Chapter I

The Semantic Basis of Understanding

The ability of language acquisition contains the abilities of language understanding and production. For both abilities, the meaning of a linguistic term is relevant. The studies on language acquisition emphasize that "the patterns of production and comprehension are similar, with comprehension almost always ahead of production" (Johnston & Slobin, 1979: 533). Therefore, in pursuing the origin of meaning for UNDER and other spatial relational terms, infants' ability of understanding will be investigated. Concerning the terminology, the term acquisition is used globally here. It relates to language perception, understanding and production. When one of these individual processes is meant, it will be made explicit.

The aim of the first chapter is to introduce to the processes involved in the complex ability of understanding spatial relational terms. The problems developed here 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. At the center of this chapter is the question of which cognitive prerequisites are required to learn the meaning of spatial relational terms.

The starting point for a discussion about the acquisition of the semantics of spatial relational terms are selected developmental studies which point explicitly to a correlation between language and spatial reasoning. This correlation is revealed in the order of spatial prepositions in acquisition: from IN, ON to UNDER. Then, according to four different perspectives on the connection between spatial concepts and meanings for spatial terms four different semantic tasks will be presented. These tasks form hypotheses for the acquisition of meaning. In the empirical section of this thesis, it will be examined which task is regarded by children.

I.I From IN, ON to UNDER

The connection of language and space in acquisition is commonly associated with the acquisition of prepositions. In the literature, a wide range of terms exist to classify words for spatial relations. The term locative prepositions which is commonly used is purposely avoided here, because it is limited to static relations. Spatial prepositions, however, can also refer to dynamic relations. Besides of the term spatial prepositions, proposed by Cienki (1989: 3), the term "spatial relational terms" (Feist, 2000) will be preferred in this thesis. In

contrast to Cienki's term, this alternative is more general and covers other morphological possibilities for expressing spatial relations since these are not expressed by means of prepositions in all languages. Furthermore, the chosen term encompasses for more than the more restricted word class of prepositions, whose status and existence has recently been questioned in Hallan (2001).

The choice of spatial relational terms connected with the UNDER-relation as the focus of this thesis stems from a long tradition in investigations of language for space in developmental studies. In this tradition, the spatial expressions related to the relations IN, ON and UNDER in particular have been investigated cross-linguistically in empirical studies of languages such as English (Clark, 1973; Wilcox & Palermo, 1974; Grieve, Hoogenraad & Murray, 1977), Hebrew (Dromi, 1979; Halpern, Corrigan & Aviezer,1983), German (Paprotté, 1979; Ahnert, Klix & Schmidt, 1980; Thiel, 1985), and Polish (see section 3.2). In these studies, it has been observed that infants understand requests related to IN and ON earlier than requests related to UNDER. Such an order (from IN, ON to UNDER) has also been supported cross-linguistically in studies about language production. The findings indicate that the spatial prepositions related to IN- and ON-relations are produced earlier by children than UNDER. This has been shown for English (Johnston & Slobin, 1979; Sinha, Thorseng, Hayashi & Plunkett, 1999), German (Grimm, 1975), Serbo-Croatian and Turkish (Johnston & Slobin, 1979), Italian (Parisi & Antinucci, 1970; Johnston & Slobin, 1979), Hebrew (Dromi, 1979; Halpern, Corrigan & Aviezer,1983), Flemish (van Geert, 1985), Swedish (Zlatev, 1997), Danish and Japanese (Sinha, Thorseng, Hayashi & Plunkett, 1999). In addition to languages just listed, J. Johnston (1988) mentions studies done for Portuguese, Russian and Turkish.

In studies about the advanced acquisition of spatial terms, there are also indications for further continuity in the order of development of spatial prepositions. Accordingly, IN, ON, UNDER and NEXT TO precede BETWEEN and IN BACK OF/ IN FRONT OF (e.g. Johnston, 1988: 197 also Bowerman & Choi, 2001: 478).

The fact that "spatial words emerge over a long period of time in a relatively consistent order, both within children learning the same language and across children learning different languages" (Bowerman & Choi, 2001: 478) leads to the idea of a correspondence between spatial concepts and their expressions. In the case of spatial relational terms, it is assumed that the spatial preposition marks a child's knowledge about an appropriate spatial relation (e.g. Sinha, Thorseng, Hayashi & Plunkett, 1999: 99).

The proposition that there is a correspondence between spatial concepts and their expression was also found by Johnston and Slobin (1979: 529), who established that the sequence in acquisition of spatial terms interacts with the order of emergence of spatial concepts. A hypothesis that accounts for this correspondence is that "as new spatial concepts mature nonlinguistically, children discover the forms that are used to express them in their local language" (Bowerman & Choi, 2001: 478). The study by Halpern, Corrigan and Aviezer (1983) provides supporting data for this correlation. The authors compared infants'

performance in non-verbal cognitive tasks such as spontaneous construction, structured imposed-order constructions and imitations (ibid: 157) with their performance in linguistic comprehension and the production of IN, ON and UNDER locatives. As they put it, the "discussion concludes that the same underlying skills are necessary for the solution of both the cognitive and language tasks" (ibid: 153).

In keeping with the aforementioned assumption, spatial prepositions and therefore the concepts of the correlated spatial relations seem to be acquired in a temporal order: a child first learns the preposition IN, then ON and, much later, UNDER. The order gives an initial indication about the answer to the question posed in the title, i.e. how infants acquire the meaning of UNDER and other spatial relational terms.

