

SEMANTIC ASPECTS OF APHASIC WORD SUBSTITUTION

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1. Goal of the study

The aim of this study is to describe and discuss word replacements found in the speech of aphasic patients in relation to existing theories and studies, focusing on:

- 1) a classification of word substitutions especially with regard to semantic factors
- 2) a possible multidimensionality in word substitutions
- 3) how context, especially type of spoken interaction, is related to word substitutions
- 4) the possible influence of word frequency on word substitutions
- 5) what kinds of semantic (morphological) features pertain to the relation between replacement word and target word in a word substitution
- 6) the relationship between word replacements and aphasia.

A more complete version of the paper also exists, cf Allwood & Ahlsen 1986).

2. Previous studies of aphasic word substitutions

The terms *word replacement* and *word substitution* will in the following be used synonymously to cover all word finding problems where one or several words have replaced a word that the aphasic cannot find (we have not studied replacements of target phrases). These terms do not imply any interpretation of what processes cause the replacement, i.e. if it is an "error" (wrong choice, lack of inhibition of alternatives etc) or a "strategy" (a goal directed procedure which in this case could

involve cueing oneself into finding the correct word or of cueing another person into helping you out).

The word replacements of aphasics have been the subject of several studies, which have tried to obtain information about the organization of a possible mental lexicon. (For a review of these studies, see Allwood and Ahlsén 1984). The underlying assumption is that regularities in malfunction also reveal regularities in function. An important question is therefore how word-finding problems and replacements in aphasics can be related both to normal speech production and to the various types of word finding problems found in nonaphasic speakers. (Cf Linell 1983 for a good over- view.)

The most common ways of studying word finding problems have been to study replacements occurring in a test situation involving a naming task of some kind (e.g. Rinnert & Whitaker 1979). A few studies have also been made of word finding in more spontaneous speech (e.g. Marshall 1976). If we take the Rinnert & Whitaker study as an example of how word replacements have been classified, they claim that the replacements can be of five different types, all predictable within the semantic association field of the target word. The types were:

- 1) synonym (e.g. *pussy* for *cat*)
- 2) member of the same category (e.g. *bird* for *cat*)
- 3) spatial relation (e.g. *collar* for *cat*)
- 4) superordinate or subordinate category (e.g. *animal* or *manx* for *cat*)
- 5) object description (e.g. , *furry animal* for *cat*)

Buckingham (1979) in another study added some possible substitution types to the list:

- 6) antonym (e.g. *dog* for *cat*)
- 7) part of whole eg. *whiskers* for *cat*)
- 8) location (e.g. *fireplace* for *cat*)-.
- 9) function (e.g. *hunts rats* for *cat*).
- 10) form and/or size analogy (e.g. *tiger* for *cat*).

Looking at this kind of classification, it is immediately obvious that the categories are not mutually exclusive or even on the same "level", i.e. there is no homogeneous basis for the classification and the categories therefore do not make up any simple taxonomy, where items can be assigned to one category or another in an unambiguous way. In some cases the relation between target word and replacement is based on the auditive or visual properties of the objects that are referred to by the word and in still other cases the relation is contextual in some sense.

Some concrete examples of the problems in determining what semantic category a replacement should be classified under, are: cottage replaced by house (synonym? superordinate? description? form/size analogy?) cradle replaced by crockle (neologism? non-word? phonematic error? perceptual similarity?)

It thus seems probable that most replacements are more easily described by several category-labels than by one.

But still, the category labels seem to capture important characteristics of replacements. It is possible to phrase a plausible description of a replacement in terms of the category labels used above, where one category is sometimes the sufficient or dominating feature, but where two or more categories are also often "cooperating" as different dimensions involved in a replacement. In consequence, the categories, used not as categories but as "features", "dimensions" or "characterizations" of replacements, are still very useful (cf Allwood 1980).

3. On the classification of word substitutions

There is no agreement in the literature on how to classify aphasic word substitutions. From an aphasiological point of view, the most appealing would probably be to classify substitutions in terms of the causal mechanisms behind the substitution. However, since we do not have sufficient insight into this, we propose that the following sources of classification are available from a more behavioral point of view.

