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Who's Doing What to Whom
–Testing the Competition Model on Swedish

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Introduction

Within the psycholinguistic model of language processing known as the Competition Model (Bates & MacWhinney 1981, 1982, 1989 inter al.; henceforth CM) several cross-linguistic studies have been performed in order to assess what elements speakers of a given language rely on most to determine grammatical functions. Statistical methods of analysis of variance are used to determine these so called cue weights. The model has been applied to first and second language acquisition studies as well as to studies of aphasia. The aims of this paper are twofold. First it aims to investigate possible subject coalitions in the Swedish of adult native speakers using the tools provided by the model in its present state. It will be shown that word order cues support the strength of the V2 phenomenon and that there is powerful interaction with semantic cues. Furthermore, subgroups of speakers will be seen to rely on different processing strategies. Secondly, it means to discuss the model itself in relation to the parametric framework.

The first section will introduce the model with its key concepts. In the following sections a description of the experimental design and the results of the study will be presented and discussed.

The Competition Model

The Competition Model has been developed as a functionalist connectionist *performance grammar* dealing specifically with variation in actual language use. Communicative functions are assumed to determine forms and the model assumes only two levels – a functional and a formal level without the intermediary of any syntactic deep or surface structure. Instead, the lexicon is considered as the organiser of semantic relationships or roles in that predicates 'open up' slots and hence connections between lexical items (MacWhinney 1987). Syntax is seen as consisting in recurring connections between units of function and units of form.

The model assumes *direct multiple mappings* between these levels and the sources of information are: word order, morphology, the lexicon and prosodic patterns. Mappings take place on a many-to-many basis, since languages tend to show an overlapping of functions as well as of forms, thus forming *coalitions*. Mapping is direct since information from several sources is processed dynamically and simultaneously contributing to on-line comprehension or production.

The form-function coalitions form *prototype categories* (Rosch 1977) with fuzzy boundaries and best-fit membership. Many studies have dealt with prototypical sentence subjects. The link between form and function is assigned a weight, referred to as *cue strength*. Form-function coalitions sometimes break down if conflicting functions are assigned the same form or vice versa. In this case *competition* occurs between cues and the best-fitting element will be chosen to assign the linguistic role. In English the first noun in a sentence will normally indicate the subject even if it is an inanimate noun: *the ball hit the boy*. The word order (WO) cue is stronger than the lexical animacy (Anm) cue and assigns the role. In other languages Anm would dominate WO and *the boy* would be chosen as subject. Cue strength, then, is a subjective, psychological property and a function both of frequency and of an objective property of the link known as *cue validity*. This is said both to represent the number of times a cue or a link is present and indicate the correct assignment of function (McDonald 1986). Cue validity is explained in terms of *cue availability*, i.e. the percentage of times a cue is present in all examples, and of *cue reliability* or the percentage of times a cue assigns the correct function given that it is present (McDonald & Heilenman 1991). Cue validity is numerically said to be the product of cue availability and cue reliability.[1] However, McDonald 1987 has suggested that a distinction has to be made between *overall validity*, i.e. the cue validity of all sentences in a language, and *conflict validity*, the validity of cue strengths in competition to determine the final interpretation. Cues indicating correct assignment when faced with competition are said to have high conflict validity. There is some evidence to suggest that children and adults depend on different kinds of validity in their language processing (e.g. Kail & Charvillat 1988).

Cue strength states the degree of association between form and function in a *probabilistic* manner. There are no determinate rules, contrary to what

[1] Readers interested in the exact terms for describing this are referred to McDonald 1984 (quoted in MacWhinney et al. 1985:184).

is assumed in the generative tradition, but rather stochastic tendencies of functional assignments. What might seem like fully determinate mappings are patterns whose strength begins to approach unity. This has been referred to as *conventionalisation* (Bates & MacWhinney 1981, 1982). Learning is assumed to be a result of input processing, not of rules as such. The learner has to discover mapping relations and what weights are attached to what cues, i.e. set the cues and decide on the cue validities in accordance with feedback. Items activated and winning in competition become stronger whereas cues leading to misinterpretation will gradually be weakened. The CM literature on acquisition is extensive and will not be dealt with further here. For a survey, see Gullberg 1992.

