

# Negotiating spatial relationships in dialogue: The role of the addressee

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## Abstract

How do addressees who are not informed about targets contribute in a conversation to the negotiation of spatial locations? Results in dialogue research show the general importance of the addressee's reactions to a speaker's utterances. Results in spatial language research demonstrate the range of variability available to a speaker when providing a spatial description. In this paper, we combine these two approaches in order to investigate how the spatial position of objects in a dolls' house is negotiated, using a naturalistic dialogue scenario. Results show the ways in which the instructed person actively supports the negotiation of spatial reference, for example by pointing out ambiguities and suggesting alternative conceptual perspectives on the scene.

## 1 Introduction

When engaged in joint action, you may be asked to place an object in a particular position. How do you react? In theory, all you need to do is place the object and wait for the next instruction. However, in natural dialogue addressees do much more than that (e.g., Clark, 1996): they acknowledge the speaker's request, ask for clarification, or contribute to the description by expanding it or suggesting a different description. When placing objects, the situation becomes particularly complicated, as spatial terms can typically be interpreted in more than one way (e.g., Schober, 1993). Then how do addressees contribute to the given task of a spatial

placement so that an agreement can be reached "well enough for current purposes" (Clark, 1996)?

Previous work on spatial language in dialogue has focused, for example, on direction-giving through a maze (Garrod & Anderson, 1987) or map task (Filipi & Wales, 2004), on spatial object reference, i.e., the identification of an object in contrast to other objects present in a scene accessible to both dialogue partners (e.g., Schober, in press), on route descriptions (Muller & Prévot, in press), and on the description of spatial relationships in pictures (Watson et al., 2004). In contrast, in a situation like the one just sketched, spatial language is used to instruct someone to place an object in a particular position. Such a situation involves a fairly strong knowledge discrepancy, raising the question whether the instructed person will be able to contribute any suggestions of their own at all. However, even at a brief glance at our data corpus (targeting such a scenario), we encounter the following exchange:

*director*: also oben links in dem Ba+ in dem Zimmer also oben links [okay, at the top and left in the ba+ in the room that is at the top left]

*matcher*: neben dem Fenster die Dusche?  
[next to the window the shower?]

*director*: ne - mehr rechts also im Raum hinten rechts  
[no - more right that is in the room at the back right]

Apparently, the matcher has quite a good idea already of where the shower (a piece of dolls' house furniture) is to be placed, and makes an informed suggestion, which is taken up and corrected by the director. Strikingly, the director's subsequent description departs fundamentally from the original: obviously, the conceptual perspective on the scene

has changed by the matcher's utterance. This phenomenon can be regarded as a specific case of the generally well-documented dialogue processes of repair, clarification, and grounding (e.g., Clark & Krych, 2004); or in Schegloff's (1997) terms, 'candidate understandings' or 'appendor questions'. In this paper we ask how the peculiarities of spatial language come into play in this kind of collaborative negotiation procedure.

Spatial language constitutes a common class of natural language that is particularly regularly used in everyday discourse (Talmy, 2000). This includes the so-called projective terms which indicate a direction (*left, right, above, below, front, back*); these are interpreted against conceptual reference systems (Levinson, 2003; Tenbrink, 2007) and may be relevant in a static or a dynamic sense (van der Zee and Slack, 2003). Further, there are topological terms which indicate aspects of contiguity (*on, in, at*), path-related terms (e.g., *across, through, along*), distance-related terms (e.g., *near, far, close*), and others. These terms can be used in a broad variety of discourse tasks and then exhibit different features and implications (Bateman et al., 2007). For instance, searching a hidden object in a small-scale array requires descriptions on a different level of granularity than describing a route for a stranger in town. Furthermore, spatial terms may be used in order to describe an object for reference purposes (e.g., *the car with the blue top*), or in order to describe an object's location (e.g., *the car is in front of the house*). To describe an object's position in yet more detail, one may wish to describe the orientation of an object, again using spatial terms (e.g., *the front of the car points towards the house*). Here we focus on a scenario designed to maximise the occurrence of spatial terms by combining the latter three options in an *object placement* task. To reach that goal successfully, speakers must agree on an object's identity as well as its location and orientation.