However, despite the cross-linguistic conformance, the phenomenon of the order in the acquisition of spatial prepositions is not straightforward – nor is it as universal – as the findings mentioned above seem to suggest. There are studies casting some important doubts on the categorical order-phenomenon and indicating individual differences in the acquisition of spatial relational terms (Zlatev, 1997: 247). Moreover, the results of the study by Choi and Bowerman (1991) suggest that there are also language-specific differences in the acquisition of spatial prepositions. In Korean, for example, infants acquire spatial relations in categories other than the English IN and ON, which suggests that there is no direct connection between perceiving space and talking about it. Last of all, there are indications that prepositions are used initially in their non-spatial meaning (van Geert, 1985: 19, Tomasello, 1987: 86; Hallan, 2001) like phrasal verbs 'come on' (Hallan, 2001: 109). This contradicts the view that infants have to acquire the spatial meaning of a preposition first, and casts some doubts on the possibility of investigating infants' knowledge about spatial relations by looking at their acquisition of spatial prepositions.

Obviously, what the mentioned objections are pointing to critically is the correlation between spatial relations and linguistics terms in a one-to-one manner. In this sense, the explanation of the order of spatial prepositions in the acquisition ends with a question about what prerequisites are necessary in early language development. To put the question in another way, how children's prelinguistic knowledge gets translated into lexical terms, and what a young child brings to language learning that makes such translations possible (see Nelson, 1974: 268). At this point, Paprotté (1979) appeals to include all factors in the process of acquisition to achieve a theory of word understanding. Similarly, Bowerman (1977: 244) points out that only a "sufficiently broad and flexible" theory can explain the interplay of language and child's cognition.

I.2 Spatial Concepts versus spatial meanings

Analyzing the connection between spacial concepts and spatial meaning, H. Clark (1973: 28) introduces the term P-space for perceptual space and L-space for concepts of space

underlying the spatial terms. A first look at these different spaces produces a skeptical attitude about a possible connection since the purposes of language seem to differ from the purposes for which we represent space. While L-space mirrors the contours of our thought and provides symbols for communication, P-space mirrors the contours of our external environment and provides information for us to reach, search and navigate (cf. Chatterjee, 2001: 55). Furthermore, there are some neuroanatomical observations indicating that language and spatial reasoning are segregated, as they are mediated primarily by different cerebral hemispheres (ibid).

However, there are also suggestions that we perceive spatial scenes in schematic forms, which, in turn, correspond to linguistic counterparts in the form of meaning primitives. Language and space are therefore likely to converge at the abstract levels of conceptual structures and spatial schemas (Chatterjee, 2001: 57). Talmy (1996: 267) proposes that spatial schemas are 'boiled down' features of a spatial scene and consist of simple geometric forms such as points, lines and planes. Thus, it seems likely that the language of space closely mirrors the contours of nonlinguistic spatial understanding.

In Cognitive Linguistics, especially in Langacker's Cognitive Grammar (also called space grammar), it is claimed that grammatical structures are "inherently symbolic, providing for the structuring and conventional symbolization of conceptual content" (1991: 1). When using a locative preposition, it is assumed that the speaker marks the understanding of a spatial relation (cf. Vorwerg & Rickheit, 2000: 9) and the understanding of a preposition means the appropriate spatial relation is being processed. Grabowski (1999: 86) explains that the meaning of spatial prepositions needed for its use affects the nature of spatial relations; the preposition, for example, BEHIND expresses therefore the BEHIND-relation. In Linguistics, it is also assumed that in understanding a word such as a spatial preposition, the hearer needs the appropriate "lexical competence" (Parisi & Antinucci, 1970: 197) – also related to as: lexical knowledge (see section 3.6) . In other words, the hearer should have knowledge of the meaning of this word, which specifies the affiliated spatial relation. The correlated relation plays, therefore, an important role in processing a spatial preposition. In explanations of this role within Cognitive Linguistics, different procedural stages in the processing of information are commonly considered (cf. Schwarz, 1992: 19). The following chain (see Figure 1) depicts these stages for the ON-relation (cf. also Carstensen, 2001: 5):

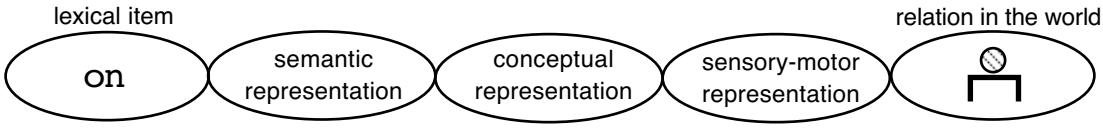

Figure 1: Possible procedural stages in processing a spatial relation

In accordance with this chain, the complex ability of language use initially involves sensory-motor representations, which provide impressions about the perceived world (or more concretely, about the perceived relation) for cognition. Conceptual representations, in turn, store these experiences and make them accessible to episodic knowledge, i.e. the knowledge about how to act in that world. Semantic representations are responsible for the symbolic use of these conceptual representations, and lexical items allow communication. In a semantic analysis of a spatial preposition, especially the connection of conceptual to semantical representations is focussed.

Some researchers (e.g. Gentner, 1982; Gentner & Boroditsky, 2001) differentiate between the conceptualization of a spatial relation corresponding to a preposition on the one hand and an object corresponding to the acquisition of nouns on the other hand. The origin of the difference is that in contrast to nouns, prepositions belong to a closed-class category of words and perform relational functions (Gentner & Boroditsky, 2001: 216). Furthermore, they are linguistically embedded, i.e. "their meanings are invented or shaped by language to a greater degree than is the case for concrete nouns" (ibid). Thus, for a child learning a language, "two different separate semantic tasks" (Slobin, 2001: 407) are presented depending on whether the child is learning a noun or a preposition. Slobin (2001), however, objects to this differentiation, because it suggests that the mental lexicon consists of two classes of items, with two distinct kinds of meaning. He makes the criticism that the theorists representing this view "have erred in attributing the origins of structure to the mind of the child, rather than to the interpersonal communicative and cognitive processes that everywhere and always shape language in its peculiar expression of content and relation" (Slobin, 2001: 407).[1] In addition, the findings from a study recently conducted by Meints, Plunkett, Harris and Dimmock (to appear) suggest an important caveat to assuming different learning strategies for object words and spatial prepositions. The behavior of children in preferential looking tasks displayed similar typicality effects in understanding both terms for objects and relations.