However, cue validity alone cannot account for all the variability in language processing. Some cues might be strong but also heavier to process. *Cue cost* can be divided into perceivability and assignability. *Perceivability* concerns the perceptual salience or detectability of a cue. If a cue is not detected in performance, then its computed cue validity is of no use. *Assignability* refers to the ease with which a cue can be assigned to a certain role. A cue which can be used as soon as it is perceived, i.e. which is local, is maximally high in assignability, like many case cues. A *local cue,* then, is a cue that can be interpreted within a single lexical word without consideration of other words in the clause. A *global* or *topological cue* is coded across words, spanning two or more potentially discontinuous items across a sentence and is thus low in assignability. It is emphasised that this is not a dichotomous distinction but a *continuum* along which languages code their cues. Moreover, MacWhinney 1987 argues that perceivability and assignability are properties not only of the input but also of the individual, since individuals have different physical capacities for perceiving or noticing.

Experimental design

Introduction

The Competition Model traditionally deals with tests of sentence comprehension in order to determine what cues are relevant in a given language, and their respective weights. There are two reasons for performing this test on Swedish. One is the variable word order and particularly the V2 phenomenon, which says that almost anything can be found in the first position in the sentence, the fundament (Diderichsen 1946), provided that the verb appears next, i.e. that inversion of the subject and the verb takes

place. The variability in the fundament means that the canonical, unmarked word order of Swedish, SVO, is only found in about 60% of the cases, whereas 40% of all sentences have the structure XVS (Jörgensen 1976), X usually being object or Adv or a subordinate clause. SVO, OVS and VSO are all highly normal word orders, but SOV, OSV and VOS would be possible mainly in specific stylistic domains such as poetry. Consequently, semantic cues such as animacy are expected to determine subject in Swedish. It is further possible that semantic subcategorisation of the verb, i.e. semantic role assignment, can be related to this. Secondly, Swedish resembles English in that it has minimal inflectional verb morphology and no grammatical Case marking. However, in spite of the rigid word order in English, speakers choose the second noun as subject in specific contexts. The present study therefore means to investigate how WO, Anm and semantic role manipulation affect the assignment of subject role to nouns, and furthermore to compare Swedish strategies to those in English.

Cue validity in Swedish

A small and informal study of validities based on frequency for the cues involved in Swedish has been carried out. The calculations draw on a corpus of totally 605 sentences containing 178 transitive sentences. The corpus is based on equally sized excerpts from three different kinds of newspaper prose (political page, sports page, consumer's page), and two different kinds of fictional prose (a children's book and a novel). Cue validities in percent based on frequency were as follows:

Table 1. Cue validities in % for Swedish.

Anm validities		WO validities		Agency validities	
AA	8%	NV	71%	+A	51%
AI	61%	VN	28%	-A	49%
IA	3%[2]				

These figures, although tentative, will serve as comparison to the results of the test sentences.

[2] The remaining 28% are represented by II in the corpus, i.e. cases of two inanimate Ns, one of which is usually an existential formal subject.

Experimental set-up

Stimuli. Measuring psychological weights given to particular form-function links or the validity of a particular cue entails manipulation of cues and arranging of stimulus sentences where competition occurs between forms and functions so that, when a speaker is asked to pick the subject or actor, he will face conflicting cues. This fact and the random construction of sentences entails semigrammatical or semantically anomalous sentences.

From a fixed vocabulary pool, 50 simple transitive sentences were randomly constructed by combining the factors WO, animacy (Anm) and subcategorisation for outer theta role as Agent in the V and their respective levels. Cues and levels were:

word order: NVN, NNV, VNN
animacy: both Ns animate (AA), only first N animate (AI), only second N animate (IA)
agency: V subcategorises for outer theta-role Agent (+A), V subcategorises for outer theta-role other than Agent (-A)

The sentences thus consist of a transitive V in present tense, third person singular and two definite nouns.

Subjects. 20 subjects (10 males and 10 females) participated in the test. All were in their twenties and had a university background.

