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Cue phrases in discourse: further evidence for the core:contributor distinction

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1 Introduction

Moser and Moore (in prep) carried out a corpus study of cue phrases in tutorial dialogue. Their annotation uses Relational Discourse Analysis, which distinguishes **core** elements (nuclei-like) from **contributors** (satellite-like). In their discussion of these results, Moser and Moore claim that clauses in the contributor:core order are harder to understand than clauses in core:contributor order, but do not attempt to explain why the “hard” order is ever used. Here, we recruit evidence from work by Stevenson and her collaborators, which substantiates the empirical claim, and we then suggest that by distinguishing information structure (given-new) from intentional structure (core-contributor), we can explain why hard orders are surprisingly frequent. Along the way (space permitting), we show how the core:contributor distinction can help dissolve an empirical puzzle concerning apparently causal interpretations of the full stop.

2 Corpus observations

Moser and Moore (in prep) gathered, annotated and analysed a corpus of tutorial dialogues, to help investigate the distribution of discourse cue phrases, such as *because*, *also*, *although* and *first*. They predicted that both the occurrence and placement of such cues were correlated with the functional relationship of intentional subordination between discourse units. For them, ‘intentional subordination occurs when one discourse unit, the **core**, manifests a communicative purpose and another discourse unit, a **contributor**, helps to realize that purpose. Cues signal a structural or semantic aspect of how a core and its contributors fit together to form the segment’

(p. 2). The idea that speaker intentions dictate the hierarchical structure of discourse, and that the defining feature of a segment is that there be a recognizable segment purpose, is due to Grosz and Sidner (1986). The idea that discourse is hierarchically structured by pairwise relations in which one relatum (the **nucleus**) is more central to the speaker’s purpose than the others (the **satellites**) is due to Mann and Thompson (1988). Moser and Moore (in prep) point out the correspondence between the relation of dominance among intentions in Grosz and Sidner and the nucleus-satellite distinction in RST. In addition, several other models of discourse exploit a similar device (for instance, those due to Hobbs 1985, Polanyi 1988, Redeker 1990). Thus, Moser and Moore’s annotation involved coding up all the core:contributor relations in the corpus, both within and between sentences. Note that here most of our examples are cases of the former.

Turning to the analysis, we find that, given a pair of elements, one containing a cue phrase, we can distinguish the linear (first, second) and functional (core, contributor) role of each element. Consider the two-clause examples here, where the recommendation of testing is taken to be the core:

- (1) a. *Since* Part2 is more likely to be damaged, you should test it first. [Contributor-1]
- b. Part2 is more likely to be damaged, *so* you should test it first. [Core-2]
- c. You should test Part2 first, *because* it is more likely to be damaged. [Contributor-2]
- d. *#So* you should test Part2 first, it is more likely to be damaged. [Core-1]

Functional order of relation	Linear placement of cue		
	First	Second	Both
Core:contributor	0	53	0
Contributor:core	38	57	5

Table 1: Distribution of cues with respect to both functional and linear location ($n = 153$). Reproduced from Moore and Moser.

In (1a) and (1b), the clauses occur in contributor:core order. In (1a), the cue occurs on the contributor; combining order and function, we can call this a **contributor-1** placement. In (1b), the cue occurs on the core, and so we have a **core-2** placement for the cue. In (1c) and (1d), the clauses occur in core:contributor order. In (1c), the cue occurs on the contributor, and thus we have **contributor-2** placement. In (1d), we have placed a cue on the core, attempting a **core-1** placement; however, this particular utterance is ill-formed.

Note in passing that in Relational Discourse Analysis what makes one element the core, rather than the contributor is a functional matter, not a semantic one. Operationally, the discourse analyst takes a segment and determines which part of it is the core by asking ‘what information the hearer is expected to believe or to understand as a result of the segment’; the contributing information is that which is provided by the speaker so that the hearer is more likely to believe or understand the core. Thus, there is no correlation between causes and cores or consequences and contributors; the match or mismatch will depend on the communicative intentions as determined in the specific context.