I.3 Infants' early conceptual knowledge

In accordance with the processing chain shown above (see Figure 1), an important condition for understanding a spatial relational term is having a conceptual representation for the spatial relation in the world. In cognitive development theories, the emergence of abstract, conceptual categorizes is explained by means of language-based knowledge (Mandler, 1992: 589; Madole & Oakes, 1999: 278). Consequently, before starting to consider how children acquire the meaning for spatial relational terms, it is essential to ask whether children who are beginning to understand terms like IN and ON have concepts for these relations or

[1] In support of Slobin's view see also the argumentation by Tomasello (1987).

whether they just react to perceptual stimuli. Generally, from the developmental perspective, it is not clear how infants manage the transition from pragmatic-perceptual or sensorimotor to linguistic behavior grounded in the conceptual system. What seems clear is that conceptual representation is needed for language.

In cognitive semantics, categorization, or conceptualization, is taken to be a basic mental process, which enables us to cope with our experiences in a complex environment. It is one of the most fundamental processes in human cognition, serving the dual functions of information reduction and the support of inductive inferences (Madole & Oakes, 1999: 264). What is regarded as crucial in this process are concepts. Semantic structures are viewed as a partial process of conceptualization (cf. Langacker, 1991; Tomasello, 2000a). To achieve a complete description of the meaning of a word it is, therefore, necessary to describe all the cognitive areas that are taken for granted in this meaning. However, in linguistics not much is known about how concepts work and the evidence used comes from introspection.

> I argue that introspective linguistic evidence does not determine mental representation to as high a degree as appears to be commonly assumed. [...] the "right" model of mental representation cannot be determined by introspective linguistic evidence alone. Introspective linguistic evidence can limit the range of alternative mental representations to a set of possibilities. [...] Only evidence beyond introspection, such as usage date or psycholinguistic experimentation, might be able to narrow this set of possibilities to a single plausible mode (Croft, 1998: 152).

Tomasello (2000a: 77) suggests that, if we are interested in people's "stored linguistic experience", and how they use this experience in acts of linguistic communication, it would seem relevant to systematically investigate the processes, by which linguistic experience is built up and used in human ontogeny.

In the extensive literature on the topic, researchers agree that concepts are established by sensorimotoric experiences and are abstracted further in the course of conceptualization. Through this abstraction, more complex concepts arise that do not only deal with physical experiences, even if they are ultimately founded on them. Regier (1996: 32) even notices that the perceptual system restricts the possibility of conceptualization. For language acquisition, however, it is hotly debated when the abstraction to concepts takes place.

Piaget (1993[2] [1971]) argues that the conceptual knowledge of a child begins with the end of her or his sensorimotor period. Consequently, Piaget distinguishes between the level of perception and the intellectual level (Piaget, 1993[2]: 21). Similarly, in adult research, Knauf (1997: 115) differentiates between functional episodic knowledge, which is strongly influenced by contextual and situational cues and conceptual knowledge, which is seen as a competence for paying attention to linguistic symbols and for detaching them from situated and contextual information if necessary. The semantic, conceptual or terminologic knowledge is an abstraction from individual concrete experiences and the individual units of this exclusively meaning oriented knowledge are known as concepts, notions or categories (ibid).

Johnston (1988) appeals for a preservation of this distinction between sensorimotor thought and representational thought "if we wish to understand mental development" (1988: 201).

> The sensorimotor thought is viewed as presentational, successive, and non-reflective; the infant reacts to objects-of-the-moment without anticipation or contemplation. Representational thought, on the other hand, is free of space and time, reasons and reflects on imaginary states, and operates in a world of abstracted relations quite apart from their embodiment in any particular object or event (Johnston, 1988: 200).

The differentiation, however, requires a transition for explaining the development. In Piaget's theory, an abrupt transition from the perceptual to the intellectual level is read. It arises naturally from Piaget's conception how language acquisition and the accompanying development of lexical knowledge begin; as in order to use language, the child has to develop conceptual knowledge at the end of sensorimotoric period. For Mandler this conception of the process is too sudden — "a kind of Copernican revolution" (Mandler, 1998: 278). She believes it lacks psychological plausibility, as the development from sensorimotor to conceptual knowledge in the cognitive development is far more gradual and probably starts much earlier than Piaget supposes. In her studies with McDonough (cf. Mandler & McDonough, 1993, 1996, 1997, 1998), the findings suggest that babies at the age of nine months make inductive generalizations on the basis of global and abstract concepts like "animate", "inanimate", "self-motion", "caused-motion" (Mandler, 1998: 275). These findings are in line with studies about conceptual object knowledge in very young infants, which were carried out with infants as young as two to four months of age (e.g. Baillargeon, 1995) and contradict the polarization suggested above.

Also with regard to the process of language acquisition containing both, production and understanding, the polarization between perceptual and conceptual knowledge seems implausible. Even for understanding, infants need meanings. The understanding of language starts, however, much earlier than the production. It is therefore not clear why infants require a different kind of knowledge for production while they cope with a more 'simple' knowledge in understanding. Hence, the presumption of a progression, which excludes the possibility of a qualitative change is made for early cognitive development[2] (cf., e.g., Needham & Baillargeon, 1993; Spelke & van de Walle,1993; S. Johnson, 1998 for the development of spatial concepts). That it is more a progression than an abrupt change is also assumed for the development of semantic and lexical competence. Menyuk (2000) explains that progress in semantic development is possible due to the altering nature of the underlying conceptual structures: "It is the changeable nature of conceptual structures that establish utterances and mark semantic development. [Es ist die sich verändernde Natur der konzeptuellen Strukturen, die den Äußerungen zugrunde zu liegen scheinen, die die

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2 The issue of this conceptual progression is a part of an overall debate about the nature of the relationship between perceptual and conceptual knowledge, i.e. in what way perceptual information contributes to conceptual knowledge (cf. Jones & Smith, 1993; Madole & Oakes, 1999).

semantische Entwicklung markiert]" (Menyuk, 2000: 182). In learning spatial prepositions, Gasser, Colunga and Smith (1999) report developmental evidence that "there is not some magical point in development at which children become able to use relations".