Test. The subjects were asked to read the sentences and identify 'who was doing what'. Questions of clarification were answered to ensure that the task was correctly understood. The subjects were allowed approximately 10 minutes to process the 50 sentences.

Analysis. The N1 scores or choice of N1 as subject were counted and run through an analysis of variance (ANOVA) test in StatView512+™ for Macintosh. The dependent variable was choice of N1 as subject (for ANOVA procedures, see e.g. Winer 1962, Woods, Fletcher & Hughes 1986).

Results

The ANOVA analysis shows that for choice of N1 as subject in the test sentences, the main effects for all factors were significant at a .05 level (p-values < .0001, .0001 and .0121). However, Anm was a stronger indicator than WO which in turn was stronger than Agency. The interaction

effects between WO and Anm were equally significant ($p < .0001$) whereas the other interactions did not show a significant outcome.

WO cue effects: the optimal WO for N1 choice is VNN (mean 90%)
the least propitious WO for N1 choice is NNV (mean 76%) sign. at 10 % level at $p < .117$

Anm cue effects: the optimal Anm for N1 choice is AI (mean 96%)
the least propitious Anm for N1 choice is IA (mean 62%)* at $p < .0001$

Agency cue effects: the optimal Agency for N1 choice is -A (mean 84%)
the least propitious Agency for N1 choice is +A (mean 81%).

Interaction effects: the optimal WO+Anm±A for N1 choice is VNN, AI, -A
the least propitious WO+Anm±A for N1 choice is NNV, IA, +A

The difference of means for ± A is not significant (84 vs. 81). Moreover, the highest single N1 score within Agency is found in the +A category in conjunction with AI Anm (97%) whereas the lowest score is found in the -A category IA (59%). In comparison with the cue validities for Swedish based on frequency, the results for Agency conditions match well, as do the Anm proportions indicating a preference for AI. As for WO, it is obvious that mere frequency is insufficient to describe its cue validity in Swedish.

Discussion

The overall results support the assumption that Anm is a stronger cue to N1 choice than word order in Swedish. There may be several reasons for this. Apart from variability in word order, Anm is a local cue, high in assignability and therefore less costly to process than the global word order cue. Furthermore, it is natural to assume that the strong influence of Anm in these results is due to the lack of prosodic cues and especially contrastive stress, which would normally disambiguate NVN constructions as being SVO or OVS[3] . The results further indicate that there is a strong tendency to assign the subject role to an animate noun, irrespective of word order, as can be seen in Figure 1. AI is a better N1 indication than AA. However, the difference between the two is only significant in the NNV WO (AI = 92,78% vs. AA = 61,68%) where high scores for N2 as subject can be found. N1 scores are lowest in NNV IA constellations. Interestingly enough, even the NNV WO gives high N1 scores in the AI Anm condition. Encyclopaedic knowledge of the world and pragmatics therefore act forcefully in all word orders.

[3] It may be noted in this context that studies which have included constrastive stress have not mentioned the methodological problems involved in manipulating this cue alone in the stimulus. There is great difficulty in avoiding interpretation of the entire sentence when recording it, which is equivalent to performing the subjects' task for them beforehand.

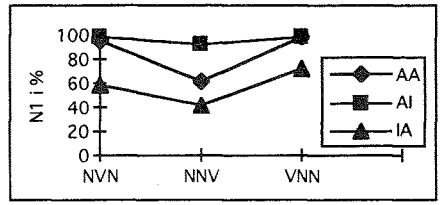

Figure 1. N1 scores in % across WO and Anm conditions

Word order, however, is also a strong cue. The word order results rather unexpectedly indicate that VNN is the strongest WO level for choice of N1 as opposed to the expected canonical NVN. It seems reasonable to assume that this is related to the V2 phenomenon. Due to fundament variability, it is more difficult to ascertain the function of whatever precedes the verb, whereas a noun appearing immediately after the verb almost invariably is classified as a subject. Interestingly enough, the difference of means between NVN (80%) and NNV, the least propitious word order (76%), is not significant. The significant difference lies between NVN, NNV and VNN although the significance is statistically rather weak. SVO then is still a fairly reliable word order, but there is always the risk of conflict if the Anm conditions are not appropriate. In the postverbal position, on the other hand, less notice is taken of conflicting Anm cues, and word order prevails.

