UNDERstanding

How Infants Acquire the Meaning of UNDER and Other Spatial Relational Terms

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Introduction

We have gradually come to realize that one of the best ways to understand the complexities of mental processes is to find their origins in infancy and trace them as they develop over time.
Jean M. Mandler

The title question – How infants acquire the meanings of UNDER or other spatial relational terms – addresses both linguistic and psychological perspectives. From the linguistic perspective, there is the issue of which semantic aspects make UNDER different from other spatial relational terms in acquisition. From the psychological perspective, there is the controversy about which cognitive prerequisites are required to learn the meaning of UNDER.

In the last two decades, new research techniques have provided new results about how infants think and what their linguistic knowledge before the beginning of production includes (cf. Bowerman & Levinson, 2001). These findings bring both strands of investigation to a dialog. It is discussed which psychological abilities in thinking proceed or even induce the abilities for speaking. An overview about the interaction of language and thought development that reaches beyond a specific domain is presented in Weinert (2000). In this thesis, it is of interest how language and thought are linked in a particular domain: the domain of space.

The question of the connection between language and space has been rethought recently (Gumperz & Levinson, 1996) and has been pursued in research fields of language acquisition and cognitive development (Bowerman & Levinson, 2001). Researchers agree that if any cognitive domain has a plausible claim to a strong language-independent perceptual and cognitive organization, it is space (cf. Bowerman, 1996b: 387). This is what attracts research into this domain. If we assume that the categorization of space is language independent, the semantics for spatial terms should be motivated more by language-independent categories than by the structure of language. It is expected that investigating the meaning of spatial terms will provide insights into language-independent cognition. It seems clear that language acquisition in particular promises new results with regard to this question, and the understanding of the complexities of the mental process: finding the origins in infancy and tracing them as they develop over time (cf. Mandler, 1992).

However, even though our experience of space is of a primary nature and in referring to space we refer to concrete objects and events, it is questionable whether the way we describe them linguistically and the way we conceptualize them are converging. The questions of whether and how language is related to our knowledge of space are two of the most fundamental issues in Cognitive Linguistics. There are two different views on the relationship between the cognitive domain of space and the cognitive domain of language. Some linguists propose several types of connections between the two domains, while other linguists claim that the two domains, space and language, are independent of each other.

The starting point for the discussion is established by the order in the acquisition of prepositions that has been observed cross-linguistically and supports the idea that language and spatial reasoning are connected. According to the order that has been observed infants acquire the expressions related to IN- and ON-relations earlier than the expression for UNDER. As the order has been observed in different languages, it is plausible to assume that the order is driven more by cognitive prerequisites than the system of a specific language. To analyze this idea, it is sufficient to answer the question why UNDER occurs later than IN and ON — this makes the investigation of the order so attractive. There is already a long tradition of investigating the reason for infants' late understanding of the preposition UNDER in languages that use prepositions describing spatial relations. For this reason, the thesis is organized around previous studies, which are relevant for different aspects of the title question. Their presentation is structured by first explaining the theoretical approach or empirical study, secondly introducing selected problems in the particular theoretical view presented and thirdly discussing these with reference to other empirical findings.

What is noticeable in the most previous studies dealing with this issue from the psychological perspective, is that they disregard the linguistic problem and omit questions about the meaning of a word or the connection of a preposition with a spatial relation. In other words, studies concentrating on the question of what it means to learn a preposition often disregard the question of what it means to learn a preposition. This is probably due to a tradition in psychology of not differentiating between the semantics of words and their conceptual propositions[1] (Knauf, 1997: 121; Herrmann & Graf, 1999: 17-19). The same narrow view can be objected to research on linguistic aspects of prepositions. With regard to this question, a few linguistic approaches (e.g. Dromi, 1979) concentrate on the structure of language without including learning processes in their considerations i.e. “how do children organize and store word meanings” (Bowerman, 1977: 239). Such questions are intrinsic to the cognitive perspective on language acquisition. The main motivation for the studies presented here, therefore, is an attempt to explain infants' understanding of spatial prepositions against the background of the complex cognitive process of language acquisition. This reflects how humans perceive, act within and communicate with their environment and gain meaningful information from their experiences. Without answers to questions about infants' perception and the development of their conceptual knowledge, a coherent theory of the acquisition or understanding of language is not possible. In keeping with this, considerations and general problems from the field of cognitive development regarding the increase of conceptual knowledge will be included and discussed in the

1 ”Dahinter steht die psychologische Tradition, die Semantik von Wörtern und deren konzeptuellen Gehalt nicht voneinander zu unterscheiden [It is based on the tradition in psychology not to differentiate between the semantics of words on the one hand and their conceptual proposition on the other hand]” (Knauf, 1997: 121).

present approach.

The first chapter has the aim of introducing the research field and pointing out the linguistic complexity involved in the understanding of spatial relational terms. The problems developed in this chapter lead to the theoretical background about the semantics of prepositions. The different theories presented highlight the correlation between spatial terms and concepts of spatial relations. In accordance with these, different semantic tasks are set up for children who are learning to understand prepositions. The hypotheses developed are examined in the empirical sections of this thesis.