Much work on dialogue (e.g., Garrod & Anderson, 1987) relates to spatial settings, but the intricate repertory of how to describe spatial relationships has not yet been explored thoroughly with respect to dialogue phenomena. Crucially for our present interests, little is known yet about how the *addressee* contributes to establishing spatial relationships in task-oriented dialogue, since the focus of attention in most analyses mostly lies either on the direction giver or on particular discourse proc-

esses such as interactive alignment (Pickering & Garrod, 2004). Our present contribution provides a complementary perspective, exploring those instances in which not alignment is at stake but rather the contrary: the introduction of new spatial lexical material by addressees.

## 2 Empirical study

We designed an empirical study to investigate the dynamics of dialogic interaction in a joint spatial task. A scenario was chosen in which it was likely that participants would spontaneously use spatial terms in a variety of ways (as explained above). Pairs of participants were confronted with the task of furnishing a dolls' house. This situation can be characterized as a referential communication task (similar to many earlier studies, e.g., Brennan & Clark, 1996; Brown-Schmidt et al., 2005) combined with joint spatial action (cf. Rickheit & Wachsmuth, 2006). While this corpus is still being prepared for several purposes, we focus here on a subset of data investigated as to the addressee's contribution as just motivated.

### 2.1 Method and Procedure

For this task, two sets of dolls' house furniture together with two open wooden dolls' houses were used. One of the houses was fully furnished (see Figure 1 below), while the other was empty, with the furniture positioned randomly beside the house. The participants were placed facing each other, but separated by a screen. One of them (henceforth called *matcher*) was placed in front of the empty dolls' house, the other one (henceforth called *director*) in front of the furnished one. Now the director was asked to describe the positions of the furniture in their house in such a way that the matcher could furnish the empty one in exactly the same way. They were encouraged to talk to each other and ask clarification questions, and they were told that the results would be photographed afterwards.

The dialogues (covering between 30 and 90 minutes each) were recorded and transcribed. For present purposes we analyze an extract of the collected data as follows. We focus on the first 50 utterances (segmented according to turn-taking shifts as well as content-related criteria) of 11 different same-sex dyads (3 of which male) of students between 17 and 24 years of age. This way we address a manageable proportion (3.968 words in

total) of the dialogic data that allows for a rough assessment of relative frequencies across a range of participants, while still allowing for a fairly exhaustive qualitative coverage.



Figure 1. Dolls' house arrangement. During the experiment the dolls' house was arranged with two floors on top of each other and a roof.

## 2.2 Data Annotation

Prior to the qualitative analysis, we developed three simple (i.e., fairly well definable) annotation steps in order to assess the quantitative relationship of the phenomenon we are interested in with other kinds of dialogue contributions by the matcher.

First, we investigated the *lexical material* contributed by the matcher. We classified all utterances as ACKNOWLEDGEMENTS that do not contain any lexical material other than (typically backgrounded) acknowledgements of the previous instruction (Clark 1996:231; Carletta et al. 1997), expressed by the German equivalents of "yes", "okay", and affirmative feedback signals (*uhuh*). For the remaining utterances, we investigated the extent to which new content is contributed. There are many different ways of distinguishing between *given* and *new* in discourse (e.g., Prince, 1981; Halliday & Matthiessen, 1999). Aiming at the development of operationalizable criteria, we determined for each utterance whether it consists only of lexical material present in the previous discourse context, or whether it introduces new lexical material with respect to the current discourse topic. This way we avoided relying on the subjective interpretation of possible inferences from the earlier discourse. In fact, it is precisely by analyzing the new lexical items that we can gain insights about how inferences are made by the matcher.

Second, we determined whether or not each matcher utterance contained a spatial term, since we are interested in the usage of spatial language. Spatial terms here include various morphological and syntactic forms expressing spatial relationships of any kind, e.g., *left, in front, frontal, middle, to, at, through, out, in, where, here, parallel, there*. From this analysis we extracted those utterances by the matcher that involve the contribution of new spatial content. In our scenario, reaching the discourse goal consists of three steps:

1. *Identifying* an object (out of the range of objects that still need to be placed)
2. *Locating* the object's position in the dolls' house
3. *Orienting* the object in the correct direction in the dolls' house.