The relatively high N1 scores in NNV are slightly surprising in the light of V2, since NNV is a highly marked word order and furthermore directly contradicts the V2 condition. Moreover, NNV might result in high N2 scores if it is seen as a relative clause without a relative marker as such constructions are possible in Swedish: *Pojken hunden bet heter Pelle.* 'The boy the dog bit is called P.' NNV sentences might then be interpreted as incomplete sentences with an embedded relative clause in which case N2 would be the normal choice for subject assignment. So far very little work has been done within the CM on more complex sentences of this kind and little is known about whether such interpretations are made or are possible.

However, the NNV WO does result in fairly high N1 scores, especially if Anm conditions are favourable, indicating that the interaction between even unfamiliar word order cues and Anm is a very strong determining factor. Comparing this to the results for English reported in Bates & MacWhinney 1981:204, we can establish that no strong 'second noun strategy' can be detected in Swedish. The N2 strategy means that native speakers of English prefer OSV and VOS interpretations of NNV and VNN seeing them as dislocations. This is not the case in Swedish. N1 is clearly preferred as we have seen in VNN according to V2, but also in NNV constructions. A further comparison with German, another V2 language, indicates that the preference for N1 in postverbal positions is higher in Swedish than in German (Figure 2).

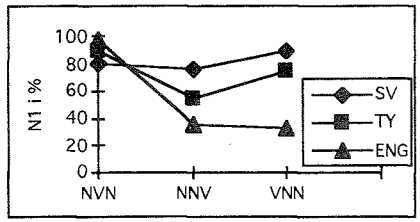

Figure 2. N1 scores in % across WO in Swedish (SV), English (ENG) and German (TY) (as reported in Bates & MacWhinney 1981:204).

The Agency results are not significant. Either they are simply less important as a cue in Swedish, or the experimental design has failed to capture their true role. It might be argued that due to the semigrammatical and certainly semantically anomalous character of a number of sentences, ordinary rules for theta-role assignment cannot be expected to function. This might be a reason to ignore theta role conditions in the test sentences.

The model makes predictions as to the efficiency of converging cues vs competing cues, assuming that two converging cues are more effective than one and further that converging cues are more effective than competing ones. The traditional way of testing this within the model has been to look at so called consistency scores. The consistency score is calculated by subtracting 50% from the N1 score, ignoring direction. Perfect consistency = 0.5. It is hypothesised then, that:

- converging WO+Anm should result in higher consistency
- competing WO+Anm should result in less consistency

Table 2. Converging vs. competing cues. N1 scores in % and consistency scores. > = higher than and more effectively processed. * = significant at a 5% level.

converging cues			competing cues		
WO+Anm	%	cons.	WO+Anm	%	cons.
AVI>AVA	98.7>96.2	0.49>0.48	AVI>IVA	98.7>59.3*	0.49>0.3
AIV>AAV	92.8>61.7*	0.46>0.3	AIV>IAV	92.8>41.7*	0.46>0.2
VAI>VAA	99.4>99	0.5>0.49	VAI>VIA	99.4>72.8*	0.5>0.36

As can be seen in Table 2, the prediction is borne out at least in part. The difference between AI and AA in the converging cues block is only significant at the 5% level in the NNV WO. In the competing cues block, on the other hand, the differences are all significant as the table shows. This means that in adult processing of Swedish, the interaction of *converging* cues only help determine the subject more effectively in unreliable word orders. Instead, the *conflict* validity of cues seems to be the more determining factor.

Summing up so far, the local Anm cue appears to be a stronger cue to subject assignment in Swedish than the topological or global WO cue. The WO cue is not only costlier to process due to this assignability property, but it is also less reliable in Swedish given the many variations possible. Interestingly enough, it is most reliable in postverbal constructions where only extremely unlikely Anm conditions will result in N2 choice. This indicates the psycholinguistic strength of the V2 phenomenon in Swedish. Moreover, two converging cues are not necessarily better than one, but converging cues are more effective than competing ones since the former give a significantly higher N1 score than the latter. Anm has higher conflict validity in Swedish than word order.