The semantic structure of spatial prepositions is focussed on in chapter two. Complementing developmental studies about infants' acquisition of spatial prepositions with research about preposition use in adults is designed to fill the gap between linguistic and developmental studies about understanding of spatial relational terms. While developmental studies address cognitive requirements and input constraints, the research about the semantics of prepositions in adults gives prominence to the content that the category structure of preposition entails. In this sense, the semantic proposition the children have to cope with is focussed in this chapter. Even though each of the aspects in understanding prepositions described in chapter 2 are empirically motivated, it seems that the order of prepositions cannot be ascribed to a single factor (frequency, canonical knowledge, etc.). Rather, a complex account of the issue is attempted based on several semantic aspects in understanding such as the interplay of perceptual and functional features of objects. Moreover, situative aspects are brought in as well such as different contexts, situation and the ability of attention. All of these aspects form a framework for the meaning of prepositions and their effect will be analyzed in the experiments.

In order to handle this complex issue methodologically and relate it to the observed order in the acquisition of spatial prepositions, two studies were conducted. The first experimental section, presented in chapter 3, concerns the content of prepositions. Pursuing linguistic interests in the semantic structure of a preposition, the chapter focusses on infants' understanding of the Polish preposition NA [ON]. What motivated this study was the fact that there is scarcely any semantic research about infants' understanding of 'known' prepositions, such as the preposition ON, not to mention semantic analyses of the meaning infants assign to a spatial relational term. In this thesis, therefore, an analysis is made of what infants know about this NA [ON]-preposition. The first experimental study is dedicated to the question of what infants know about spatial relations before they can name them, and how this knowledge helps in understanding prepositions. In other words, it addresses the context-dependent aspects for the development of meaning.

The Polish language was chosen as the language of study, because in this language system, spatial relations are marked with the aid of a preposition and, depending on the object's gender, a case inflection on the noun. It will, therefore, be considered whether linguistic form is helpful for children at the age of 20 to 26 months and whether they receive any specific information through it. The system of spatial prepositions in Polish and further methodological features for these two experiments will be explained in this third chapter.

Both experiments (chapter 3 and 5) follow a psycholinguistic setup for language understanding within a controlled observation study.

> Controlled observation is expected to yield causal information through the experimenter's manipulation of an independent variable information which cannot be provided definitely by observation alone. In experiments involving comprehension or judgment, the dependent variable has usually been the child's response to a stimulus provided by the researcher (Bennett-Kastor, 1988: 28).

In the test, infants' understanding of instructions containing spatial prepositions was studied. Such a methodology allows the learners to act naturally on objects and the researcher to observe their linguistic competence in this communicative situation. It is especially appropriate in the case of the theoretical background, against which linguistic competence is viewed as a part of social behavior (see also section 3.7) — as it is central for this thesis. This method also allows one to extend the data beyond the children's responses to a stimulus and to provide qualitative observations about children's comprehension of the situation.

An analysis of qualitative results of this type is undertaken at the end of the third chapter. There, selected observations of infants' behavior in the first study will be discussed within the framework of Cognitive Grammar (Langacker, 1987, 1991). The role of strategies supporting infants' understanding will be investigated against the background of infants' early conceptual knowledge about space. The analysis within the framework of Cognitive Grammar will show that strategies observed in different experimental studies by, for example, Clark (1973) or Sinha (1982) are affiliated with each other and are engaged in situated learning involving a bundle of relevant aspects. Afterwards, the question of which semantic aspects are involved in understanding linguistic information at this early age will be discussed. The aim of the conclusion is to show that the perception and behavior of learners is influenced by the culture and by language, which transports social information. However, the knowledge the learners apply to solving problems is grounded in their cognitive abilities such as perceptual analysis, change of attention and profiling.

In the second experimental study, the process of understanding a spatial preposition is investigated. Chapter 4 considers different theoretical approaches to the question of why spatial relational terms for UNDER are acquired later than terms for IN and ON. Once again, the complexity of the learning process is discussed, pointing to the contribution of different semantic and cognitive factors. What establishes a theoretical basis for the experimental approach to the later understanding of UNDER, are ideas presented in Thiel (1985), Vandeloise (1991) and Sinha, Thorseng, Hayashi and Plunkett (1999: 99). The authors suggest that some spatial relations may be cognitively or semantically basic. Thiel (1985) assumes, moreover, that the UNDER-preposition is learned with the aid of the IN- and ON-prepositions. However, the assumption of basic relations such as IN and ON for the acquisition of UNDER raises problems of a twofold nature: a methodological one (about how to observe the process of building up the meaning for UNDER) and a theoretical one about its ontology.

The training study presented in chapter 5 is an experimental approach to this issue and focusses on the acquisition of understanding the Polish preposition POD [UNDER]. The training study aims to investigate how infants develop their linguistic competence in understanding prepositions and to what extent situational cues contribute to the learning process. The design of the training study considers the adult's input to the child. The results of this study reflect the infants' performance in the pretest and test that resulted from the training sessions. The accompanying learning processes in their understanding of the preposition POD and relation UNDER are then analyzed. This analysis establishes a basis for an answer to the question of why is UNDER more difficult, which attempts to shed more light on the order of spatial prepositions in acquisition.

Chapter 6 unites the results and discussions of the two experiments presented and summarizes the situative view on semantics. From this perspective, criteria for modelling understanding processes in cognitive science are developed. Not only the transition from perceptual to conceptual knowledge will be considered but also the nature of concepts and factors contributing to the meaning.

Since only two of the many possible experimental approaches to studying the development of meaning in the embodied and situated understanding process are presented in this proposal, further possible experimental steps are suggested.