PROSODIC AND LEXICAL CORRELATES OF SWEDISH DISCOURSE MARKERS IN SPONTANEOUS DIALOGUE

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ABSTRACT

Discourse markers are words or phrases that speakers use at the beginning of a contribution to signal how it relates to prior discourse. They mark changes in the global discourse structure by e.g. signalling the beginning of a new topic or the return to a previous topic. However, words that are used as discourse markers often also have a sentential function. If discourse markers are to be used in speech processing algorithms to facilitate the detection of topic shifts, it is therefore necessary to find features that distinguish discourse from sentential uses.

This study reports on the Swedish discourse markers men ‘but’/’and’ and så ‘so’. The results show that men and så along with their prosodic and lexical correlates can provide important cues to the structure of a dialogue.

1. INTRODUCTION

Discourse markers are defined as sequentially dependent elements (words or phrases) which bracket units of talk, e.g. sentences or speech acts [1]. They are used extensively in spontaneous speech and function as explicit indicators of the structure of discourse by marking the beginning of a new topic, a return to a previous topic, etc [2]. Speakers use discourse markers to signal how the upcoming utterance relates to prior discourse. They help the listener to develop an expectation of the discourse intent of the upcoming utterance by signalling how to integrate it into a mental representation of the discourse [3, 4]. This study reports on the Swedish discourse markers men ‘but’/’and’ and så ‘so’.

Discourse structure identification is an important process for speech understanding systems. Information about the makeup of discourse helps language processing e.g. with the problem of reference resolution. From previous studies we know that prosodic cues provide important information on discourse structure which can be used to segment speech [5]. Nevertheless, textual cues also constitute an important source of information which should be taken into account together with prosody. When discourse markers are present, they provide reliable cues to discourse structure [6].

However, lexical items that have a discourse function often have a sentential function as well. In addition to their discourse functions, men and så also have functions within sentence grammar. Sententially, men may be used as a conjunction linking together two clauses and så may function as a clause initial placeholder in main clauses preceded by adverbial subordinate clauses [7]. If we can distinguish between discourse and sentential usages, discourse markers such as men and så can be used in speech processing algorithms to facilitate the detection of discourse boundaries. Surface position within the clause (clause-initial/non-initial) cannot be used since men and så occur in clause-initial position in both functions. The prosodic characteristics of the two functions are therefore investigated as well as local lexical cues co-occurring with one or the other of the two uses of men and så.

2. METHOD

2.1. Data

The speech material consisted of four spontaneous, natural dialogues recorded at two different travel agencies in Lund, Sweden. Two travel agents (one male and one female) and four clients (two male and two female) were recorded. The dialogues are between 2 and 15 minutes long, yielding about 23 minutes of speech in total. The speech of each dialogue participant was recorded on a separate channel to enable separate acoustic analyses for the individual speakers.

2.2. Labeling

All together the dialogues included 47 tokens of men and 67 tokens of så. Using both textual and auditory information, the tokens of men and så with a discourse function were distinguished from those with a sentential function. The discourse men and så were labeled D and the sentential men and så were labeled S.

2.3. Prosodic analysis

Acoustic analyses were made of each speaker’s speech in the ESPS/waves environment. The prosodic correlates of both discourse and sentential tokens of men and så were investigated and compared with each other. On the basis of previous knowledge of prosodic boundary signalling [8], the following features were examined: preceding and following pauses, duration of men and så, F0 reset, and glottalization in association with men and så.

2.3.1. Pauses. Measurements were made of the duration of pauses preceding turn-internal men and så. Both pauses located immediately before men and så and pauses located before a discourse marker or a hesitation sound occurring between men and så were measured.

One would expect relatively longer pauses before discourse men and så than sentential men and så since the discourse tokens mark the beginning of a new prosodic utterance while sentential men and så often occur at the start of a new prosodic phrase. Prosodic utterances (often corresponding to a paragraph in written language) are most often preceded by longer pauses than prosodic phrases (often corresponding to a clause in written
language) [9].

The general distribution of both turn-internal and turn initial pauses before and after discourse and sentential uses of men and så was also investigated.