1. *The relationship between the replaced word and the replacement word*

2. The relationship between the replacement word and preceding and simultaneous verbal and nonverbal communication
3. The relationship between the replacement word and various features of the context surrounding the communicative behaviour, such as the speaker's internal state or features of the interaction.

The features we have picked out for our present study are: 1. Relation replaced word -replacement word

- A. *Semantic*. The following types of-semantic relation (see below) were chosen:
- i) same semantic category (with subcategories)
 - ii) super- and subordinate semantic category
 - iii) part - whole

- iv) attribute
- v) spatial relation
- vi) functional-causal relation

B. *Phonetic*. Phonetic similarity.

C. *Morphological/syntactic correspondence*.

- i) When a target word is replaced by several words we use the label multiword description or phrase.
- ii) We have also classified the relation between target word and replacement in terms of word class and inflection.

2. *Relation replacement word - verbal context*

Only phonetic similarity was taken into account in the present study.

3. *Relation replacement word - context of communication*

Here we have studied the overall influence of activity, as well as factors which seem to have directly influenced reference, e.g. when a patient is asked to name a car, but looking at the window says *window*.

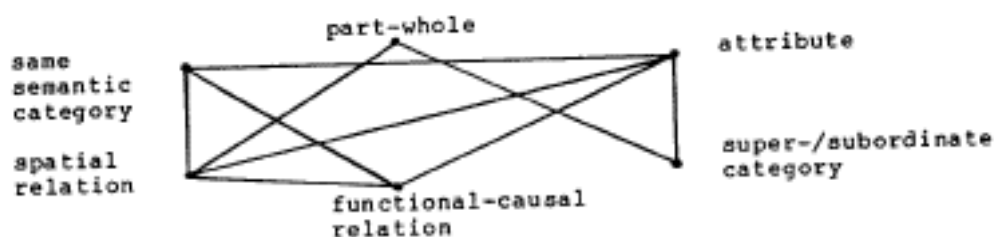
As is evident from our choice of features, the main focus of this study is on the semantic aspects of the relationship between the replacement word and the replaced word. Therefore this type of classification has been made more fine-grained than the others. In order to get a fuller picture of word substitutions the other kinds of relations will also have to be studied in a more detailed way. Since we wanted to include some information about these relations, in order to study the multidimensionality involved in word substitutions, we included the two aspects that were most easily accessible from the data, i.e. the ones mentioned under 2. and 3. above. A few more words should, however, be said about the relations under 3 "Relation replacement - context of communication". There are many important relations of this type. Some of these are (cf also Allwood 1985):

- A. Type of interactive activity , task etc.
- B. Type of role relationship in activity and other characteristics of interlocutor.
- C. Prominent objects (e.g. stimulus material) and other characteristics of physical surroundings.
- D. The relation between the substitution and the speaker's internal state. Very many different factors could here come into play, such as fatigue, emotional state, accessible semantic information, mechanisms for verbalization and speech production (and possible damage of these).

We have taken into account mainly referential relations to replacement words falling under category 3C. We have also made a general investigation of the influence of interactive activity.

The taxonomic categories we have presented are, as we have mentioned above, not mutually exclusive empirically. one can easily imagine a replacement having all types of relation to a target word. For example, if light is replaced by white, there is in addition to the sound similarity a semantic (both refer to properties), and it is not hard to imagine white having occurred in an earlier utterance while at the same time being the colour of the walls in the room where the recording is made. in this case there would be several types of relation: semantic, phonetic and contextual (both linguistic and nonlinguistic) between target word and replacement.

In the same way, possible subfeatures of our chosen main dimensions, semantic, phonetic and context, are not necessarily empirically mutually exclusive. In our present study, this only plays a role regarding the semantic classification of the relation between replacement word and replaced word. The potential compatibility of our chosen semantic features can be presented in the following way:



Classification of word substitutions thus provides for a potentially multidimensional relationship between target word and replacement on several levels, semantic, phonetic and contextual.

4. Method

4.1. Material and subjects

The study is based on a corpus of 186 replacements made by five aphasics (two Broca's aphasics, one conduction aphasic, one anomic aphasic and one Wernicke s aphasic, classified on the basis of a clinical aphasia battery - Reinvang & Engvik 1981). The replacements have been taken from video-recorded conversations of ten minutes between patients and therapists and from a naming test.