The data were also annotated with respect to each of these discourse topics. These steps of analysis were done by two different coders independently, with overlaps for substantial portions of the data and identical annotation results for more than 90%.

## 3 Results

### 3.1 Distribution of matcher's utterances

Of a total of 238 utterances by matchers, 98 (41.18%) contained new lexical material, and 114 (47.90%) were ACKNOWLEDGEMENTS without no new content (which are not analyzed further here). Thus, 10.92% of matcher utterances that are not ACKNOWLEDGEMENTS repeat previous lexical material. They can typically be interpreted as REQUESTS FOR EXPANSION (Clark & Wilkes-Gibbs, 1986:22), as in the following example (1):

*director*: äh die Toilette is äh parallel zur Dusche praktisch an die Hinterwand gestellt. kannst du dir das vorstellen?

[uh the toilet is uh parallel to the shower standing virtually at the back wall. can you imagine that?]

*matcher*: parallel zur Dusche [parallel to the shower]

*director*: [provides further information]

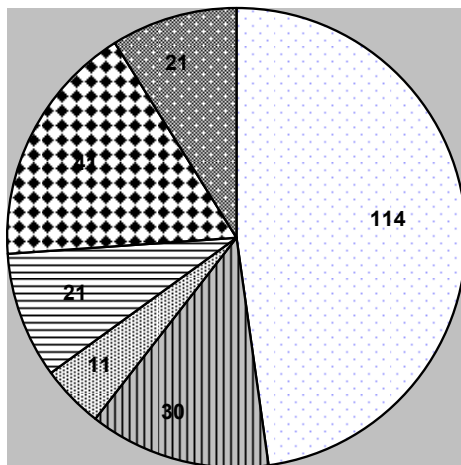
82 utterances (34.45% of the total of 238) contained one or more spatial terms; all of these are not classified as ACKNOWLEDGEMENTS. 30 (12.61%) concerned the *identification* of objects, 11 of which contain spatial terms. 62 (26.05%) concern the *location* of objects, 60 of which contain spatial terms; and 16 (6.72%) concern the *orientation* of objects (in 5 cases together with loca-

tion-related content), 12 of which use spatial terms. The remaining 21 utterances concerned other topics; 2 of these contained spatial terms. Thus, spatial terms were mostly used to express *location* or *orientation*. Here are some examples:

Example (2) *Identification*:  
*dir*: da kommt dieser Herd dran,  
 [there the stove is attached]  
*match*: ein Herd. der mit dem Abzug oben?  
 [a stove. the one with the hood on top?]

Example (3) *Location*:  
*dir*: ähm dann steht im rechten Zimmer an der Wand das große Bett. [uhm then in the room on right there is the big bed at the wall.]  
*match*: hinten an der Wand? [at the back at the wall?]

Example (4) *Orientation*:  
*dir*: so dass der Kreis so äh zum Bett zeigt.  
 [so that the circle points uh to the bed]  
*match*: zum Bett? [to the bed?]



□	Acknowledgements
▨	Identification
▩	Orientation (only)
▧	Other topics
▦	Location-new spatial info
▤	Location-other

Table 1. Distribution of matcher's utterances

Of the 82 utterances containing a spatial term, 64 contained new lexical material, which did not concern the spatial term in only 8 of the cases. Thus, the matcher regularly contributed *new spatial content* to the dialogue, sometimes for purposes of *identification* of objects, sometimes requesting information about the *orientation* about the object to

be placed. In as many as 41 cases (17.23% of all 238 matcher utterances), however, new spatial content was used for *location*-related utterances. In the following subsection we take a closer look at these instances, investigating how the matcher may contribute spatial content to the placement of objects. Table 1 summarizes the categories of matcher's utterances as described so far.