2.3.2. Word duration. Measurements were made of the absolute duration of men and så. It was expected that (D)iscourse-men and D-så would have a greater duration than S(ential)-men and S-så. Conjunctions (men) and place-holders (så) are non-prominent word classes. However, when functioning as discourse markers, they are expected to be drawn out as a result of the speaker’s need for extra speech planning time when introducing a new topic.

2.3.3. FO reset and creak. Measurements of FO were made at the end of the phrases preceding men and så and in the vowels of men and så. The expectation would be to find a relatively larger FO-reset on D-men and D-så than on S-men and S-så since the degree of topic-continuity between what precedes and follows discourse men and så (in different discourse units) is less than between what precedes and follows sentential men and så (i.e. clauses pertaining to the same sentence) [10].

The presence of glottalization (‘creak’) in association with men and så (in the vowels at the end of the preceding phrase or in the vowels of men and så) was also examined.

2.4. Lexical analysis

In the lexical analysis, we searched for local lexical cues which co-occurred with one or the other of the two functions of men and så. Co-occurring discourse markers were noted if they constituted one of the three words following men or så. On the assumption that discourse markers would only be found in association with topic shifts, sentential men and så were not expected to co-occur with discourse markers.

3. FUNCTIONS OF DISCOURSE MARKERS IN DIALOGUE

3.1. Men ‘but’/’and’

Prior work on the Swedish discourse marker men in monologues [8] suggests that it has two main functions: (1) as a marker of the beginning of a new topic, and (2) as a marker of the return to a previous topic, as in (1) and (2). In the former function it is often interchangeable with the discourse marker och ‘and’, in the latter function it frequently co-occurs with the marker i alla fall ‘anyway’.

(1) ja han är förtvivlad verkar det som åh sedan blir han mer eller mindre utkord från hotellet men åh så åh väntar han tills det blir kväll ‘well he’s devastated it seems like uh then he’s more or less thrown out of the hotel and uh then uh he waits until it’s night’

(2) jag vet inte om han stannar kvar på hotellet eller om han lyckas ta sig ut därifrån eller hur det nu var men i alla fall så går han kommer tillbaka ‘I don’t know if he stays at the hotel or if he manages to get away from there or what happened but anyway he leaves returns’

In dialogues men has further usages. The marker men is often found at the beginning of a turn which expresses a contrast or an objection to something which has been said earlier on in the dialogue, as in (3). This discourse meaning of men is quite similar to the meaning of the sentential men ‘but’.

(3) A: så det man kan gora om man hittar platser alltså for det kan vara rätt så fullbokat i och med att det är över jul nåd ja
B: ja men om inte vet priset så kan det ju
A: ‘so what you can do if we find any seats that is because it can be pretty booked up since it’s around the holidays right’
B: ‘yes but if you don’t know the price then it feels’

The marker men is also used for terminating the topic under discussion before introducing a new one and for ending the whole dialogue, as in (4). In this function men often co-occurs with the marker då (så) ‘then’.

(4) A: men då så åh ringer jag eller kommer in och
B: ja nej men välkommen
A: ‘okay then uh I’ll call you or come here and’
B: ‘yes well welcome back’

3.2. Så ‘so’

The marker så has several discourse functions. It can be found in logical sequences, at the beginning of an utterance which constitutes a conclusion, or a request for confirmation of a conclusion, as in (5). In this function så does not cause inversion of subject and verb.

Så is also found in temporal sequences, where it is interchangeable with sedan ‘then’ and causes inversion of subject and verb, as in (6).

(5) så den här ska jag bekräfta ‘so I’ll have to confirm this’
(6) och så skulle jag be dig fakturera på en universitetsinstitution ‘and then I’d like to ask you to bill a department at the university’

Så has an additional function which is closely related to its function as a discourse marker. It serves as a topic place-holder (TPH) after topicalized adverbs and discourse markers [11], as in (7). In this function, så seems to be used as a means of focusing [12].

(7) och sedan så är man då i Köpenhamn på morgonen den femte ‘and then TPH you’re in Copenhagen in the morning on the fifth’

One can expect that the above mentioned discourse functions of men and så would be associated with prosodic and lexical cues which help listeners interpret them as markers of the discourse structure.

