View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by The Aphasiology Archive

Phonological output errors in conduction aphasia

Introduction

Individuals with (Reproduction) conduction aphasia are understood to have a post-lexical deficit of phonological encoding. The deficit is post-lexical because it applies to all phonological output tasks (naming, oral reading, repetition). Comprehension is be spared and output is affected by the number of phonemes in the word. All production tasks result in phonologically related non-words errors (often with conduite d'approche).

A detailed study of the way production breaks down in conduction aphasia should give us information about the system for phonological encoding, and possibly suggest appropriate remediation. In this paper we use the same error data to consider the evidence for a number of different theoretical positions.

1. Is the deficit, although at a phonological level, mediated by lexical information? Interactive models of speech production would assume that conduction aphasia is affected by lexical processing such that lower frequency words are more likely to be impaired (Shallice et al,2000) and an unexpectedly high number of errors will be real words (Schwartz et al, 2006).

Stage models make no such assumption. Some individuals with conduction aphasia may have a lexical deficit in addition which could produce an effect of word frequency (Franklin et al, 2002), but a pure deficit should be affected only by phonological variables, such as word length. Nickels and Howard (1995) pointed out that a small number of real word errors would be expected by chance, given the pattern of incorrect phonemes.

2. Are errors predictable in terms of phonological theories?

Phonological theories could also provide an explanation of error production (Jacobson, 1968). For example particular phonemes or processes could be problematic, or errors might tend to be phonemically close to targets in terms of distinctive features.

3. Are errors predictable in terms of phonological encoding theories?

An interactive model might predict that response phonemes are more frequent than their targets. A deficit in copying phonemes into a production frame (Shattuck-Hufnagel, 1992) might produce errors in the ordering of phonemes. A simple decay theory would predict errors tending to occur more at the ends of words (Miller and Ellis, 1892).

Method

Five participants (age range 57-79) with chronic reproduction conduction aphasia were tested on a word repetition test. (Repetition was used rather than naming to enable the inclusion of a greater variety of word types.)

All performed within normal range on spoken word/picture matching. All made copious phonological errors in naming (but no phonetic distortions). Repetition was not significantly worse than naming. (See Figure 1).

The 208 word repetition test was not controlled for word variables, but which was rather a list of words of varied properties, eg words comprising singletons or clusters

and of differing lengths. Compound words were also included. (Examples of words are Banana, Cooker-hood, Football, Tomato, Sieve, Kestrel, Zebra, Brush, Temple.) This list was given for repetition by each participant on two occasions. (NB participant ST abandoned the test after 160 items, first administration). Responses were all tape recorded and transcribed, with sample checking by a second transcriber.

Results

1. Is the deficit, although at a phonological level, mediated by lexical information?

Logistic regression was carried out to see if correct performance was predicted by number of phonemes, syllables or clusters or word frequency. Number correct was compared on both occasions to establish if lexical priming was occurring. Error types were analysed to establish whether formal errors (real word phonologically related errors) were common.

Logistion regression (Table 1) shows that the most robust effect was of number of phonemes (4/5 participants on both occasions), which is in line with the findings of Nickels and Howard (2004). Word frequency, on the other hand only showed a significant effect for WB and this was not replicated. There was no effect of repetition priming (Figure 2).

There are very few unrelated real word errors in the sample (Figure 3). There are a small number of formal errors, especially for the most severely impaired participant, ST. However looking at these errors, they are mostly extremely close to the target:

Examples of ST's formal errors:

Family -> fat
Worktop -> cop
Majesty -> man
Metrotrain ->my
Matches -> mat
Castle -> carrot
Stairlift -> tea
Rosebud -> boast
Mansions -> match

Summary

Lack of an effect of word frequency and lack of repetition priming effect suggest impairment is not mediated by lexical information (but remember this is repetition, not naming). The presence of a small number of formal errors may be taken as evidence of lexical interaction. However, the shortness of most of these errors suggests that these could be real words by chance.