### 3.2 Negotiation of spatial object location

As Tversky (1999) and others observed, speakers often mix and change perspectives on a spatial scene. In fact, agreeing on a shared perspective poses the most prominent problem in much spatial dialogue research (e.g., Schober, 1993). In our scenario, the director and matcher both have their own dolls' house in front of them so that they share perspective functionally; therefore this kind of conflict should not arise.<sup>1</sup> Nevertheless, there are many ways of conceiving of – and describing – a spatial situation (Tenbrink, 2007); new conceptual perspectives may be added to the information available so far.

Spatial location descriptions consist of three main elements (e.g., Bateman et al., 2007): one (or more) spatial term(s), the *locatum* (the object currently described and – in our scenario – to be placed), and a *relatum* (another object or entity that the locatum is spatially related to) which may remain implicit. Our criterion for identifying new spatial content is based only on the spatial term. To get a clearer idea of how new spatial content is presented we categorized our utterances according to whether the locatum and the relatum, or both, are also new, and develop on this basis a first classification of spatial content suggested by matchers.

**All elements new.** Utterances that contain new spatial terms, a new locatum, and a new relatum can be said to introduce a completely new spatial description. We identified only three such instances in our data, one of them is example (5):

<sup>1</sup> There are, in fact, a few instances in the data reflecting that the participants did not always realize that perspective was actually shared, as in "also links von meiner Seite aus oder links von deiner Seite aus?" [that is, left from my side or left from your side?] asked by the matcher; this is then clarified by the director: "es steht ja auch vor Dir das Ding das Haus." [it stands in front of you as well you know, the thing the house.]

*match*: wir sind noch links ne?  
[we are still on the left side, right?]

Such instances can be interpreted as clarifying a global aspect of the current situation, removing uncertainty based on the complexity of the task.

**Locatum new.** There were no instances in which the locatum was new but not the relatum, which would mean that a new object was described in relation to another object that had just been used to describe the position of a different object.

**Relatum new.** In 16 instances in our data (39.02% of the 41 location-related utterances containing new spatial content), the relatum was new but the locatum was not. Thus, the object currently in focus was described in relation to a different object than the one that the director related it to. In the following example (6), the matcher shows considerable initiative by first summarizing a previous (complex) spatial description by the director (not represented here), and then offering a new description (for the same object location) in addition, marking this explicitly by "also" (that is):

*match*: und der kommt direkt daneben.  
[and this one is put directly beside it]  
*dir*: ja an die Wand ran [yes, at the wall]  
*match*: also hinten links von links von dem Spülbecken.  
[that is, at the back left of left of the sink]  
*dir*: ja aber an die Wand so ran an die,  
[yes but at the wall at the]

Notice also how the director repeats her own description "an die Wand ran". Apparently these two interlocutors have different conceptions of the scene and wish these to be clarified or confirmed before moving on. Crucially, for the matcher the object location becomes clearer when seen in relation to another object in addition to the one the director chose to relate it to. This possibility arises because of the fact that the matcher has already placed several objects, so that the visual scene offers more than one basis for spatial descriptions. Sometimes the matcher's suggestion of an alternative relatum is used to disambiguate the director's description, as in the following example (7):

*match*: neben das Klo an die Wand? oder an die andere Wand. [beside the toilet at the wall? or at the other wall]  
*dir*: an die andere Wand. [at the other wall]

In example (8), the matcher's suggestion of a new relatum clarifies a misunderstanding, highlighting an underdeterminacy in the director's instruction:

*dir*: das Waschbecken stellst Du jetzt so dass das ähm in die Lücke ja okay, [now you place the sink so that it fits into the gap yes okay]

*match*: ja? zwischen Toilette und Dusche?  
[yes? between the toilet and the shower?]

*dir*: nee nee nee. [no no no.]

*match*: okay. [okay.]

*dir*: ähm (...) da fehlt doch so'n Stück der Wand ne?  
[uhm (...) there is you know a piece of the wall missing, okay?]

Here, the director offered a "gap" as a relatum, actually not an object but rather a kind of non-entity defined by further entities that are left implicit. The matcher identifies a different interpretation than the one intended and clarifies this by explicitly mentioning the relata she is thinking of (toilet and shower). This induces the director to make the intended underlying relatum (the basis for the non-entity) explicit, namely, the wall.