4. RESULTS AND GENERAL DISCUSSION

The results of the prosodic and lexical analyses show that different prosodic and lexical correlates characterize the two
functions of *men* and *så*. Furthermore, the correlates of *D-men* are similar to those of *D-så* and the correlates of *S-men* similar to those of *S-så*.

### 4.1. Prosodic correlates

#### 4.1.1. Pauses

In 73% of the cases (68 of 93 tokens), the discourse *men* and *så* are preceded by a silent pause. Seven tokens of *men* and *så*, all functioning as discourse markers, are both preceded and followed by pauses. Moreover, five discourse *men* and two discourse *så* are followed by filled pauses/ hesitation sounds (most often the vowel [e]). Only 3 of the 21 tokens (14%) of sentential *men* and *så* are, on the other hand, associated with pauses.

Pauses can be seen as either signals to improve comprehension or traces of production difficulties [13]. Either way, one would expect that the pauses preceding discourse *men* and *så* would be relatively longer than pauses preceding sentential *men* and *så*.

Pauses intentionally introduced to inform the listener about the presence of a boundary are expected to vary in duration depending on the kind of boundary they mark. When the purpose of the pause is to inform about the presence of a topic shift, as in the case of pauses preceding discourse *men* and *så*, one expects the pause to be relatively longer than a pause marking e.g. a prosodic phrase boundary [9].

A pause can also be a trace of speech planning. One can assume that a speaker encounters some production difficulties when introducing a new topic. The required speech planning causes the time needed to initiate speech to increase. Since discourse markers, but not conjunctions and clause initial place holders, are found in association with topic changes, one expects to find relatively longer pauses before discourse than sentential *men* and *så*.

However, because of the few occurrences of pauses that precede sentential *men* and *så* in the examined material, it is not possible to determine whether there is a difference in the length of the preceding pauses. The measurements of the pauses’ duration (only turn-internal pauses) show that *S-men* are preceded by pauses which are on the average of 560 ms long (n=2), *D-men* of pauses 540 ms long (n=32, SD=580 ms), *S-så* of pauses 480 ms long (n=1), and *D-så* of pauses 970 ms long (n=26, SD=1130 ms). Nevertheless, discourse *men* and *så* are more often than sentential *men* and *så* associated with pauses both preceding and following them, as shown in table 1.

#### 4.1.2. Word duration

Measurements of the duration of *men* and *så* show no statistically significant difference in average duration between the two functions. Both discourse and sentential *men* and *så* are relatively short in the examined data.

### Table 1. Distribution of pauses preceding and following *men* and *så*. The number of tokens is given in brackets.

<table>
<thead>
<tr>
<th>Pauses</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentential <em>men</em> (5)</td>
<td>40% (2)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Discourse <em>men</em> (42)</td>
<td>90% (38)</td>
<td>17% (7)</td>
</tr>
<tr>
<td>Sentential <em>så</em> (16)</td>
<td>6% (1)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Discourse <em>så</em> (51)</td>
<td>39% (30)</td>
<td>8% (4)</td>
</tr>
</tbody>
</table>

#### 4.1.3. F0 reset

Measurements of F0 show that a larger mean F0 reset is associated with discourse *men* and *så* than sentential *men* and *så*. *D-men* tokens are associated with a mean reset of 3.73 ST (SD=3.08) and *S-men* with a reset of 1.75 ST (SD=1.03). *D-så* is associated with a mean reset of 5.13 ST (SD=4.16) and *S-så* with a reset of 1.99 ST (SD=2.57). The difference in mean reset is statistically significant (p=0.0218, t=2.370, df=49) in the case of *så*, but not in the case of *men* (p>0.05).

#### 4.1.4. Creak

Creak (glottalization) is more often found in association with discourse than sentential *men* and *så* (in 15 of 16 cases). The use of glottalization to mark prosodic boundaries is well known. Dilley, Shattuck-Hufnagel, and Ostendorf [14], for example, have shown that speakers are more likely to glottalize word-initial vowels when those vowels occur at the beginning of a new intonational phrase. The results of the present study suggest that speakers of Swedish also use glottalization as a marker of discourse structure. Moreover, vowels associated with boundaries of higher-ranked prosodic constituents, such as the prosodic utterance boundary (where discourse markers are found), seem to be more frequently glottalized than vowels associated with boundaries of lower-ranked prosodic constituents.