Returning to (1d), it is notable that one of Moser and Moore’s main findings was that cue phrases are *never* placed on a core which occurs first (core-1). It’s not just that *so* cannot occur as core-1; there is simply no cue that occurs there. When the core comes first, if a cue phrase is used at all, it is placed on the contributor (contributor-2). Table 1 summarises the distributions.

Note that it is true that (in this and other corpora) cue phrases can occur sentence-initially; for instance, *In order to close the program, press*

Order of relation	Number of relations with cues	
	with cues	overall
core:contributor	53	129
contributor:core	100	157
TOTAL	153	286

Table 2: Cued relations tended to be in contributor:core order. Reproduced from Moore and Moser.

F7. However, it is clear that some cues function at a level below the intentional structure defined by core:contributor relations. Arguably, this example falls into that category, since it appears to fail the deletion and replacement diagnostics for detecting intentional substructure (cf. Mann and Thompson 1988 on nuclearity). Although these cues and this level of structure are included in the full RDA analysis, they are not the subject of this paper. It is therefore possible that Moore and Moser’s finding generalises: there is a set of segments in which cue phrases occur sentence-initially, and a set of segments which can be analysed into a core and contributor(s), with the core first; but these two sets are disjoint.

They also note that cue phrases are in general substantially more likely to occur when the core *follows* the contributor: in these cases, the cue may be placed on either the contributor (contributor-1) or on the core (core-2). Table 2 summarises the relative frequencies of occurrence versus non-occurrence. One other point worth mentioning is that they found that particular cue phrases (such as *since*, *so*, *because* or *this means*) have preferred positions, and rarely stray from them. Thus, *since*, *so*, and *because* occur almost always in the positions they occupy in (1) above; and *this means* always occurs in core-2 position.

In their discussion of these results, Moser and Moore raise two questions; first:

The origin of order: What explains the relative order of core and contributor?

Their answer to this Origin question is that ‘In core:contributor order, the context of interpretation for the contributor includes the core. We

would expect that the core would help a hearer to understand the contributor by motivating its utterance. In contributor:core order, the context of interpretation for the contributor does not include the core. It may be more difficult to understand a relation in this order' (p. 42). It is the relative difficulty of the latter order that leads speakers to use cue phrases more frequently. It is thus marked in not one, but two senses. Conversely, when the core comes first, a cue indicating forthcoming support for it is superfluous, since whether it's supported or not does not affect its interpretation.

It might be accepted that core-1 cue phrases do not occur, but argued that this is just a corollary of simple syntactic constraints on cue phrases. We cannot use subordinating conjunctions here, or coordinating conjunctions; and conjunctives are out because they are anaphoric. Thus, ease of processing is immaterial: it's a matter of the resources available in the language. Against this, it is worth noting two points. First, there are cases in which syntactic and intentional subordination do not line up, which undermines the general line of argument. Secondly, of course, some would argue that the syntax reflects the functionality (and hence the psycholinguistic facts) rather than vice versa.

The second question, following from this, is:

The existence of marked order: If contributor-core order is harder to understand, why is it ever used?

To this Existence question, they have no answer. As a step towards answering it, in the next section, we consider whether there is any empirical support for their answer to the Origin question, and in particular, for the supposition that contributor:core order is relatively hard to understand.

3 Is contributor:core order hard?

Reading time and comprehension studies provide important sources of evidence regarding relative ease of linguistic processing. To address the contributor:core issue, we need to look at data that carries out the right comparisons;

in particular, we require experimental materials that manipulate core:contributor order (and thus the connective) while maintaining the materials. The alternation between *so* and *because* we saw earlier provides one kind of test:

- (1) b. Part2 is more likely to be damaged, *so* you should test it first. [Core-2]
- c. You should test Part2 first, *because* it is more likely to be damaged. [Contributor-2]

In (1b), we encounter a sentence in the (supposedly marked) contributor:core order; in (1c), we encounter the same material re-cast in core:contributor order. If the latter is "easier" to understand, we would predict that it would be read more quickly, and that people would be more likely to understand it correctly. The general question then is: are *because* sentences read faster and understood better than *so* sentences?