Another possibility is to offer a first spatial description for the object currently in focus, as in (9):

*dir*: dann is' das nächste Ding du hast ähm  
[then is the next thing that you have uhm]  
*match*: noch immer im selben Raum?  
[still in the same room?]  
*dir*: genau. [exactly.]

In this example, the matcher's suggestion remains on a fairly high level of granularity – the relatum "room" together with the spatial term "in" leaves much room for interpretation. The suggestion is based on expectations from the previous discourse context, which the matcher wishes to confirm.

**Only spatial term new.** In 21 of our 41 cases (51.22%), neither the locatum nor the relatum is new, so that only the spatial term is changed. Typically in these cases, the matcher has detected a spatial ambiguity or underspecification in the director's utterances, which is clarified by changes concerning the spatial term. In five cases in our data (clearly identifiable by the use of "or"), their reaction is to make the options explicit and request a choice, as in the following example (10):

*dir*: ja genau. stell's an die Wand (...)  
[yes, exactly, put it at the wall (...)]  
*match*: frontal , frontal an die Wand,  
[frontally, frontally at the wall]  
*dir*: ja genau frontal (...) [yes, exactly, frontally]  
*match*: links oder recht [left or right]  
*dir*: ähm äh, rechts [uhm, uh, right]

Here there are two specific possible positions (left or right) to choose from. In example (11), the problem seems to consist of the area being too large which has so far been determined, so the matcher wishes to clarify the precise position of the object in this area, again by making the options explicit:

*dir*: an der hinteren Wand dran so dass ähm ja die Füße quasi zu dir zeigen. [at the back wall so that uhm yes the feet point to you so to speak]

*match*: hinten links oder rechts oder in der Mitte?  
[at the back left or right or in the middle?]

*dir*: ach so genau in der Mitte.  
[I see, exactly, in the middle.]

However, not all of the utterances in this category are formulated in this *multiple-choice* fashion. Sometimes the matcher simply adds further (spatial) aspects to the previous description, as in (12):

*dir*: ähm dann steht im rechten Zimmer an der Wand das große Bett. [uhm then there is the big bed in the room on the right at the wall]

*match*: hinten an der Wand? [in the back<sup>2</sup> at the wall?]

In other cases, the matcher simply re-formulates the spatial description so that the spatial relationship between locatum and relatum is highlighted in a different way, as in the following example (13):

*dir*: die steht da so [it stands there in such a way]

*match*: die passt da so rein?  
[it fits in there in such a way?]

**In sum.** To sum up the results of this subsection, the matcher's contributions of new spatial content in order to locate an object's position may fulfill the following functions:

- to clarify a global aspect of the current situation (using a completely new spatial description)
- to (further) specify an object's position by relating it to an(other) object already placed
- to (further) specify an object's position by suggesting a different or additional spatial term to describe the spatial relationship (in more detail)
- to disambiguate an ambiguous description by explicitly mentioning options.

#### 4 Discussion

How does the addressee (or matcher) contribute to the negotiation of object placement in joint action?

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<sup>2</sup> As Carroll (1993) points out, German speakers sometimes partition the visual field into regions; more distant positions are then referred to as "back".

In the present study we investigated the matcher's utterances with respect to the extent to which they introduced new lexical material. About half of the matcher's utterances did not contain any new lexical content; these were typically either acknowledgements or requests for expansion. Half of those utterances that did contain new lexical material concerned either the *identification* (prior to its placement) or the *orientation* of an object (after the location has been identified). Only a relatively small number of matcher utterances concerned orientation; this is somewhat surprising given that theoretically objects could be placed in many different orientations. However, in practice the participants may have assumed a standard orientation of the objects according to their expectations as to how dolls' houses should be furnished; and in fact, our arrangements in the present study did not depart from such standard expectations.

Our main interest, however, concerned the other half of those matchers' utterances that contained new lexical material, namely, those negotiating the *location* of objects. Here we determined more closely which part of the utterance was new: the spatial term, the locatum, the relatum, or any combination of these. It turned out that most utterances fell into either one of two major categories, both of which concern the suggestion of a new conceptual perspective on the current spatial scene. Matchers regularly attempted to further specify an object's position by either modifying the spatial term used to describe the position, or by relating the object to another entity that had already been placed.