### 4.2. Lexical correlates

33% of the discourse *men* and *så* are followed by another discourse marker or a hesitation sound (31 of 93 tokens). Sentential *men* and *så* are, as predicted, never followed by discourse markers. Co-occurring discourse markers thus constitute strong cues for identification of discourse markers, when they are present.

The marker *men* is more often than *så* followed by another marker or a hesitation sound. While 19 of the 42 tokens of *D-men* were followed by another marker, only 12 of the 51 tokens of *D-så* were so characterized. However, unlike *men*, *så* is in many cases preceded by a marker instead.

Following are some examples of common combinations in which *men* or *så* occurred in the material: *jo men alltså,* *men då* (*så*), *och så,* *och sedan* (*så*), *så då* (*så*) (corresponding approximately to English ‘yes but’, ‘but then’, ‘and then’, ‘so

### Table 2. Duration of discourse and sentential *men* and *så*. The number of tokens used to calculate the duration statistics is given in brackets.

<table>
<thead>
<tr>
<th>Duration (ms)</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentential <em>men</em> (5)</td>
<td>120</td>
<td>70</td>
<td>50-240</td>
</tr>
<tr>
<td>Discourse <em>men</em> (42)</td>
<td>150</td>
<td>80</td>
<td>70-370</td>
</tr>
<tr>
<td>Sentential <em>så</em> (16)</td>
<td>120</td>
<td>30</td>
<td>50-170</td>
</tr>
<tr>
<td>Discourse <em>så</em> (51)</td>
<td>150</td>
<td>130</td>
<td>50-700</td>
</tr>
</tbody>
</table>

However, as seen in table 2, there is a number of occurrences of discourse *men* and *så* with a relatively long duration. 14% of the *D-men* and *D-så* tokens have a longer duration than the longest tokens of *S-men* and *S-så*, which suggests that a long duration in some cases is a prosodic characteristic of discourse markers. In the monologue data studied in [8], duration differences between *D-men* and *S-men* were statistically significant.
5. CONCLUDING REMARKS

Summarizing the results of this study, it appears that there are several prosodic and lexical cues which help a listener to disambiguate men and så and decide whether a discourse or a sentential use is meant. As far as associated prosodic correlates are concerned, discourse men and så were characterized by a larger F0 reset than sentential men and så and in a few cases also with a longer duration than sentential men and så. Discourse men and så were also more frequently than sentential men and så preceded and followed by pauses and associated with glottalization (in the vowels of men and så or in the vowels at the end of the phrases preceding men and så). As regards lexical correlates, it was seen that a third of all discourse men and så occurred in combinations with other discourse markers. These cues may prove useful for automatic detection of discourse markers (cf. [15]).

Due to the short turns in the investigated dialogues, most of the tokens of discourse men and så occurred in turn-initial position (which is reflected in the number of discourse men and så that are preceded by pauses). The turn-initial position therefore provides an additional cue for identification of men and så’s discourse functions in dialogue. However, not all discourse markers occur in turn-initial position, nor are all discourse markers followed by another discourse marker or have all of the prosodic characteristics mentioned above, see figure 1.

Figure 1 shows an example of a token of men which has been labeled D, since it marks the return from a digression. It is associated with a relatively large F0 reset of 66 Hz (9.60 ST), from 89 Hz in the word det to 155 Hz in men and it is preceded by a silent pause. Furthermore, it is both preceded and followed by words which also function as discourse markers. However, the short duration of men (110 ms) is not an expected characteristic of a discourse men, nor is the short duration of the preceding pause (369 ms). The preceding pause’s duration and the word duration rather seem to indicate that a sentential usage was meant, although this was not the case.

It is clear that not all cues are equally important for the interpretation of men and så and that a number of features need to be taken into consideration when disambiguating discourse markers.

REFERENCES