2. Are errors predictable in terms of phonological theories?

The first administration of the test was used to analyse each participant's phoneme inventory. Substitutions were analysed to establish whether errors were produced according to particular phonological processes. Finally the number of distinctive features common to target and substitution were calculated, and compared to the similarity achieved by a random distribution of substitutions.

All participants produced examples of all English phonemes except for /ʒ/, but there was only one target word which included this phoneme. One participant, ST, devoices /z/.
No consistent use of a phonological process was detected. For example the same participant would produce:

Fronting AND backing
Cluster reduction AND addition (and for each participant there are examples of correct 2 and 3 element clusters and substitution of clusters for single phonemes)
Final phoneme deletion AND addition

Producing fricatives for stops is more common than stopping

Phoneme substitutions do seem to share more distinctive features than is predicted by chance (Table 2), but in every case, this is equivalent to only one distinctive feature – is this a reflection of the perception of the transcriber, or a real effect?

Summary

There is no compelling evidence that these participant's errors are predictable in terms of a restricted phoneme inventory, or a return to supressed processes. Errors may be determined by similarity of phonetic features, but this is at best a minimal effect. Errors are highly inconsistent.

3. Are errors predictable in terms of phonological encoding theories?

Following an interactive processing account, all substitution errors (for both administrations) were compared with their targets to see if substitutions were of more common phonemes. It can be seen from Figure 4 that there is no consistent pattern. Figure 5 demonstrates that only a small number of metathetic and substitution errors are produced, suggesting that the main deficit is not one of phoneme ordering.

Table 3 contrasts the numbers of substitutions and omissions produced at the beginning and ends of words, to establish whether phonological information is decaying abnormally fast. Substitutions do not occur more often at the ends of words, but omissions do. The majority of final omission errors are omissions of whole syllables suggesting the word is abandoned rather than a specific difficulty with the word's end.

Summary

None of the phonological encoding accounts appear to support the data. Still the strongest predictor of error is the number of phonemes in the word.

Conclusion

Neither consideration of which words are incorrect or the types of error produced appear to be mediated by lexical constraints, and real word errors tend to be very short and could be real words by chance. There is no obvious rule-governed or constraint based explanation for the types of error produced. All participants were highly inconsistent and all produced (nearly) all phonemes. Findings are consistent with a deficit of random selection of incorrect phonemes at a constant level.

References

Jacobson, R (1968). Child language, aphasia and phonological universals. The Hague, Mouton.

Levelt, WJM, Roelofs, A and Meyer, AS (1999). A theory of lexical access in speech production. Behavioural and brain sciences, 22, 1-75.

Miller, D and Ellis AW (1892). Speech and writing errors in neologistic jargon aphasia: a lexical activation hypothesis. In M Coltheart, R Job and G Sartori (Eds), The Cognitive Neuropsychology of language. Hove:LEA.

Nickels, L and Howard, D (1995). Phonological errors in aphasic naming – comprehension, monitoring and lexicality. Cortex, 31, 209-237.

Nickels, L and Howard, D (2004). Dissociating effects of number of phonemes, number of syllables and syllabic complexity on word production in aphasia: it's the number of phonemes that counts. Cognitive Neuropsychology, 21, 57-78.

Scwartz, MF, Dell, GS, Martin, N, Gahl, S and Sobel, P (2006). A case-series test of the interactive two-step model of lexical access: evidence from picture naming. Journal of memeory and language, 54, 228-264.

Shallice, T, Rumiati, RI and Zadini, A (2000). The selective impairment of the phonological out put buffer. Cognitive Neuropsychology, 17, 517-546.

Shattuck-Hufnagel (1992). The role of word structure in segmental serial ordering. Cognition, 42,213-259.

Swinburn, K, Oorter, G and Howard, D (2004). Comprehensive Aphasia Test. Psychology Press.

Yavas, M (1998).Phonology Development and its disorders. San Diego, Singular Publishing.