I.4 Infants' early linguistic knowledge

It was argued that infants display conceptual knowledge very early. However, not only conceptualization induces the establishment of meanings, Bowerman (1996b) suggests that it is also the language system, which determines the way spatial meanings are formed. The correlation of linguistic and cognitive factors contributing to the acquisition of spatial relational terms is discussed extensively in Johnston and Slobin (1979). In this study, Johnston and Slobin do not restrict the understanding of language to merely perceiving words, i.e. to perceptual knowledge. They admit, moreover, the possibility of a certain degree of interaction between cognitive development and linguistic factors (Johnston & Slobin, 1979: 529). The term linguistic factors refers to the "principles for the construction of language" as a system (Slobin, 1985: 1159). These principles, in turn, determine the "linguistic complexity" of a morpheme (Johnston & Slobin, 1979: 541).

How linguistic factors may contribute to the acquisition of spatial prepositions is demonstrated in Slobin's (1973) study of infants learning two languages. The infants studied were acquiring both Hungarian and Serbo-Croatian. In Hungarian, spatial relations are expressed by means of noun suffixes, in Serbo-Croatian by means of prepositions and inflection of cases. Slobin found that the spatial relational terms are mastered earlier by children in Hungarian than in Serbo-Croatian: the bilingual children could already express particular relations in Hungarian, even though a look at their linguistic output in Serbo-Croatian would have given the impression that they had not yet developed representations for them. These results suggest that a child's conception of spatial relations does not necessarily manifest itself in her or his language understanding or production. Instead, Serbo-Croatian seems to be linguistically more complex than Hungarian for expressing spatial relations (Slobin, 1973: 188). According to Slobin, infants learning a language system where spatial relations are expressed by means of prepositions have to cope with a more difficult task. Slobin explains the difficulty in terms of "operating principles for the construction of language" (Slobin, 1985: 1159). One of these addresses children's attention to the end of units: "Pay attention to the last syllable of an extracted speech unit. Store it separately and also in relation to the unit with which it occurs" (Slobin, 1985: 1251). When in a language like Hungarian, spatial relations are marked by means of noun suffixes, it is easier for infants to perceive them and to map the specific form onto an appropriate situation. In line with this operating principle, the spatial relations markers are more salient and therefore easier to learn than in Serbo-Croatian, where spatial relations are expressed by means of prepositions, and there are no operating principles helping to attract the child's attention to them. This explanation is further supported by evidence from monolingual children learning Polish. The Polish language

system is comparable to the system of Serbo-Croatian in expressing spatial relations. In Polish, the case inflection that accompanies the preposition marking a particular spatial relation is acquired before the acquisition of the preposition itself (cf. Slobin, 1973: 188). Since infants can mark spatial relations by means of inflection of cases earlier, it can be presumed that the difficulty in acquisition of prepositions is more due to a child's difficulty in the production of language and less to her or his understanding of spatial relations — this idea will be tested in the first study with Polish speaking infants described in chapter 3.

Since the contribution of linguistic factors cannot be denied (see chapter 4 for details), the connection between cognitive development and language acquisition is not presented in a direct way in Johnston and Slobin (1979; cf. also Grimm, 1975: 118). Instead, comparing data of spatial relational terms used by children speaking English, Italian, Serbo-Coratian and Turkish, the authors conclude:

> Wherever conceptual complexity fails to predict actual order of acquisition, we find some pocket of relative LINGUISTIC difficulty. In English and Italian, for example, although $BACK_f$ [for reference objects with inherent fronts and backs — ibid: 530] and $FRONT_f$ are conceptually easier than BETWEEN, they incorporate greater linguistic complexity. [...] Wherever LINGUISTIC complexity fails to predict actual order of acquisition, we can argue for relative CONCEPTUAL complexity. In Turkish and Serbo-Croatian, although the lexemes for BETWEEN are relatively easy linguistically, they require greater conceptual sophistication (Johnston and Slobin, 1979: 541).

Although Johnston and Slobin (1979; cf. also Slobin, 1973: 182-183) initially discuss conceptual and linguistic factors as though they operate independently, they admit in the discussion of their results that "the effect of linguistic parameters might instead be contingent upon conceptual level of development" (Johnston & Slobin, 1979: 542). Johnston and Slobin observe in their study that the correct use of a spatial relational term was frequently preceded by substitutions and circumlocutions using known linguistic forms. Accordingly, a new form seems to be acquired at a time when the "child already has a number of locative terms, making it possible to observe the expression of a semantic notion in the 'waiting room' before the appropriate new form emerges" (Johnston & Slobin, 1979: 543).

The notion of waiting room provides a metaphor, in which the linguistic factors merge with non-linguistic factors in understanding spatial prepositions. It is an attempt to explain the interaction between linguistic factors and cognitive development as a basis for language acquisition. According to this metaphor, "each linguistic form has its own waiting room" (Johnston & Slobin, 1979: 544). When a child discerns, primarily on non-linguistic grounds, the existence of a given locative notion, she or he will 'receive' the key to the entry door. "The entry is thus determined by conceptual acquisition of the sort generally referred to as COGNITIVE development" (Johnston & Slobin, 1979: 544). The child therefore has to figure out a meaning for expressing the concept in 'waiting' (e.g. the corresponding spatial relation) in the language she or he is learning. Only then will the child use this expression (e.g the preposition UNDER).

