Adaptation of the use of colour terms in referring expressions

Markus Guhe, Ellen Gurman Bard
Human Communication Research Centre,
Linguistics and English Language
University of Edinburgh
40 George Square, Edinburgh, EH8 9LL
{m.guhe, e.bard}@ed.ac.uk

Abstract

In a modified Map Task we looked at the use of colour terms. Colour terms in this version of the Map Task are unreliable, because (1) they can mismatch between the maps (2) about half of them are obscured on the Instructions Follower's map by 'ink blots'. The data show that the dialogue partners adapt to this property of the task environment by using fewer colour terms over time.

1 Introduction

When referring to objects linguistically, humans use referring expressions, that is, expressions that single out one object from the set of potential referents. A standard assumption in the literature on generating referring expressions is that the semantic structure of the expression can be specified by a set of attributes, e.g. type (alien, fish), size, colour. Given this, the main problems are (1) to find an efficient generation algorithm that selects attributes which single out one object and (2) to generate naturally sounding expressions.

The most prominent proposal for what an efficient, cognitively plausible algorithm could be is Dale and Reiter's (1995) algorithm, which has been enhanced and modified in many ways. The main problem that has to be solved by such algorithms is that they have to select those attributes that humans choose in the same situation. Jordan and Walker (2005) present modifications to Dale and Reiter's algorithm on how the selection of attributes can be adapted to the properties of linguistic corpora. These algorithms already incorporate results of psychological findings (e.g., Brennan and Clark's 1996 conceptual pact model), but they do not account for changes over time.

2 Experiment

In a modified Map Task (Anderson et al., 1991; Guhe et al., 2006) we asked whether the participants adapt to properties of the task environment (the maps) when referring to the landmarks. In the Map Task two dialogue partners – the Instruction Giver (IG) and the Instruction Follower (IF) – each have a map of the same location (Fig. 1). IG's map contains a route not present on IF's
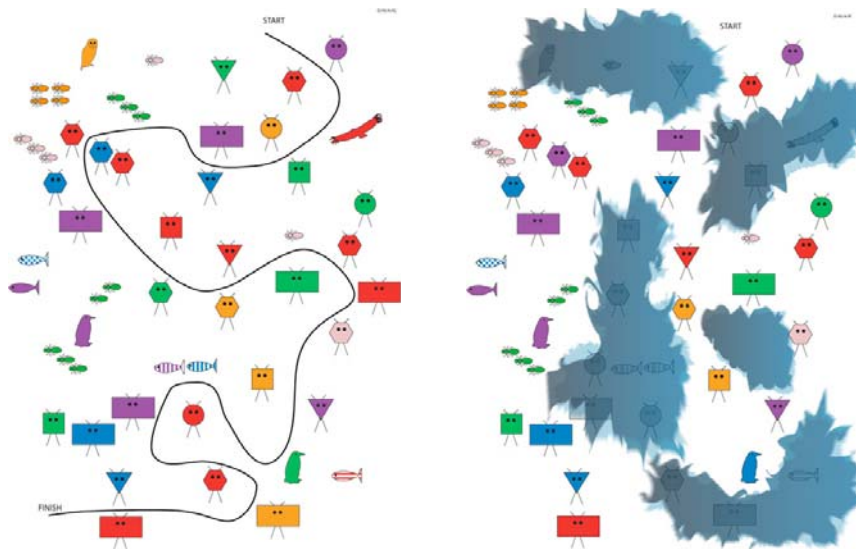

Figure 1: Maps for the analysed dialogues; IG's map (left) contains a route and a START and STOP mark; IF's map contains 'ink blots' that obscure the colour of some objects; circles (added here for expository purposes) indicate the differences between the maps

map. They communicate to reproduce IG's route on IF's map. Players cannot see each other's maps. They use landmarks for navigation. Although most landmarks are identical on both maps, some differ by: (1) being absent on one of the maps or present on both; (2) having clearly different attributes; (3) being affected or not by 'ink damage' that obscures the colour of some landmarks on IF's map.

Our Map Task (Fig 1) has three experimental variables: (1) homogeneity (whether the landmarks are of one or different kinds, e.g. only aliens, or aliens and fish); (2) orderliness (whether the 'ink blot' obscures a continuous stretch of the route); (3) animacy. These are varied factorially so that each pair of participants (dyad) completes a set of 8 map pairs. There are 32 dyads.

3 Data

Currently 210 of the 256 dialogues are transcribed and used here. Each dialogue is about 10 minutes long. Overall the 210 transcripts contain 184,711 words of which 5,251 are colour terms.
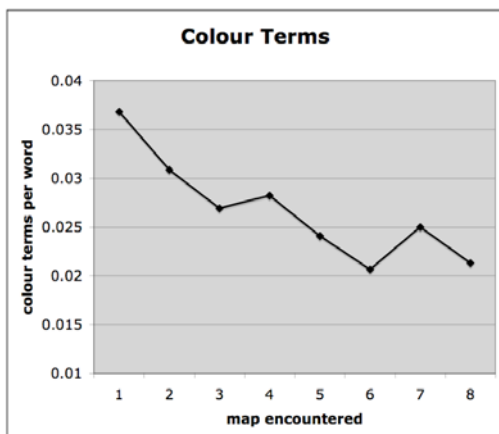

Figure 2: Use of colour terms per word over time.

Fig. 2 shows the mean number of colour terms per spoken word across the 8 map pairs that each dyad encounters. As the task environment affords no other occasions to use colour terms, we make the simplifying assumption here that all colour terms are used for referring to landmarks. The mean number of colour terms decreases over the course of the 8 maps. There is a significant negative correlation ($r = -0.172$, $p < 0.01$) between the rate of colour terms used and the number of the encountered map.

A 3-way repeated measures ANOVA showed that of the 3 experimental variables only landmark homogeneity affected the use of colour terms: ($F_1(1,20) = 12.26$, $p = 0.02$) on average the mixed landmark condition attracts fewer col-

our terms per word (0.024) than the uniform landmark condition (0.032).

4 Conclusions

The participants in our Map Task pick up the fact that colour is an unreliable attribute in referring to the landmarks on the maps. The adaptation is not a sudden change in behaviour but is a gradual adaptation to the properties of the items they have to refer to.

The effect of homogeneity is most likely due to the difficulty of the maps with landmarks of just one kind: the type attribute does not distinguish such landmarks; colour must be used to identify the target landmark.

The main result is that the use of colour terms changes over time during a task, which is not accounted for in Jordan and Walker's (2005) model, and to our knowledge such a model does not exist yet. For an adequate dialogue model it is insufficient to simply let the computer choose a level of colour terms (observed in a suitable corpus), because that would be unnatural. In such models the referring expressions in the first maps would not be natural, because they would use the colour attribute less often than humans (analogously too often in the last maps). One goal of our current project is to develop such a model.

References

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