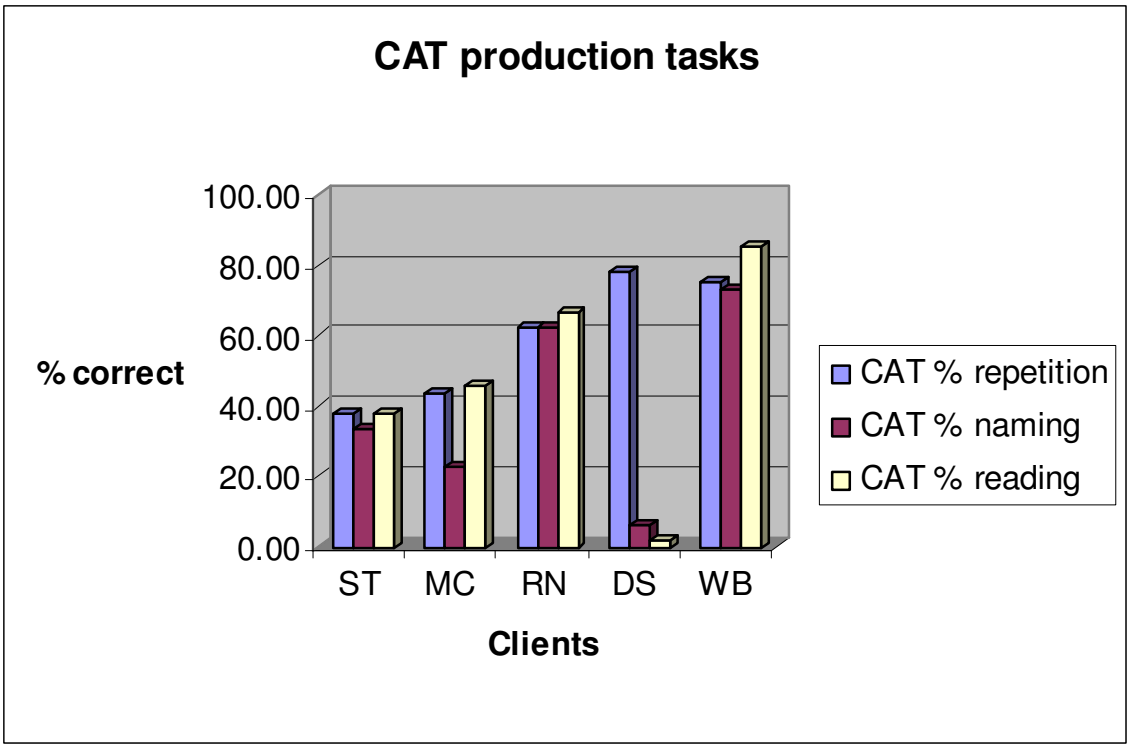

Figure 1: The five participants' performance on repetition, reading and naming of items from the Comprehensive Aphasia Test.

Participant	Number of phonemes		Number of syllables		Word frequency		Number of Clusters	
ST	+	+	+	∅	∅	∅	+	∅
MC	+	+	∅	∅	∅	∅	∅	∅
RN	+	+	∅	∅	∅	∅	∅	∅
DS	+	+	+	∅	∅	∅	∅	∅
WB	∅	∅	+	∅	+	∅	∅	∅

+ = significant effect of variable administration 1
+ = significant effect of variable administration 2

Table 1: which word variables affect word repetition?