Subgroup strategies

A *post hoc* analysis of the results shows that the subjects appear to rely on two radically different processing strategies. Eight subjects have 5 or less instances of N2 choice or Anm sensitivity across WO and Agency. They form Subgroup 1 (S1) which essentially follows a N1 strategy irrespective of other factors involved. Subgroup 2 (S2) on the other hand combines WO cues with Anm cues. In S2 VNN is the preferred word order and AI by far the most propitious Anm cue. Whereas S1 chose N1 almost as often in the IA constellation as in the AI, S2 only chose N1 40% of the times in IA. Since S1 constitutes as much as 40% of the subjects, these results become particularly interesting.

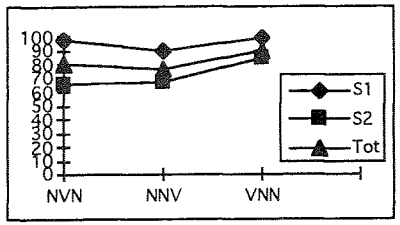

Figure 3. N1 scores in percent for WO across other factors for all groups.

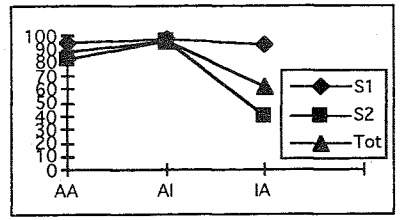

Figure 4. N1 scores in percent for Anm across other factors for all groups.

In Figures 3-4, variance within the subgroup indicates sensitivity to factors whereas lack of variance shows indifference. It might be argued that participants in S1 were just uninterested in the task as such and ticked off N1 mechanically. However, most of them have reacted to at least one IA sentence in NNV, marking N2 as subject, which indicates that, under unreliable word order conditions and highly deviant Anm conditions, the conflict validity of Anm cues prevails and the animate noun is chosen as subject. In one sense their N1 scores resemble those of native speakers of English since word order clearly is dominant in this group. However, the word order cue is set to a N1 strategy in all cases, indicating an even stronger word order preference than in English. Hence native speakers of Swedish can use dramatically different language processing strategies. A similar phenomenon has been reported for English by Harrington 1987, who found that a subgroup of native speakers of English were more sensitive to Anm cues than the majority which mainly relied on word order. Overall results therefore have to be handled with caution, as there might be important subgroup differences.

The Competition Model revisited

The descriptive power of the model resides in its dynamic approach to actual language use, seeing language as statistical tendencies, and grammaticality (and acceptability, incidentally) as a matter of degree rather than absolute rules. However, there is an obvious risk that the statistical results be allowed to dominate the analyses and be regarded as results *per se*. Caution is recommended in interpreting figures. This being said, the method can and does reveal connections not always visible to the naked eye.

It is emphasised that it is a descriptive model and no claims are made as to psychological or anatomical reality. However, for the CM to develop, a

number of problems will have to be addressed. The issue of ungrammatical stimuli has aroused much debate. The model assumes that un- or semigrammatical sentences are processed in the same way as grammatical ones. It is argued that subjects respond in a consistent and language-specific manner even to ungrammatical sentences (MacWhinney et al. 1985). Gass 1987 further claims that there is no reason to assume that listeners first decide whether something is grammatical or not before deciding on grammatical relations in a sentence. Moreover, if language deviating from the standard were processed differently, how would humans cope with rudimentary learner language, pidgins, child language or poetry?

A greater problem is the fact that the model does not admit syntax as a level, whereas it defines its cues in terms of syntactic features such as linear order or Case. Although there are approaches such as LFG which allow grammatical information to be stored in the lexical entries, the model would benefit from a more explicit position in this respect, defining the role of the information levels, especially given that a number of the cues and grammatical role assignments involved are far from trivial in terms of definition (cf. Croft 1990 for a discussion of the subject). Cues and cue validity are never really defined, but rather postulated and enumerated. This must be seen as a methodological flaw. Furthermore, in relation to language acquisition, there are a number of questions to be raised concerning the role of input, the role of 'noticing', etc. (cf. Larsen-Freeman & Long 1991). These issues will have to be dealt with in the future.

