

# Linear order information in agreement: subordinate vs. coordinate structures

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## Goal

At least three different kinds of representational structure could be relevant to the processing of coordinate NPs. Various syntactic proposals hold that coordinate structures have a nested hierarchical structure, as would be the case if the conjunction were a syntactic head (cf., Citko, 2005). But since some well-studied production phenomena (e.g., attraction effects, Bock and Miller, 1991) associated with subordinating structures have been argued to be sensitive to linear representations of surface form (Haskell and MacDonald, 2005), such representations could also be relevant to the processing of coordinates. Finally, some linguistic proposals ascribe set-like structure to coordinates (cf., Peterson, 2004).

This study sought evidence relevant to this issue. It was aimed in particular at describing the manner in which the number features of NP constituents within a complex NP affect the perceived acceptability of grammatical and ungrammatical agreement marking on a following main verb, especially as this may differ across subordinate and coordinate structures.

## Approach

Haskell and MacDonald (2005) have shown that attraction-like effects can be detected with a judgment task. We apply a similar approach here. In this context it is possible to see an agreement relation as a function that integrates selected information about a subject NP to determine the judged acceptability of a given verb form. Various claims about the representation of coordinates predict different patterns of performance with superficially similar subordinate and coordinate structures. Such structures can be made virtually identical with respect to linear order and thus should induce similar performance in so far as some linear representation plays a similar role in the handling of these two classes of construction. If, as Franck, et al., (2002) and others have argued, hierarchical representations play a predominant role in attraction effects, and coordinates are also hierarchically organized, attraction-like effects may arise with coordinates. Finally, linguistic proposals that treat coordinates as sets suggest that neither hierarchical nor linear relations will govern performance with our materials.

## Results

1) There was a reliable interaction between Structure Type (subordinate vs. coordinate), Second NP Plurality (Same/Different relative to first NP), and Grammaticality,  $F(1,31)=5.47, p < .05, F(2,1,47)=7.61, p < .01$  (see Figure 1). The interaction reflects two facts about the results. First, in the subordination cases the difference between the grammatical and ungrammatical cases was largest when the second NP carried the same plurality as the first, and smallest when the two NPs carried different plurality, regardless of whether the second NP was singular or plural. Second, in the coordination cases there was no such pattern; the grammaticality effect (the difference between grammatical and ungrammatical cases) was, on average, of essentially the same size regardless of whether the second NP carried the same or different plurality relative to the first NP. 2) Another aspect of the results is revealed by summarizing the coordinate data in terms of how many singular NPs appeared in each of the tested structures. Figure 2 plots changes in the difference between the judged acceptability of the grammatical and ungrammatical forms as this relates to the number of singular NPs in the structure. We calculated the mean 'grammaticality effect' for each of the four relevant data points in the coordinate cases. As the graph indicates, differences in the number of singular NPs in each structure type accounted for nearly all of the variance among these four means,  $r^2 > .99, t(2)=41.0, p < .001, t(2)=84.8, p < .001$ .

## Methods

**Materials:** The materials consisted of sentences with complex NP subjects. The design varied the number of each of two NPs internal to this structure, the syntactic character of the link between them (subordinate/coordinate), and the agreement marking on the verb, as illustrated in Table 1.

NP1	Linker	NP2	Verb	Completion
A book	about	a newspaper	is	
Some books	and	some newspapers	are	on the desk

Table 1

There were 16 variants of each of the 48 items. The experimental sentences were organized into 16 fully counterbalanced and blocked questionnaires. Two pseudorandom orderings were created for each questionnaire in such a way as to preserve block structure, but otherwise to make the linear position of an item unpredictable across each pair of questionnaires.

**Procedure:** Acceptability Judgment Task. Participants rated the sentences by way of a scannable line-drawing protocol (see Cowart, 1997).

**Participants:** 32 USM undergraduate students (replication: 32 undergraduates at USM and SMCC)

**Design:** The results were analyzed by way of a  $2 \times 2 \times 2 \times 2$  ANOVA with factors NP1 (singular/plural), Linker (subordinate/coordinate), NP2 (same/different plurality relative to NP1), Verb (grammatical/ungrammatical), all of which were within-subjects.

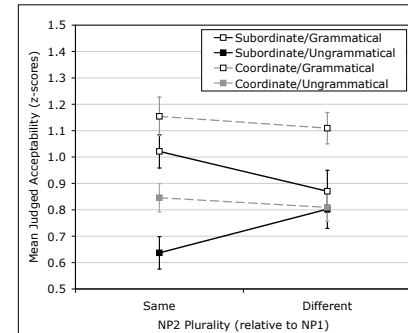


Figure 1: Acceptability -- subordinates vs. coordinates

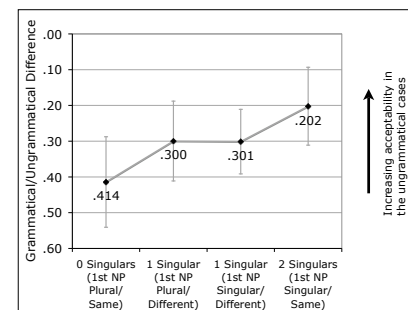


Figure 2: Grammaticality Effect -- coordinates

## Conclusions

Attraction effects are generally attributed to errors that can be characterized as misidentifying the appropriate agreement controller in a hierarchically structured subject NP. It has also been argued, however, that the linear proximity of the local noun to the following main verb also makes a contribution to these effects. Depending upon details, either analysis can predict that our coordinate materials should have behaved more like our subordinate materials. Since they did not, these results set some constraints on possible theories of either how attraction effects arise or how our English coordinate NPs are organized.

While the evidence displayed in Figure 1 presents some challenges for the view that coordinates are hierarchically organized, the evidence in Figure 2 aligns well with predictions derived the proposal that coordinate structures constitute a kind of set. Sets differ from trees in that the members are unordered and coequal while restrictive theories of phrase structure assign asymmetric roles to any two nodes descending from some higher node and frequently in natural language have implications for linear order as well.

Figure 2 displays two patterns that are suggestive of set-like behavior. First, the total number of singular NPs in the structure seems to cumulate such that increasing numbers of singulars are associated with a reduction in the perceived ungrammaticality of a singular verb. Second, in the two middle cases it is apparent that a singular NP contributes equally effectively to this effect regardless of whether it is adjacent to the verb or in the first NP position.

In sum, the evidence at hand suggests that the processes that analyze agreement relations when readers give judgments of acceptability are sensitive to hierarchical structure and/or linear order when dealing with subordinate structures, and in dealing with the internal syntax of conjuncts in coordinate structures, but insensitive to hierarchical structure or linear order in dealing with relations among conjuncts within coordinate structures. There are various analyses of these results. Further work is in progress.

## References

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