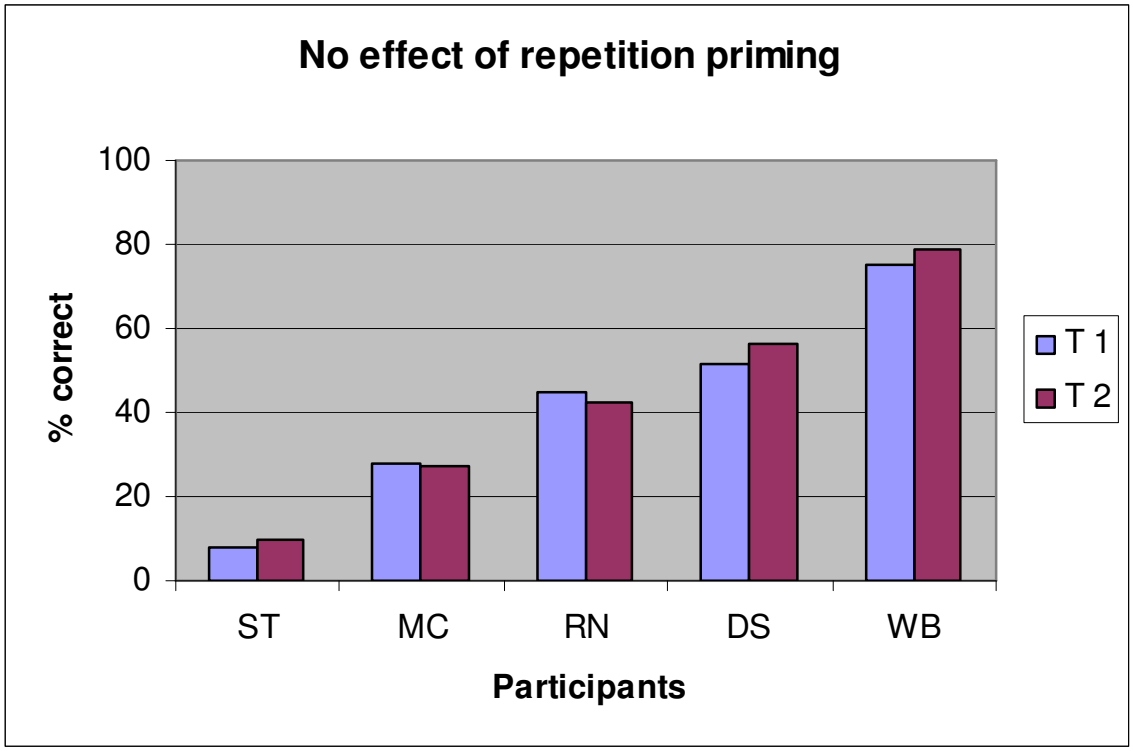

Figure 3: Percentage correct on first and second time of repetition.