Furthermore, the model claims to be based on general cognitive strategies, although strategies such as context-dependence or 'probable event strategies' are usually ignored within the framework. However, the model potentially allows for incorporation of a number of possibilities in this respect. More complex sentences will have to be tested, such as subordinate clauses; prosodic and context- and/or discourse based features will have to be included in a full analysis of language processing.

Despite the problems mentioned, the CM is still an interesting alternative to other current frameworks for language processing and/or acquisition. Recently, the notions of *optimality, best-fit,* and *competition* have been introduced into the parametric framework (e.g. Grimshaw 1993). Within the minimalist program of Principle and Parameters, *optimality* is said to act when a construction violates the least number of constraints, i.e. when it

is the best fit ceteris paribus[4]. The similarities to the CM are obvious, as is the need to allow for variation in any linguistic description of actual language use and to introduce a grey zone where rules sometimes apply and sometimes do not. Ultimately, cue weights and parameters can be said to be two different sides of the same coin. The difference between rules and tendencies is quantitative rather than qualitative. So far, nativists have had a more static view of language, concentrating on generation of sentences rather than parsing or understanding. This might be about to change. In the meantime, the Competition Model continues to hold potential for those interested in developing this framework for performance and variation.

Conclusion

This paper has dealt with subject coalitions in Swedish within the framework of the Competition Model. Animacy and word order, in isolation and in interaction, play a significant role in assigning the grammatical role of subject. The interactions between these cues relate both to encyclopaedic knowledge of the world and to the V2 phenomenon. There is a preference for animate subjects and inanimate objects, particularly in conflict situations, whereas V2 is assumed to account for the strong preference of the postverbal position in the choice of N1 as subject. Furthermore, a subgroup of native speakers of Swedish were found to rely exclusively on word order with a strong preference for the first noun, totally ignoring semantic cues.

The paper has furthermore discussed the model itself. In relation to the parametric framework, the difference between cues/weights and parameters could be said to be quantitative rather than qualitative. With the introduction of *optimality* into Principles and Parameter Theory, the notion of competition, if not of statistical tendencies, seems to be recognised as a powerful descriptive concept. There are a number of possible perspectives for application of the model to Swedish: cue weights in child language, in bilinguals, integration of contextual and prosodic features, tests of more complex structures such as subordinate clauses.

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Verb-initial Sentences in the Development of Swedish

Gisela Håkansson

1. Introduction

The aim of this paper is to discuss Swedish word order, specifically verb initial clauses (V/1), from the perspective of language development. The paper is organized as follows. First, a short description of Swedish word order is made. The syntactic properties will be discussed from a synchronic as well as a diachronic perspective. Second, earlier studies of the acquisition of Swedish will be reviewed and results from new data on first and second language acquisition of Swedish will be presented. Third, the implication of the empirical findings will be discussed and related to issues of historical change.

2. Swedish syntax

Swedish belongs to a group of languages usually described as V/2 (verb-second) languages. In V/2 languages subject-verb inversion is obligatory in topicalized declarative main clauses, i.e. whenever an adverbial or object occurs in sentence initial position, the verb-second constraint prescribes that the inflected verb comes in the second position (*Han kom igår* 'He came yesterday', *Igår kom han* 'Yesterday came he'). Interrogatives typically exhibit inverted word order, and this is in fact what syntactically differentiates yes-/no-questions from statements. Furthermore, in many V/2 languages there is a differentiation between main clause and subordinate clause word order, which implies that the V/2 constraint only works in main clauses. For example, in Swedish subordinate clauses, subject-verb inversion is not admitted, but the subject always precedes the verb. Swedish word order rules are described in generative terms by assuming verb movement to the C position in main clauses. In subordinate clauses this movement is blocked by the complementizer (Platzack & Holmberg 1989).