A naming test was designed, including 48 pictures (photographic or drawn) illustrating 24 nouns (12 more frequent, 12 less frequent), 12 verbs (6 more frequent, 6 less frequent), and 12 adjectives (6 more frequent, 6 less frequent) and six pictures of "famous faces", where the task is to give the names of well-known persons. The words were taken from Allén (1972), a word frequency list based on newspaper articles. The "more frequent" words were taken from the 2.000 most frequent and the "less frequent" words from those between 8.000 and 10.000 in frequency. Additional criteria of selection were that the words were judged to be reasonably useful in spoken language and picturable. Verbs and adjectives have only been used in naming tests in very few cases. Pictures and objects naturally give associations primarily to nouns, and therefore some kind of "leading questions" are needed to obtain an answer from a different word class. The questions used in the administration of this test were, for nouns "Vad är det?" (=What is that?), for verbs "Vad gör han/hon/den/de?" (=What does/do he/she/it/they do?) and for adjectives "Hurdan är han/hon/den/de?" (=What is he/she/it /are they like?). The test was given to five aphasics and the answers were recorded on audiotape.

4.2. Procedure

Each replacement was scored and it was found that the same patients sometimes used several different replacements for the same target type, e.g. table could at one trial be replaced by chair - and at another trial by sofa. Each replacement - target word pair was then classified according to the features presented above.

4.3. Reliability

The problem of deciding what should be counted as an instance of replacement was dealt with by having two independent judges pick out probable replacements, on the basis of criteria like hesitation, pausing and semantic mismatch (in the conversation) and direct question (in the naming test). (Cf Ahlsén 1985, for a more general discussion of behaviour exhibited in connection with word finding problems). All cases where there was a difference of judgement were then discussed. An analogous procedure was applied to the problem of deciding what should be counted as a target word for a supposed replacement. This procedure was also used to deal with the problem of deciding what relations between a target word and a replacement are possible.

4.4. Analysis

1. Frequency

Word finding problems for all words were counted and a comparison was made between more and less frequent words, taking word class membership into account.

2. Multidimensionality

In tables 1, 2 and 4 we can see that there is frequent cooccurrence of different features classifying the relationship between replacement word and target word and intra- and extralinguistic context respectively.

3. Context

The two types of interactive context used - conversation and naming test - were systematically compared to number and type of word substitutions.

4. Semantic classification

The semantic aspects of the relation between replacement word and target word were investigated more in detail. An analysis was made of the type and frequency of the features that occur (table 5).

5. Aphasia, context and classification

Finally, an attempt was made to correlate results of type 1 - 4 with each other and with the aphasiological status of the patients.

5. Results and discussion

5.1. Word frequency

The total number of word finding problems was 30 for the more frequent words and 36 for the less frequent words. There is evidently no big difference between these groups, neither when all word classes are counted together nor when verbs or adjectives are considered separately. Among the more frequent nouns 14 cases of word finding problems were found, while 23 cases were found among the less frequent nouns. Verbs, however, show the opposite tendency. Word frequency, at least as far as it is based on a corpus of newspaper articles, like Allén (1972), can, therefore, not be seen as a main explanatory factor behind word finding difficulties. This, however, does not mean that word frequency could not potentially be interesting. If one could, for example, during a period, record and analyze the totality of an individual's linguistic output or record the language used in a certain type of activity, frequency counts based on the resulting transcriptions would

provide an indicator of the actual state of the individual or activity. This type of indicator, if repeated at regular time intervals, could provide data for an explanatory account of what factors uphold or change such states.

5.2. The multidimensionality of word substitution

one of the most striking features of spoken interaction is its multidimensionality. Any speaker simultaneously communicates by verbal and nonverbal means of expression and his/her verbal utterances simultaneously utilise prosody, lexicon and grammar. The content of the utterances simultaneously expresses the speaker's emotions and beliefs, attempts to evoke reactions from the listener and attempts to constitute a social relationship between speaker and listener. Further, any speaker is usually also simultaneously a listener to his/her own words and most listeners are also speakers, giving different kinds of feedback to the speaker who is the turnholder. If the process of verbalization is to fit into this picture, it must be multidimensionally sensitive. One of the questions of our study has therefore been whether word substitutions can be related to several simultaneous possibly influencing dimensions. Another question has been which these dimensions are?