The waiting room metaphor also gives an impression about the nature of the cognitive prerequisites infants need to develop for understanding an underlying spatial notion. To formulate it in Bowerman and Levinson's (2001: 3) words: "[i]f children display knowledge of the relevant concepts long before they display a corresponding grasp of the language that expresses them, then the concepts would appear to be independent of language". According to this view, the phenomenon that UNDER is acquired later than IN and ON can be explained by either cognitive development or linguistic factors. In the former case, the locative UNDER is in the waiting room while IN and ON have already left it. The concept needed for UNDER seems, therefore, to be more complicated. With regard to linguistic factors, on the other hand, various characteristics of adult use make the acquisition of the morpheme difficult for children (see chapter 4 for more details).

Tomasello (1987) argues against this "cognitive hypothesis" (ibid: 90). He claims that, if there is a waiting room for UNDER, there should also be a waiting room for the opposite relation OVER. In his study, he observes that several prepositions designating spatial concepts are acquired later than those designated by the corresponding spatial oppositions, for example, OVER versus UNDER. These findings raise a justified question about why concepts for OVER should be different in their complexity (and the waiting rooms take different time) than for the opposite. As Tomasello (1987: 90) puts it: "if the concepts are indeed no more complex than those of the spatial oppositions, their relatively late acquisition must be explained in other than cognitive terms".

To support his argument, Tomasello points to the age-period of the observed child, in which the spatial oppositions were initially used as prepositions. The child omitted, however, all of the later learned prepositions designating non-spatial relations from appropriate sentences.

> Over was not once used in a truly prepositional sense to designate 'above'. Under, on the other hand, was used in the sense of 'below' (and without here) soon after initial use as a simple location word (Tomasello, 1987: 86).

Tomasello (1987) proposes, therefore, another hypothesis for the developmental priority of particular spatial oppositions. He mentions that "[w]ithout exception, the spatial oppositions were initially used by adults either holophrastically or in highly stressed and salient sentence positions e.g. do you want up /down /in /out?" (Tomasello, 1987: 91). Tomasello (2000a: 65) defines a holophrase as a "single linguistic symbol functioning as a whole utterance". Given that the possibility exists that infants learn some expressions first holophrastically and then prepositionally, i.e. they learn them "as action or location words" (Tomasello, 1987: 91), the 'waiting room' metaphor does not seem to capture every developmental phenomenon in language acquisition. The way children use expressions is thus "not so much due to the nature of underlying concepts, but rather to the way adults around her used these words" (ibid: 92).

For this reason, Tomasello (ibid) focuses on the influence of "linguistic factors" such as synonymity and homonymity and social processes on the developmental order. In this way,

his discussion highlights the complexity of the process of language acquisition as well as the difficulties involved in presenting a plausible model of the processing of linguistic information from the child's point of view. Tomasello's (1987) criticism of cognitive approaches to investigating the reason for the observed order in the acquisition of spatial relational terms casts some doubts on the role a concept plays in understanding a corresponding word. Tomasello's (1987) arguments also involve rethinking the correlation between the concepts of spatial relations and the words for them, since his data argue against a one-to-one correlation and emphasize that learning to speak is a social act.

The above discussion about the nature of children's concepts for spatial relations raises questions about the correlation between spatial relations and the linguistic terms for them. It also casts some doubts on whether children are required to map words on concepts of spatial relations in a one-to-one manner. In this sense, the explanation for the order of spatial prepositions in acquisition ends with a question about the semantic prerequisites in early language development. These will be considered in the next section in detail.

I.5 Connection between language for space and spatial reasoning

In investigating the connection between spatial concepts and spatial relational terms one can orientate oneself along two general different views on how input information is organized. Knauf (1997: 119) distinguishes between two views on semantics[3] in cognitive linguistics: "one-level [Ein-Ebenen]" versus "two-level semantics [Zwei-Ebenen-Semantik]". The former is termed holistic and, according to Schwarz (1992: 18), is represented in the works of, for example, Langacker (1987), Lakoff (1987) and M. Johnson (1987). The latter, termed modular, is represented by, for example, Bierwisch (1996). Based on these two views, however, two further extreme positions are discussed in studies about the acquisition of the meaning of spatial terms and the concept of spatial relations. Figure 2 depicts the possible views.

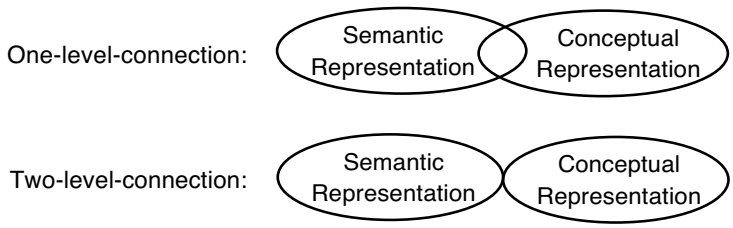

Figure 2: Levels between language and thinking

[3] Even though Knauf regards the choice between these two semantics views as problematic, he does not suggest any other resort.

Whereas in the one level-connection, an interaction between the semantic and conceptual representations is implied, in the two-level connection, they are independent and viewed as different levels (see Figure 2).

In the following, the different views on this connection will be discussed with regard to the understanding of locatives. Starting with an explanation of the first view, the semantic task for a child acquiring a spatial relational term will be described, followed by a discussion of critical points and problems resulting from this view.

