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## Prosodic marking of contrasts in information structure

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### 1 Prosodic marking of contrast

Successful dialogue requires cultivation of common ground (Clark, 1996), shared information, which changes as the conversation proceeds. Dialogue partners can maintain common ground by using different modalities like eye gaze, facial expressions, gesture, content information or intonation. Here, we focus on intonation and investigate how contrast in information structure is prosodically marked in spontaneous speech.

Combinatory Categorical Grammar (CCG, Steedman 2000) distinguishes *theme* and *rheme* as elements of information structure. In some cases they can be distinguished by the pitch accent with which the corresponding words are realised. We experimentally evoke instances of contrasting themes and rhemes to establish the circumstances under which the pitch accents occur in unrestricted spoken dialogue. ‘Contrast’ means ‘alternatives are available’, not ‘contrastive accent’. It is difficult to manipulate context or outcome in quasi-natural engaging situations. Even if contrasting themes and rhemes are available, speakers choose from among a wider set of contrastable elements when framing utterances. Their choice may be difficult to predict: contrasts not apparently critical to the local context may be as important to speakers as ones usually thought to define the situation under discussion.

Unscripted dialogue with pressing communicative motivation is difficult to control for genre, topic, and goals. We use a modified map task (Anderson et al. 1991), a restricted-domain route-communication task, which establishes what each participant knows at any time. Without sight of each other’s maps, an Instruction Giver (IG) and Follower (IF) collaborate to reproduce on IF’s map a route printed on IG’s. The route can be adequately described by route-critical landmarks. As Fig. 1 illustrates, map pairs differ in the features of landmarks and in ‘ink damage’ that obscures the colours of some landmarks on IF’s map. Participants know that

maps can differ but must learn where and how.

The discrepancies between maps do not fully define the alternatives sets speakers may wish to contrast. Instead, speakers define that alternatives set by their intonation. Provided that it is consistent with the context, the hearer will accommodate that set. Take:

(1) IF: *Do you see the two brown trees and the and the four black trees?*

IG: *You mean THREE black trees right?*  
(1:1–2:T:700.7; 1–1)

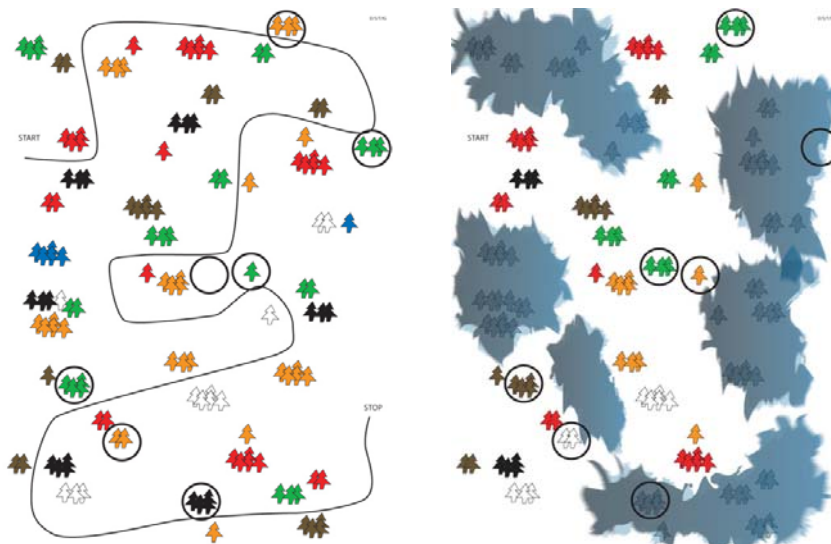
By deaccenting ‘black’ and ‘trees’ IG presupposes that the alternatives are confined to sets of black trees; specifically to IG’s set of three and IF’s set of four. Both can then adjust common ground incrementally.

As there is intense debate about whether the involved pitch accents (L+H\* and H\*) are actually categorically distinct (Ladd & Schepman 2003, Calhoun 2004), we simply seek to establish that contrasts in the information structure are indeed marked overtly by some form of prominence. We therefore use an undifferentiated notion of perceptual prominence to determine whether contrasts are marked by phonetic means.

Our prediction is the following: Only words whose denotation contributes to distinguishing the entity referred to from the other entities in the alternatives set are marked by prominence.

### 2 Experiment

Key-objects (here: trees) provide the route-critical landmarks for a map. They differ among a single map’s landmarks by colour and by one other feature (here: number). We report findings for two dialogues for the maps in Fig. 1 in order to identify episodes containing the predicted contrasts. (We superficially looked at others, which corroborated our findings.) The results are consistent within and between participant dyads. Landmarks differ in colour of tree groups; group size (1 to 5), presence of the group on IG’s /IF’s map, whether ink obscures the colour on IF’s.



**Figure 1:** Maps for the analysed dialogues; IG's map (left) contains a route and a START and STOP mark; IF's map contains 'ink blots' that obscure the colour of some objects; circles (added here for expository purposes) indicate the differences between the maps

We assessed perceptually whether the mentioned items are prominent. For landmarks differing between maps (except those inked out) we also established the most prominent item of the intonation phrase – the contrasted element.

The material contains 146 intonational phrases that mention one or two landmarks in the form [number] [colour] ['tree'/'one'] and where at least one of [number] or [colour] is present. There are 334 mentions of features (e.g. 'red', 'two') in these phrases. In only 6 mentions is the feature term *non*-prominent, but not all prominences are realised by pitch movement. Seven differences between the maps are unrelated to ink-blots: 4 colour differences, 1 number difference, 1 landmark present only on one map, respectively. They are the prime place for eliciting contrasting intonation that correct the dialogue partner's knowledge representation, cf (1). Of the 146 phrases, 9 refer to differences between maps.

The phrases include 210 mentions of landmarks, of which 124 mention both features. There is no clear preference for assigning prominence to features (86 use equal prominence; 21 make the number term more prominent, 17 the colour term). Number mentions predominate in single-feature mentions (65 number vs 21 colour). This appears to be a response to the fact that number is the more reliable feature. 137 phrases describe landmarks on a single map, of which 131 instances mention landmarks within the 'magic circle', an imaginary circle around the current position that contains the landmarks identifying the next leg. Of the other 6, 4 are close to the circle and 2 are only in the discourse history.

The two dialogues mention 9 of the 14 possible differences between maps; in 8 cases a pitch accent marks the contrast. In 2 instances the participants are off-route. So, the speakers could have chosen to mention 12 differences between the maps. The ratio of 9(8)/12 is very satisfactory.

### 3 Discussion

In this exploratory evaluation we looked at places in the maps that are prone to prompt intonation patterns marking a contrast in the information structure. Differences

*within* one map do not seem to elicit prosodic structures that mark contrasts between landmarks. These mentions are only informing or describing. Differences *between* maps require to correct the dialogue partner's knowledge representation and to introduce new information into the common ground. These contrasting items receive the most prominent pitch accent. With the exception of Ito et al (2004) we are not aware of experimental settings that can elicit 9 of 12 possible contrasts in unrestricted dialogue. In contrast to reading sentence lists this will provide deeper insight into actual dialogue.

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