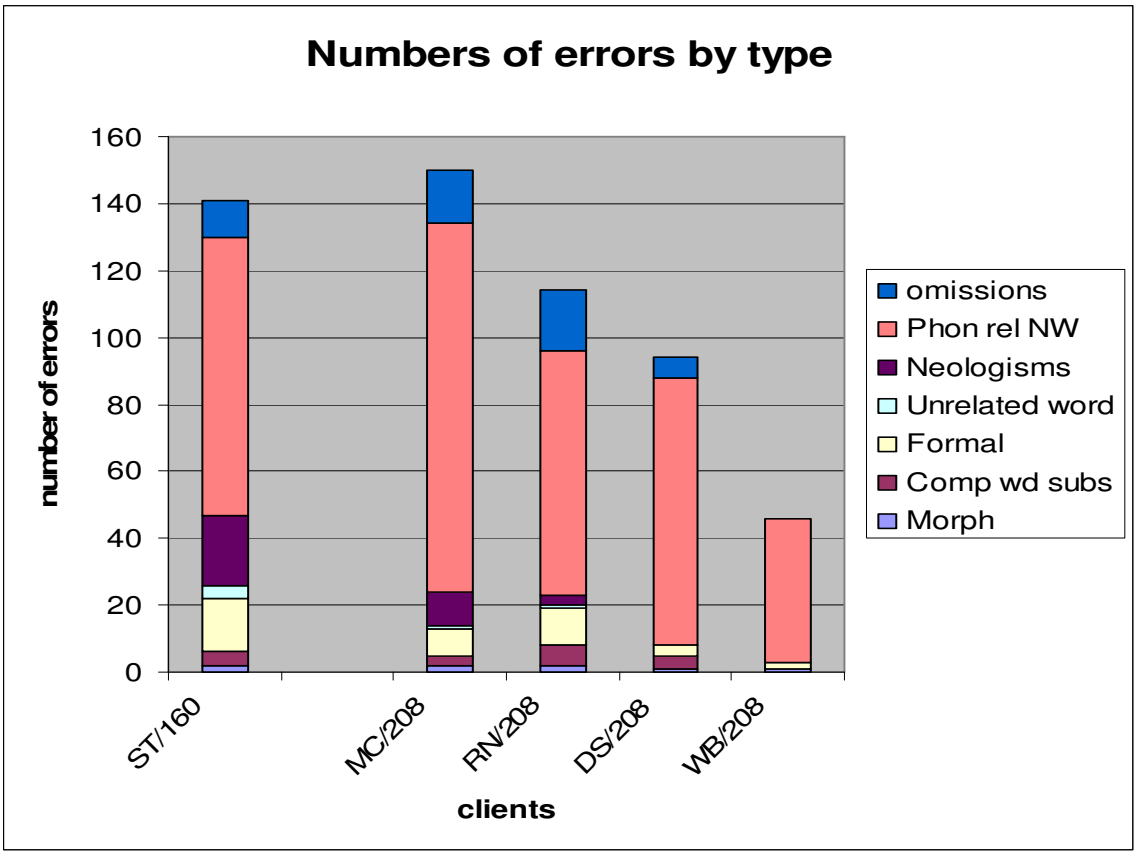

Figure 3: Types of error in word repetition

Subject	*Predicted by chance*	*Actual*	*P (two-tailed)*
ST1	9.87	10.08	0.081
ST2	9.89	10.64	0.002
MC1	9.78	10.95	<0.001
MC2	9.89	10.69	<0.001
RN1	9.75	10.87	<0.001
RN2	9.64	10.22	0.012
DS1	10.12	11.20	<0.001
DS2	10.12	11.20	<0.001
WB1	9.80	11.75	<0.001
WB2	10.08	11.64	0.013

Table 2: Average number of distinctive features shared by phoneme substitutions and their targets, using a 14 feature distinctive feature matrix (Yavas, 1998)