I.5.1 One-level-connection

In the holistic semantic theory or one-level-semantics, there is a direct connection between spatial concepts and spatial relational terms. The theory claims that by investigating the meaning of a preposition, one can gain insight into concepts of space and the organization of mind. In one-level-semantics, language is not considered as an autonomous system. Instead, it "is an integral part of human cognition" (Langacker, 1987: 12). Since there is a direct correspondence between cognitive structures and linguistic terms (cf. Knauf, 1997: 119), linguistic knowledge can be explained within the principles of cognition, and semantic representation coincides with conceptual representation:

> Bedeutungen fallen mit den konzeptuellen Einheiten zusammen, in denen das allgemeine und das spezifische Wissen der Sprecher repräsentiert wird. Semantische Einheiten sind Bestandteile kognitiver Domänen, d.h. sie sind eingebunden in komplexe kognitive Strukturen, die Wissen über die Welt in geordneten Zusammenhängen abbilden (Schwarz, 1992: 18).[4]

The semantic basis in this view is "event schematization" (Sinha, to appear). This schematic categorization of events rests on the fact that Cognitive Grammar associates semantic categories with mental gestalts embedded in Gestalt psychology (Zielinsky-Wibbbelt, 1993: 4). A meaning cannot be defined by necessary and sufficient conditions exclusively, as it depends on the pragmatic conditions of the respective situation and may vary or change over time (ibid). In this view, "semantics and pragmatics have turned out to be inseparable" (Zielinsky-Wibbelt, 1993: 3). What constrains a particular meaning – in other words, the means by which it becomes stable for communication purposes – is the context (ibid: 4). Therefore, we cannot explore the meaning of a word if we neglect to consider how meaning develops as something "humanly relevant" (ibid: 4).

In the holistic view, a complex word meaning can be divided into simpler meaning levels. The basic meaning level is connected to human spatial perception and plays – according to the Metaphor Theory by Lakoff and M. Johnson (1980) – a crucial role when humans cope with a

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4 "Meanings coincide with conceptual units, in which the general and specific knowledge of a speaker is represented. Semantic units are parts of cognitive domains, i.e. they are embedded in complex cognitive structures, which reproduce the knowledge about the world in sorted coherences".

complex reality, i.e. they structure abstract or vague experiences that are difficult to grasp by the use of concrete, elementary and physical experiences, thus making them concrete and rationally disposable. To assimilate concrete experiences conceptually, humans process them in the form of patterns and schemas. These 'packages' of knowledge are termed image schemas[5].

> Image schemas can generally be defined as dynamic analog representations of spatial relations and movements in space. Even though image schemas are derived from perceptual and motor processes, they are not themselves sensorimotor processes. [...] image schemas are imaginative and nonpropositional in nature and operate as organizing structures of experience at the level of bodily perception and movement. (Gibbs & Colston, 1995: 349)

The differences with respect to other representational formats can best be displayed by summarizing what image schemas are (see Table 3; cf. Mandler, 1992: 591).

Table 1: Main properties of image schemas

Analog	Spatially structured representations
Dynamic	Represent continuous change in location, such as an object moving along a path
Non-propositional	Their continuous as opposed to discrete nature means that they are not propositional in character
Abstracted	Although formed from the same type of information used in general perception, they eliminate most details of the spatial array that is processed during ordinary perception
Redescribed	Use a different vocabulary; the process of redescription proceeds unconsciously
Multi-combined	Multiple image-schemas can combine to form more complex concepts such as 'animal', which is intricate because it involves more than one meaning.

More concretely, an image schema emerges in forms with labels such as CONTAINMENT, PATH, FORCE, PART-WHOLE, etc. that are thought to be derived from perceptual structures. For M. Johnson (1987: 21), the meaning of, for example, an IN- preposition is based on IN- and OUT-relations which, in turn, emerge from the "experience of physical containment". One can compare this experience to a package containing several parts. A package such as

5 One can find different plural forms of the term "image schema" in the literature like "image schemata" (M. Johnson, 1987), "image-schemas" (Mandler, 1992), "image schemas" (Gibbs & Colston, 1995). For this thesis, it was decided to follow the plural form used by Gibbs and Colston because it has become the most popular and differs from the term "schemata" used in psychology.

CONTAINMENT contains experiences like "separation, differentiation and enclosure, which implies restriction and limitation" (M. Johnson, 1987: 22). These experiences are basic and schematic for typical elements like IN- / OUT-relations. In other words, activities like 'separating something' or states of 'being bounded' create the basis for the IN- / OUT-relation.

From a developmental perspective, Mandler (1992; 1996) also uses the term image schema to refer to the first step towards meaning in the process of conceptualization in the development of the human mind. In this sense, the notion is not comparable to Piaget's notion of sensorimotor schemata. Moreover, the image schemas "form, in effect, a set of primitive meanings. (Primitive in this sense means foundational; it does not mean that image schemas are atomic, unitary, or without structure.)" (Mandler, 1992: 591). In keeping with results from studies by Mandler and McDonough (1993; 1997; 1998), the first meaning forms are seen as independent of language and emerge from the selective attentive registration of simplified perceptual (spatial) information (Mandler, 1999: 305; 2000b: 69). This registration process, called perceptual analysis[6] (Mandler, 1992: 589; 1997: 173), represents the beginning of the child's conceptual knowledge. The perceptual analysis is viewed against the background of the embodiment of human beings, which in turn is linked to the assumption that the conceptual system is grounded in the perceptual one. What establishes a base for the baby's attention are objects and their movements. According to Mandler's theory (1992) these events are eventually analyzed and transferred (through perceptual analysis) to conceptual meanings.

> Moving objects are the basis of events, which is what infants attend to, and, according to my theory, it is attended events that get analyzed into the first conceptual meaning. [...] Understanding events is absolutely central to conceptual life, and it would be surprising indeed if even infants did not have the capacity to generalize across them (Mandler, 1999: 305).

Even though the notion of event is characterized in Nelson (1996: 93-94) as consisting "of an organized sequence of actions through time and space that has a perceived goal or end point", it should also be specified to what infants are paying attention in events for conceptualizing them. This specification is given in Mandler (2000a: 8; cf. 2001), Nelson (1996: 110) and in the model of acquisition of spatial relational terms presented in Gasser, Colunga and Smith (1999). According to the authors, when participating in or looking at events, infants characterize the roles of the objects involved, i.e. what they do and what is done to them (Mandler,2000a: 8). Consequently, conceptual knowledge is engaged very early in human development, and there is no qualitative change within this knowledge developmentally, merely increasing accuracy in the use of information (Mandler, 1988: 424).

