and whether it extends to non-language based tasks. In the case of children with dyslexia, there is controversy about whether slower processing speed, independently of phonological ability, contributes to the children's cognitive difficulties (Catts et al. 2002; Wolf & Bowers, 1999; Vellutino et al., 2004). Future research in all these areas needs to be more systematic and new research techniques need to be developed; the techniques used to investigate adult lexical production offers a promising way forward.

It has been known for some time that children with dyslexia show word production difficulties. This has been extensively documented in relation to slower serial naming, but also appears to occur with slower and more error prone discrete naming. One explanation of these word finding difficulties is the presence of inaccurate or imprecise phonological representations of words in the lexicon (Nation et al., 2001; Snowling et al., 1988; Swan & Goswami, 1997). This contrasts with suggestions that semantic related difficulties are responsible for word retrieval problems in children with WFDs. Thus, it is possible that naming difficulties may originate from different locations in the word retrieval process, but give rise to similar behavioural manifestations such as delays and errors. A systematic comparison of the word finding in these two groups of children could help understand the way that impairments to different cognitive processes can result in speech difficulties. This illustrates a general need for closer attention to the performance of sub-groups of children with disabilities.

Another issue in the study of word finding has been whether this is a separate problem or whether it is a by product of other language difficulties. Our review indicates that these word finding difficulties occur in children from different diagnostic categories, and though in some children they may occur as a separate problem, word finding difficulties appear to be more usually associated with other disabilities. Consideration of models of lexical retrieval and production indicate that word finding is a complex process, so that word finding problems may originate at a number of different locations in this process. Furthermore, within a child, problems with word finding may originate in different locations for different words. As a result, we suggest that word finding difficulties are presently best conceptualised as involving a range of cognitive processes; from difficulties that occur due to lexical access disruptions (e.g. tip of the tongue failures), to more general problems that might originate with less precise phonological/semantic representations or slower speed of information processing. The challenge is to identify the match between these explanations and children's difficulties.

To conclude, this review has drawn attention to the widespread presence of lexical access difficulties in a number of groups of children and considered the ways in which models of lexical access could help clarify the nature of their deficits. Attention has been paid to methodological issues that will be useful for future studies of this topic. Descriptions of naming problems are well developed but explanations of the phenomena require more detailed analysis. The review points to a number of major questions that remain to be answered if we are to better understand this important aspect of children's language use.

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