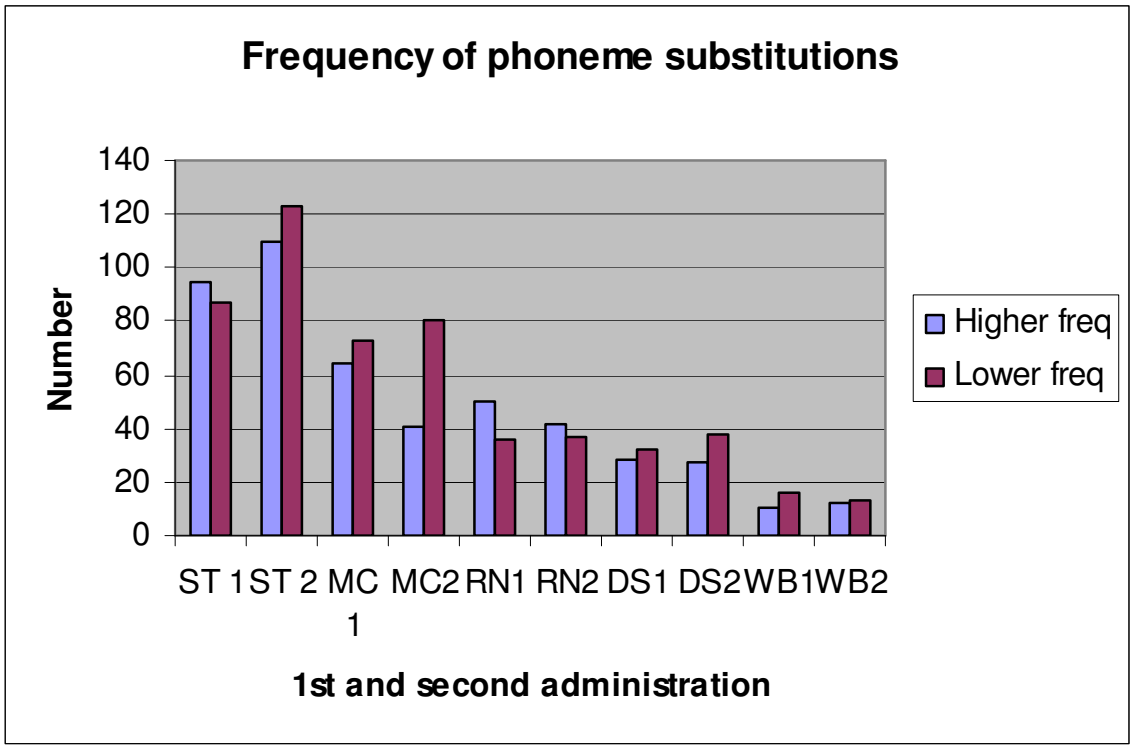

Figure 4: Number of errors which are higher in frequency versus lower in frequency that the target.

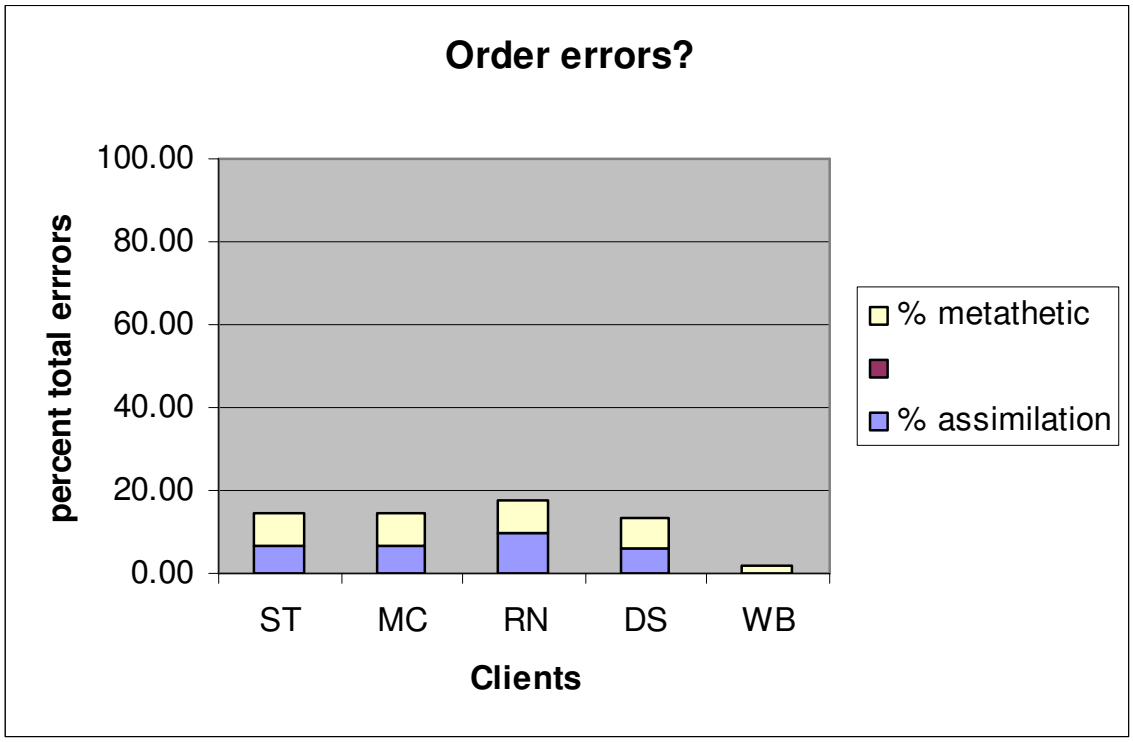

Figure 5: Do the participants make a large number of order errors?

	initial substitution	final substitution	initial omission	final omission
ST	**28**	**34**	**9**	**45**
MC	**24**	**25**	**4**	**58**
RN	**25**	**13**	**2**	**37**
DS	**26**	**20**	**1**	**39**
WB	**6**	**10**	**0**	**12**

Table 3: Are errors (substitutions and omissions) more common at the beginning or the end of words?