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6 "The name I gave to a process resulting in conceptualization is perhaps not ideal because it includes the term "perceptual", but I chose it because the process works by analysis of perceptual data. It is the analysis that is crucial; that is a central process that differs from the usual perceptual processing, which occurs automatically and is typically not under the attentive control of the perceiver" (Mandler, 2000a: 18).

With regard to the acquisition of spatial prepositions, Thorseng (1997b: 5) explains the early appearance of IN and ON in terms of image schemas. For her study with Sinha (Sinha & Thorseng, 1995), they developed a coding system, which is built upon a number of features such as 'size', 'nature of contact', 'relative motion' etc. Features, in turn, are defined in terms of possible values. Values reveal the trajector-landmark relationship[7].

> Thus, the coding of a given utterance consists in the coding of the referential situation in terms of the value(s) taken by each of the features making up the coding system (Sinha & Thorseng, 1995: 272).

A dimension like 'size', 'gravity and support', 'motion and path' (cf. Sinha & Thorseng, 1995: 272) may cover one or more features. The authors argue that the conceptualization of the bearer-burden relationship, based upon the dimension 'gravity and support' is "fundamental to the spatial relational semantics of many languages, and reference to these relationships by means of "basic" terms (such as the English preposition on [...]) occurs at an early stage of language acquisition in different languages" (ibid: 290). A concept for SUPPORT, for example, is organized around different features of the spatially related objects (see Sinha & Thorseng, 1995 for detail). Thorseng (1997b) coded the utterances spoken by two Danish and four English children focussing on their use of I (IN) and PÅ (ON). The data showed that "when children produced IN or ON more than one time in a session, they very often produced each term for more than one meaning" (ibid: 28). Sinha (1999b: 45) explains: "[d]ifferent meaning of prepositions, i.e. the polysemy, corresponds to different discursive patterns and practices, different subject positions within the discourses embedding the prepositions, and different construals of the situation".

The conclusions from their study can be summarized as follows: initially, children analyze the features of the non-linguistic context. Since they already have non-linguistic concepts of SUPPORT and CONTAINMENT, the children are guided by these concepts in analyzing the non-linguistic context. Consequently, they do not need to analyze every feature in a situation in order to produce a term like IN and ON, because IN and ON correspond to CONTAINMENT and SUPPORT (Thorseng, 1997b: 5). The children need, therefore, to merely map the prepositions to the concepts they already have. Sinha and Thorseng (1995: 297) propose "meaning as mapping":

> The mapping [...] is between (a) the features which constitute the linguistic conceptualization of the Referential Situation [...], and which we regard as the description of the semantic content of the expression; and (b) the linguistic expression which expresses the conceptualization (ibid: 297-298).

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7 The termini trajector and landmark originate from Langacker's approach (1987; 1991: 6; 1998: 5) — see section 2.5 for more details.

The semantic task

As the image schemas "lie at the core of people's understanding, even as adults" (Mandler, 1992: 591), the task the child is confronted with is to map a preposition onto the corresponding image schema. Understanding a certain spatial preposition means to recall the corresponding image schema. In a more general way, the semantic task accounts for a straightforward correspondence according to the following hypothesis: "as new spatial concepts mature nonlinguistically, children discover the forms that are used to express them in their local language" (Bowerman & Choi, 2001: 478).

Problems emerging from this view

In the holistic view, the meaning of spatial relational terms is allocated around the notion of image schema. In most recent semantic analyses, this basic level is adopted and used without question. Cienki's commentary (1998: 108) provides an example for this attitude: "I will rely on Johnson's criteria for what constitutes an image schema". However, one should keep in mind that the criteria for this notion were established about 15 years ago. Linguists using this notion and claiming a cognitive approach are, thus, relying on outdated definitions of a theoretical construct without considering recent psychological investigations in conceptualization. Recently, there has been an attempt by Gibbs and Colston (1995) to investigate the psychological reality of image schemas. However, the authors merely relate various findings from psychological studies to this construct and do not analyze the notion itself.

In the following, a critical rethinking of the term image schema is presented, which – in holistic semantics – is crucial for the meaning of a spatial preposition. The presentation of the dilemma of the image schema has the aim of questioning the clarity of the notion and pointing out methodological problems in observing the phenomenon, which the notion is trying to capture.

Which level of abstraction? The attempts to explain and to understand the nature of an image schema end with a question about the level of its abstraction. It is important to define this level of abstraction in order to specify the kind of representation and its role in human processing of information.

As mentioned above, image schemas emerge in forms with labels such as CONTAINMENT, PATH, SCALE, etc. in linguistic research. The first obvious dilemma occurs in the explanation of the CONTAINMENT schema presented by Baldauf (1997). She explains the relation IN as follows: the preconceptual structure for CONTAINMENT emerges from experience in space (due to sensomotoric and perceptual processes) and can be described by virtue of spatial relations: CONTAINMENT implies such concrete experiences of something is 'bounded', 'limited'. This is the basis for the typical elements of these experiences such as the relations IN / OUT. On the other hand Baldauf (1997: 123) describes a recurrent CONTAINMENT schema

as meaningful against the background of the relations IN / OUT. The development of the comprehension of a spatial relation is not clear any more: which comes first, the IN-/ OUT-relation or the image schema of CONTAINMENT? A closer look suggests that Baldauf's (1997) attempt to explain the development of a CONTAINMENT schema is based on the IN- / OUT-relation. However, she first uses it as a prerequisite to build the schema and second as one of the results of processing this CONTAINMENT schema. The IN-/ OUT-relation seems to be material and product at the same time. This is probably due to the fact that it is not clear how abstract the CONTAINMENT is supposed to be.