Why is such an additional specification necessary, and how does the matcher succeed in suggesting spatial content in spite of the fact that only the director has precise knowledge about how the object should be placed? The spatial situation in our scenario – positioning many different objects in a fairly complex array – clearly poses a number of problems such as ambiguity, underspecification, and vagueness. Rather than passively wait for, or simply request, further information in such indeterminate cases, the matchers actively collaborated in identifying the intended location of an object in a range of ways, based on their *assumptions* about probable object locations. These may be derived from various sources, such as the actual spatial situation that is visually accessible to the participants, the previous discourse context, and default assumptions about typical arrangements of objects

in dolls' houses. The consistent setting used here is supportive of this process, as opposed to the Map Task (Anderson et al., 1991), for instance, which uses diverging maps as basis for communication, necessitating additional negotiation processes not inherent to the task itself. Paralleling the seminal findings by Clark & Wilkes-Gibbs (1986), thus, not only *referring* is a collaborative process, but also spatial locations are negotiated jointly, drawing on a well-established set of expectations and a broad range of available conceptual perspectives on the scene.

## 5 Dialogue structure

How do our findings on dialogic contributions by the matcher relate to previous findings on dialogue structure? There are a number of candidates for dialogue schemes that support categorizing our data in terms of dialogue structure. While they were developed in different contexts and for various purposes, some of the proposed categories match quite straightforwardly to our data, such as ACKNOWLEDGEMENT and REQUEST FOR EXPANSION (cf. Section 3.1 above). In Carletta et al. (1997)'s *move coding scheme* the QUERY-W move matches the disambiguation questions found in our data. The CHECK move "requests the partner to confirm information that the speaker has some reason to believe, but is not entirely sure about." (Carletta et al., 1997:3), which is close to the idea of making concrete suggestions for grounding, although they are in our data typically not represented as requests for confirmation. Clark & Wilkes-Gibbs (1986, pp. 22-24) suggest EXPANSIONS which contain a request for confirmation (of the expansion) while basically accepting the description so far, and REPLACEMENTS which reject the previous description and offer a new one. On a general level, approaches to clarification and grounding procedures found in the literature (e.g., Schlangen, 2004; Purver et al., 2003) fit to our data to a certain extent, though they are typically viewed as contributing to a REPAIR of failing communication, which seems to miss the mark in our case.<sup>3</sup> Clark's notion of SECOND-TURN REPAIR

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<sup>3</sup> Sack's notion of 'appendor question' as reported by Schegloff (1997:510f.) seems close to the phenomenon we have described for a spatial context; it is categorized by Schegloff as a form of repair initiation.

(1996:245), for instance, concerns the clarification of a particular aspect of the description. DAMSL (Allen & Core, 1997) does not have a general category of REPAIR but distinguishes between backward- and forward looking functions. The backward-looking tag HOLD is used in cases where the response to the previous utterance (which may be an instruction as in our context) is postponed pending further clarification. Crucially, this does not signal misunderstanding. As a forward-looking tag, the utterances may further be marked as INFO-REQUEST, defined as "an utterance that creates an obligation for the hearer to provide information."

As yet, none of these approaches capture the finer conceptual distinctions reflected by the usage of spatial language that we have pursued. Our aim in the long run is thus to develop operationalizable criteria for a reliable categorization of each utterance, and to account for the various kinds of principles governing dialogue contributions in spatial contexts.

## 6 Conclusions and Outlook

In this paper we have investigated the collaborative negotiation of spatial object placement in joint action in a novel naturalistic dialogue setting. Our findings show that addressees actively contribute to the dialogue by offering well-informed suggestions based on their expectations concerning how an object should be placed, specifying earlier descriptions further by suggesting a new conceptual perspective on the scene.

Future work using our dolls' house dialogue corpus will address both dialogue partners' choices of spatial language more closely for example with respect to reference frames and alignment processes, and we will investigate the degree to which features of the scenario influence the addressees' expectations, as reflected in their reactions. In a second line of research, we pursue in our project the modelling of dialogue structure within DAMSL.

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