In a majority of cases word substitution seems to be related to several dimensions simultaneously. Only in 44/186 (24%) of the cases has a word substitution been classified as relating to one dimension only. This means that 76% of all word substitutions are multidimensional and probably therefore also multicausal in origin. It, thus, seems we have support for the hypothesis that the nature of word substitutions cannot be understood without taking several interacting causal variables into account.

Table I gives a presentation of some of the multidimensionality involved. The table divides the classificatory features into three types (1. semantic, 2. phonetic and quantitative constituent correspondence, abbreviated quant const corr, i.e. phonetic similarity between replacement word and target word and whether the replacement is a multiword replacement or not, and 3. contextual) and shows how often each of these types has been used as the only type of classification and how often the three types have been used together pairwise or in a triple.

Table 1. Word substitutions: Correlation of three types of classificatory features: semantic, phonetic-quant const corr and contextual

semantic	98
phonetic and quant const corr	2
contextual	2
semantic & phonetic and quant const corr	65
semantic & contextual	10

phonetic and quant const corr & contextual	1
semantic, phonetic and quant const corr & contextual	8
	186

Multidimensionality was common (84 cases). In addition, several of the 98 semantic classifications were in themselves multidimensional (see below).

In evaluating the results presented so far, at least two things should be noted. All the features taken into account by our classification do not have equal force, e.g. the relation between a single word and multiword description (usually a paraphrase) can really only be explanatorily relevant through the semantic relation between the two. Secondly, the multidimensionality we have noted is not exhaustive, since, as we have seen in section 3, there are several important constraining relations we have not taken account of in our classification schema.

5.3. Context and word substitution

Word substitutions were more common in tests than in conversations. only 41/186 or 22% of all substitutions occurred in conversations, while 145/186 or 78% occurred in tests. The rounded total amount of analyzed words in the conversation was 4.400, while in the tests it was about 500. This means that 78% of the substitutions occurred in 11% ($\hat{c} 500/4.400$) of the total speech sample of test and conversation. It, thus, seems extremely likely that the type of spoken interaction the patient is engaged in strongly influences the occurrence of word substitutions (cf also Ahlsen 1985 for more evidence and support of this conclusion). In table 2 below, we now, for each of the 5 patients, present a comparison of the types of substitutions found in conversation and naming test. Observe that the numbers in the table refer to classificatory features and not to number of word substitutions.

Table 2. Classification of the relation between replacement word and target word and between replacement word and context of replacement word

(c = conversation, t = test)

(F = fluent aphasia, NF = non-fluent aphasia)

Patient	I(F)	2(NF)	3(F)	4(NF)	5(F)	total							
Type of interactive context	c t		c t		c t		c t		total		c t c+t		

Replacement:													
SEMANTIC													
same semantic													
category	11	11	0	13	16	31	0	25	3	0	30	80	110
super-sub ordinate													
category	1	2	0	2	4	12	0	3	0	0	5	19	24
attribute	1	1	0	1	0	18	0	4	0	0	1	24	25
part-whole	1	1	0	0	2	1	0	1	3	0	6	3	9
spatial relation	3	4	0	4	1	11	0	4	0	0	3	23	26
functional causal	4	12	0	1	3	27	0	10	0	0	7	50	57
subtotal											52	199	251

MULTIWORD	2	2	0	1	7	30	0	4	0	0	9	37	46
PHONETIC SIMILARITY	4	3	0	3	14	5	0	1	0	0	18	12	30
subtotal											27	49	76

phonological influence from verbal context	0	4	0	0	9	3	0	1	0	0	9	8	17
"nonlinguistic" influence on	0	1	0	0	0	0	4	0	0	0	0	5	5
Subtotal											9	13	22

Total	27	41	0	25	54	138	0	58	6	0	88	261	349

Table 2 will be further discussed below. Let us therefore comment only on what it shows with regard to the context of the replacement word. There were 17 clear cases of phonological similarity between replacement word and linguistic context. It also shows that we have been able to find 5 clear cases of probable

non-linguistic influence on choice of replacement word. Most probably these two numbers are too low, especially the number representing nonlinguistic context. As our focus, in this study, has not been on contextual influence we have only included what seemed to us very clear cases of extra-linguistic influence, as when patient 4, who have just come from the physiotherapist, is shown a picture of a cucumber (in Swedish gurka) and says physiotherapist (in Swedish sjukgymnast), or when patient 3 is telling the therapist about her work and replaces avhandlingar (theses) by avdelningar (wards), probably being influenced both by the phonetic similarity between target word and replacement word and by the extralinguistic situation of living in a hospital ward.