Stevenson and Urbanowicz (1995) carried out a series of reading time studies which bear directly on this question. They were investigating differing influences on the interpretation of pronouns and proper names in discourse, and comparing effects due to centering (related to order of mention) with those due to the thematic roles played by entities mentioned in the discourse, and those due to connectives. The thematic roles under consideration included: Goal, Source, Agent, Patient, Experiencer and Stimulus.¹ Their materials exemplify a range of manipulations, some of which can be seen in (2):

- (2) a. Malcolm won some money from Stuart *because* he was very good at poker.
- b. Malcolm won some money from Stuart *because* he was very bad at poker.
- c. Malcolm won some money from Stuart *so* he ended up feeling rich.
- d. Malcolm won some money from Stuart *so* he ended up feeling poor.

¹For instance, a sentence's Goal is the entity towards which something moves, and the Source is the entity from which it must move; an sentence's Experiencer is an entity having a given experience, and the Stimulus is the entity which gives rise to that experience.

Sentences like those in (2) place the Goal first (and the Source second) in the first clause; further materials use verbs (such as *lost to*) which place the Goal second (and the Source first). The (a) and (b) cases use *because*, and the (c) and (d) cases use *so*; the (a) and (c) cases involve pronominal reference to the Goal, and the (b) and (d) cases involve pronominal reference to the Source. Further materials make the subsequent references by using repeated names instead of pronouns (e.g., *Malcolm* instead of *he* in (2a)). With all these materials, subjects carried out a self-paced reading task. Each sentence was presented one clause at a time, and after the second clause had been read, a yes/no question was presented, the answer to which indicated how the pronoun had been assigned (in the pronoun condition, exemplified here). Time to read the second clause in milliseconds was recorded.

The materials were constructed this way because Stevenson's own hypothesis is that preferences due to centering constraints interact with those due to the thematic roles of the entities referred to. On this view, centering primarily influences *how* an entity introduced in one sentence will be referred to in the next (by pronoun, or by name, for instance); thematic roles influence *which* entities will be subsequently referred to (the Goal, or the Source, from the first sentence, for instance). We will return shortly to the specifics of Stevenson and Urbanowicz's predictions. For the moment, however, let us focus on one aspect of their results, which bears directly on our current concern.

Analysis of variance showed a significant main effect of connective on reading time: 'clauses were read more quickly in *because* than in *so* sentences' (p. 330): mean times were 1676ms versus 1926ms. There was a marginally significant main effect on comprehension accuracy: 'There were more correct responses when the questions were connected by *because* rather than *so*' (p. 331): mean accuracy was 91% correct versus 83%. The significant reading time effect was replicated when repeated names were used in place of pronouns: clauses were read faster in the *because* condition: mean times were 1555ms versus 1754ms.

Recall now that the *because* sentences present information in core:contributor order, and *so* present it in contributor:core order. Stevenson and Urbanowicz's results thus provide initial

support for the view that core:contributor order is easier to process, both in terms of speed and accuracy. Obviously, such support is compatible with other explanations, including, perhaps, those discussed in Noordman's talk at this workshop, involving iconic and non-iconic ordering of cause and consequence. To show that it is core:contributor order that determines ease of processing, we would have to go on to deal with other cue phrase pairs, and non-causal connections in particular.

4 A puzzle concerning full stops and causality

In this and previous studies (cf. Stevenson, Crawley and Kleinman 1994, which uses continuation rather than reading time tasks), Stevenson has argued that centering, thematic roles and connectives (or the lack of explicit connectives) all interact. In particular, centering tells us to expect a pronoun in subject position to specify the highest ranked **Cf** from the previous clause. On the other hand, thematic role information tells us to expect that the subject of the current clause is more likely to specify an entity associated with the consequences of the event introduced in the previous clause. For example, if the verb in the previous sentence introduced roles for Goal and Source, then the subject of the current sentence is most likely to be the Goal from the previous sentence. Finally, however, expectations relating to the connective can interfere with those arising from thematic role and centering. Stevenson, Crawley and Kleinman (1994:538) find, for instance, that people produce significantly more continuations referring to the Experiencer in completions of *so* fragments like (3a), and more continuations referring to Stimulus in *because* fragments like (3b).