5.4. Context, word class, inflection and word finding strategies

Table 3 below presents the relation between target word and replacement word with regard to word class.

Table 3. The relation between target word and replacement with regard to part of speech (REPL. = replacement)

		CONVERSATION		TEST		TOTAL	
		TARGET	REPL.	TARGET	REPL.	TARGET	REPL.
TARGET REPLACEMENT							
N	N	13	10(77%)	81	62(77%)	94	72(77%)
N	N or NP	13	13(100%)	81	64(79%)	94	77(82%)
N	ATTRIBUTE						
	or ADJECTIVE	13	0	81	3(4%)	94	3(3%)
N	V or VP	13	0	81	5(6%)	94	5(5%)
N	S	13	0	81	9(11%)	94	9(9%)
V	V	16	12(75%)	53	22(42%)	69	34(49%)
V	V or VP	16	14(86%)	53	33(62%)	69	47(68%)
V	N OR NP	16	0	53	13(25%)	69	13(19%)
V	S	16	1(6%)	53	6(11%)	69	7(10%)
V	ADV	16	1(6%)	53	1(2%)	69	2(3%)
VP	VP	4	4(100%)	1	1(100%)	5	5(100%)
ADJ	ADJ	1	1(100%)	9	3(33%)	10	4(40%)
ADJ	V	1	0	9	3(33%)	10	3(30%)
ADJ	N	1	0	9	2(22%)	10	2(20%)
ADJ	S	1	0	9	1(11%)	10	1(10%)
ADV	ADV	0	0	1*	1(100%)	1	1(100%)
PRON	PRON	1	1(100%)	0	0	1	1(100%)
NUME-	NUME						
RAL	RAL	4	4(100%)	0	0	4	4(100%)
PREP N	ADV	2	1(50%)	0	0	2	1(50%)
PREP N	S	2	1(50%)	0	0	2	1(50%)

(Percentages refer to proportion of replacements relative to targets.)

As we can see, word class is preserved significantly above chance level. If we compare nouns, verbs and adjectives we see that the preservation of word class is better for nouns (82%, if NPs are included) than for verbs (68%, if VPs are included) and adjectives (40%). This rather strongly points to word class as being a rather robust feature of verbalization.

As concerns the preservation of word class in the substitutions from the two activities, word class is far better preserved in conversation than in the test. Most of the word classes are preserved to 100% in conversation. Exceptions to this are verbs which are preserved to 86% and preposition+noun constructions which are preserved to 50%. In the naming test, nouns were preserved to 79%, verbs to 62% and adjectives to 33%.

The fact that nouns are generally better preserved than verbs and adjectives can be related to the finding that verbs and adjectives are more often replaced by substitutions having a syntagmatic relation to the target word. Note that there is a verbal context also in the naming test, created by the elicitation question from the therapist and also possibly internally by the patient from the elicitation picture. The patients sometimes seem to want to verbalize whole sentences instead of single target words, and this could possibly be done also silently, giving rise to syntagmatic substitutions. When a word is replaced by a sentence ("S"), this implies that a paraphrase is used. We see this occurring in 16 cases (11%) of the noun, verb and adjective substitutions in the test, but much less frequently in conversation. The elicitation pictures are also necessarily static, even if they illustrate an action, and when an adjective is requested there is usually someone or something having that property in the picture.

In most cases where word class is preserved, inflection is also preserved. It appears that inflection, as well as word class, is a "stable" feature in the verbalization process.

5.5. Semantic aspects of the relationship between target word and 'F(replacement word

Close to 98 % (181/186) of all word substitutions were found to involve a semantic relation between replacement and target word. The nature of these relations can be seen in table 4.

Table 4. Frequency rank of all classificatory features, i.e. features used in tables I and 2.
(Abbreviations: w word, repl replacement)

1. Functional causal relation	57
2. Multiword description	46
3. Concrete object function similarity	31
4. Phonetic similarity repl w - target W	30
5. Concrete object similarity	28
6. Spatial relation	26
7. Attribute	25
8. Sub- /superordinate category	24
9. Abstract object similarity	24
10. Abstract process function similarity	21
11. Concrete process function similarity	17
12. Phonetic similarity repl w - communicative context	17
13. Abstract object function similarity	12
14. Part - whole relation	9
15. Relation repl w, context surrounding communicative behaviour	5
16. Concrete property similarity	3
17. Abstract property similarity	1
	376

Semantic similarity features (f=feature):

Semantic f	Process similarity f	38
Similarity f	Property similarity f	4
Concrete similarity f	Function similarity f	81
Abstract similarity f		
Object similarity f		95

We see that of the 278 semantic features used 137 or 49% were similarity features. If we put this together with the fact (see table 2) that 110/186 (= 59 %) word substitutions were classified as having a relationship of the type same semantic category, we see that semantic similarity, in a fairly specific sense, is the most important constraint on word substitution. We can further see that concrete similarity is more prevalent than abstract similarity (58 % vs 42 %). Similarity concerning objects (69%) is more common than similarity concerning processes (28%) or properties (3%). Functional aspects were more important than any other aspects for judging similarity between objects and similarity between processes. The similarity features, when abstract similarity is included, very often correspond with word class similarity. They do not entirely cover each other, but clearly the word classes encode many of the kinds of semantic similarity used in this study.

The following "combinability scale" for the semantic features can also be derived from the data. (> means more combinable than, percentages show frequency of combination with another feature)

spatial relation (100%) > part-whole (78%)> similarity (61%) > functional causal (60%)> sub/superordinate category (29%)

5.6. Aphasia, activity, abstraction and speech production

With regard to the semantic features, it is very difficult to see any consistent differences between the different aphasia types. The only consistent differences lie in the amount of word substitutions. The non-fluent aphasics contribute only about 25% of all substitutions.

Hierarchical semantic relations as well as semantic field organization seem to be preserved in aphasia and activated in word substitutions. Further, since abstract similarity relations as well as a strong tendency to use words of a higher level of abstraction than the target word are found, it can be argued that "loss of abstraction" or loss of an "abstract attitude" do not automatically occur in aphasia. A more adequate terminology for characterizing aphasic word substitutions and aphasic word finding problems in general is probably to call them a "disturbance of the ability to decontextualize" (cf Allwood & Ahlsen 1984). This can also be a partial interpretation of Goldstein's (1948) term "loss of abstract attitude", since his explanations are quite vague.

Support for this view is found in the facts that:

- a) substitutions occur more often in naming test (78%) than in conversation (22%)
- b) aphasics, although they are aware of the requirements of the naming test to give single-word labels quite often seem to try to create a verbal context for the target word, thus producing sentences or words that are syntagmatically related to the target word
- c) influence from the verbal context and nonverbal context is sometimes noted.

One can also attempt to relate the findings about word substitutions to theories of speech planning. Some of the findings seem to point in a "Wundtian" direction, cf Blumenthal 1970, i.e. they point to the existence of an overall plan or structure which is specified in verbalization. Abstract semantic categories (often corresponding to syntactic and morphological categories) are preserved in word

substitutions. A possible hypothesis to explain this phenomenon is therefore that only the last steps of specification go wrong, while the overall semantic structure is preserved. This view is strengthened by the preservation of word class and inflection. The "opposing" theory of Paul, (cf. Blumenthal 1970) claims that the utterance of one word, together with the situational context, give associations which lead to the production of other words, leading to new associations, new words, and so on. Findings in favour of this theory are: (i) syntagmatic word substitutions and (ii) influence from the preceding or simultaneous communicative behaviour as well as from the communicative context. Both of the theories seem to be compatible with our data on word substitutions. This supports the view that an attempt to explain word substitutions (as well as other data on speech production, cf. Linell 1983) try to combine the two theories.

Footnotes

1) We would like to thank our colleagues at the Department of Linguistics, University of Göteborg and participants of the Ninth Scandinavian Conference of Linguistics for valuable comments, and HSR for supporting the project "Aphasia and Spoken Interaction".

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