- (3)
- a. Ken admired Geoff so he ...
(*he = Ken*)
 - b. Ken admired Geoff because he ...
(*he = Geoff*)
 - c. Ken admired Geoff and he ...
(*he = Ken*)
 - d. Ken admired Geoff. He ...
(*He = Geoff*)

Thus, *because* refocusses attention on causes, instead of consequences. In itself, this seems plausible. However, there is an interesting puzzle associated with Experiencer-Stimulus sentences. With Goal-Source or Agent-Patient sentences, there is no difference between the preferences which arise in continuations leading to two clauses connected by *and*, and those in continuations leading to two sentences connected by the full stop. But with Experiencer-Stimulus sentences, it seems that *and* patterns with *so*, and the general expectation of a focus on consequences. By contrast, the full stop patterns with *because*, and reverses the general preference. Stevenson, Crawley and Kleinman state: ‘It is likely that the use of a new sentence for the continuation . . . led to a focus on the cause of the described state of affairs’ (p. 535).

This certainly seems to describe the behaviour. However, the idea that full stop is a causal connective seems inconsistent with intuitively “iconic” behaviour in, for example, narrative construction, whereby we describe eventualities in the order in which they occurred. If I introduce a state (such as *The room was pitch dark.*), I might well go on to describe an event which occurs against the background of that state, or which is enabled by it. It seems somewhat less likely that I will start to explain the causes of the state. The account proposed by Lascarides, Asher and Oberlander (1992), for instance, goes to considerable lengths to show how such apparent departures from the default of iconicity can be captured formally. For them, full stops mean temporal *progress*, except in special discourse contexts, or if special world knowledge is in play. How, then, can we reconcile Stevenson et al.’s finding with the consensus regarding temporal ordering in discourse?

The answer lies in naive expectations concerning cores and contributors. Given the results from Stevenson and Urbanowicz’s reading time studies, we now have reason to believe that multi-clause sentences in core:contributor order are indeed relatively easy to process. As we know, this helps explain why core-1 position (a core occurring before a contributor) does not attract a cue phrase. The core can stand on its own; if a contributor is supplied first, then a connective is apparently highly desirable, either in contributor-1 position, or in core-2 position. Now, consider an experimental subject in Stevenson et al.’s

experiment. They are presented with a single sentence, terminated by a full stop, and then asked to produce a new sentence to continue on from the first. A very natural way of dealing with this task is to assume that they have been given the important information, and that they can hang some new supporting information off it. It seems much less likely that they will interpret the bare initial sentence as merely designed to support some other, more exciting sentence about an event that they will have to think up. In other words, presented with a single sentence, I will assume it is a core, and produce a contributor to go with it. I will not assume that it is a contributor, and work out what core it could have been contributing to.

What kind of contributor would I produce under these circumstances? Connectives offer a useful guide. Considering the results of Moser and Moore’s corpus study, we can ask which connectives are compatible with core:contributor order. They are those that usually occur in contributor-2 position: *because*, *first*, *second*, *however* and *also*.² Of these, *because* is twice as frequent as any other. So, when cores are followed by contributors, if we use a connective at all, *because* is our favourite. If we don’t use a connective, and indeed place the core and contributor in separate sentences, then it plausible to suppose that we will still try to generate a contributor that coheres with the given core. And a cause is an excellent candidate under these circumstances: thus, we should not be surprised if subjects’ behaviour bears an uncanny resemblance to what they do when they are confronted with a sentence fragment containing *because*.

The crucial point to note, perhaps, is that Stevenson’s suggestion was prompted by subjects’ continuation behaviour in a supposedly “null” context: they were given the first sentence in a discourse, and asked to produce the second. The unusual nature of this discourse context brings us back to address Moser and Moore’s second question, concerning the very existence of contributor:core order utterances.

²*Since* can also occur in contributor-2 position, but this use is *much* rarer than its occurrence in contributor-1 position.

5 Why does contributor:core order occur at all?

If contributor:core order is harder to understand, why is it ever used? If we can say (1c), why would we ever say (1b) or (1a)?

- (1) a. *Since* part2 is more likely to be damaged, you should test it first. [Contributor-1]
- b. Part2 is more likely to be damaged, *so* you should test it first. [Core-2]
- c. You should test Part2 first, *because* it is more likely to be damaged. [Contributor-2]

The basic answer lies in the information structure of the utterance seen against its wider discourse context. Within a discourse context, the “harder” order may be less coherent locally, but more coherent globally. Thus, although dispreferred on local grounds, it may be required on global grounds.

Elhadad and McKeown (1990) point out that a Hallidean given-new distinction applies within sentences like (1b) and (1c). In particular, following Halliday, the unmarked position for new information is seen to be towards the end of the sentence. So, sentences usually present information in given–new order. Consider (1b) embedded in a larger discourse context, and compare it with embedding (1c) in the same context:

- (4) a. Part2 has probably been damaged, but Part1 has not.
- b. Part2 is more likely to be damaged, *so* you should test it first.
- (5) a. Part2 has probably been damaged, but Part1 has not.
- b. You should test Part2 first, *because* it is more likely to be damaged.

Given this (constructed) context, it seems highly appropriate to say that *Part2 is more likely to be damaged* is given in (4b), and that *you should test it first* is new. But if this is correct, then (5b) presents this same information in new–given order. If information is presented in this order without any fancy syntactic construction (like an *it*-cleft), then arguably the reader

or listener will have to carry out extra work. In the absence of information to the contrary, we use the early part of the sentence to provide a link in to the prior discourse context, and we then attach the later part of the sentence to this link. If new information is presented first, then extra inferential effort will be required to find a place to link it into the prior discourse—or the listener will just have to wait until the linking context arrives, later in the sentence.

To avoid this extra work, the remedy is that cores should be demoted to second place *if they are new to the discourse*. And because (as we have seen) they are harder to understand when they occur in second place, a range of connectives is available to help readers build an appropriate interpretation of the contributor:core structure in which they appear.

The key point is that intentional subordination varies independently from information structure—information structure in the sense of given versus new information, that is. Moser and Moore (1996) have already elaborated the argument for intentional subordination to be seen as independent from information structure in the sense of content relations, such as cause versus consequence. What the current discussion suggests is that one cannot account for the distributional facts about cue phrases purely at the intentional level. The information-structural level is needed if a full account is to be provided.

How could we test these claims? We could conduct a reading time experiment in which we test: (a) how quickly people read matched constructions such as *A so B* and *B because A* without a prior discourse context; and compare this with (b) how quickly they read the same materials in a discourse context C in which A is given, and B is new; and with (c) how quickly they read them in another context C', in which A is new and B is given.

We would predict that: in (a), *so* is slower than *because*; in (b), the difference in speed is reduced or reversed; and in (c), the difference is the same as in (a) or increased.

6 Conclusion

It seems, then, that constructions like *A so B* are less internally coherent than constructions like *B because A*. There's empirical evidence which suggests they're harder to understand; and this supports the view that the difficulty arises because *A so B* is a contributor:core construction, while *B because A* is a core:contributor construction. However, given the right discourse context, *A so B* can have an information structure which coheres with that context where *B because A*'s information structure proves less coherent (and vice versa for a different context). This suggestion is empirically testable. If it is correct, then it helps explain Moore and Moser's puzzle; it would explain why contributor:core constructions—as in *A so B*—are surprisingly frequent, and demonstrably effective.

We conclude with a general moral, which links this suggestion back to the discussion of the supposedly causal interpretation of full stops. As Altmann and Steedman (1988) have said: there is no such thing as a null context.

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