At first, M. Johnson's (1987) description of image schemas seems to resist the potential circularity. For him, the IN-/ OUT-relation is not only a basis for "physical containment", rather it is a part of the package of an experience. Furthermore, it is important to note that this IN-/ OUT-relation is just one of many possible typical elements. Each of these depends on a small number of related schematic structures that emerge from the whole package of an experience, in this case named CONTAINMENT:

> I am not insisting that there must be only one central schema for all in-out orientation that covers all cases of the meaning of "in" used for physical containment; rather, there are a small number of related schematic structures that emerge from our constant and usually unnoticed encounters with physical containment (M. Johnson, 1987: 22).

Assuming this, M. Johnson's view on image schemas delivers more advantages and allows, for example, a language-specific content. This is valuable when confronted with the results of the study by Choi and Bowerman (1991) showing that the use of a CONTAINMENT is not the same in different languages (see 1.6.2). If the circularity alluded to in the interpretation of the notion of image schema by Baldauf (1997) can be avoided by taking into account the careful use of terminology in M. Johnson's definition, it is reasonable to ask, where the circularity in understanding his theory comes from. Presumably, it depends on a certain image emerging with this definition. One may have associations that are too specific due to the term 'image' in image schema. As soon as a schema is given a name implying a certain structure, for example, CONTAINMENT or CONTAINER[8] (Clausner & Croft, 1999: 15) – we create a sub-concept[9], which seems to include a set of conditions or a list of properties. However, these are characteristics of a propositional representation. As a result, a propositional character is given to a preconceptual structure in order to grasp and handle it more easily. The purpose of a CONTAINMENT schema is, however, to provide a non-propositional basis for further concrete specifications like the IN / OUT-relation. The circularity seems to start as soon as this specification is used to explain the basis. Against this background, Lakoff points out:

> The names that we have given to image-schemas, and to image schema transformation, are very much in keeping with the kind of symbolization that might be used in studies of computer vision. But the names are not the things named (Lakoff, 1987: 444).

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8 In German translation: BEHÄLTER.

9 Barsalou describes this phenomenon as "metatheory" (Barsalou, 1993: 171).

Concerning the level of abstraction, Gibbs and Colston (1995: 370) suggest two possibilities for the psychological reality of the term image schema.

1. Transferring image schemas to other domains, image schemas seem to be definable mental representations and grasped by forms like CONTAINMENT.
2. Image schemas are not accessible, because they are basic emerging from our ordinary conceptual system and are therefore not explicitly represented (Gibbs & Colston, 1995: 370).

Zlatev (1997: 44) concludes that the notion of image schema is "reductionist" because, if we understand image schemas as a definable mental representation that can be grasped by forms like CONTAINMENT (see possibility 1 above), they will lose their pre-conceptual character as postulated by M. Johnson (1987) and Mandler (1992). If, however, we understand them as basic principles and structures of our conceptual system, we cannot describe them concretely, because they are not accessible to our definitions (see possibility 2 above). In this sense, image schemas are "incoherent" (Zlatev, 1997: 44).

How much image? M. Johnson chose the term image schema because these function primarily as schematic or abstract versions of images (M. Johnson, 1987: XIX). The point that image schemas are abstract is crucial here. They do not imply any realistic images or mental imagery. M. Johnson (1987: 23) emphasizes, "image schemata are not rich, concrete images of mental pictures". For him they are nonpropositional structures which organize our mental representations on a higher and more general and abstract level, in contrast to a level on which we form mental pictures.

The important aspect in schemas is this generality, which raises them a level above the specificity of particularly rich images (M. Johnson, 1987: 24). In other words, image schemas are different from mental pictures. Whereas the latter are the result of effortful cognitive processes and therefore 'richer' in content, image schemas emerge as properties of nonreflective embodied experiences, and are therefore more abstract and permanent:

> Image schemas are presumably more abstract than ordinary images and consist of dynamic spatial patterns that underlie the spatial relations and movement found in actual concrete images. Mental images are also temporary representations, while images schemas are permanent properties of embodied experience (Gibbs & Colston, 1995: 356).

Liebert (1992) therefore describes them as a prelevel of concrete images — this description corresponds to Mandler's theory (1992), in which image schemas arrange perceptually analyzed information. For Mandler (1996: 380) they are, moreover, a "set of meaning packages" and therefore not only a prelevel of concrete images, but also a prelevel of meanings. They represent meanings that are in themselves not accessible but from which accessible concepts could be formed (Mandler, 1992: 592).

In which way universal? If there are indeed forms of representation like image schemas, and they are reducible to our experience with space, the representations should be universal, as

we all have similar experiences within space. Concerning the issue of universality, the domain of space has often been regarded as an important source of evidence. “Cognitive semantics and cognitive grammar - originally called ‘space grammar’ rest upon an essentially visuo-spatial conception of meaning and conceptualization, in which symbolic structures are derived from embodied constraints upon human perception and agency in a spatial field” (Sinha et al., 1999: 95). In the research field of language acquisition, there are also some important studies in line with the spatial cognition hypothesis explicitly formulated by Sinha et al. (1999: 96): “The process and content of early spatial semantic development is determined by universal pre- and non-linguistic perceptual and cognitive processes and structures”. In support of this hypothesis, it has been shown persuasively (e.g. Parisi & Antinucci, 1970; Johnston & Slobin, 1979; Needham & Baillargeon, 1993; Baillargeon, 1995) that “nonlinguistic spatial development supports the acquisition of spatial language and provides many of the guidelines children follow in extending spatial morphemes to novel situations” (Bowerman & Choi, 2001: 479). The results have been interpreted as indicating that children heavily rely for a long period upon non-linguistic strategies (as suggested by, e.g., Clark, 1973) which “are homologous with strategies which govern the performance in non-linguistic spatial tasks” (Sinha et al., 1999: 96).

Adducing more evidence for the spatial cognition hypothesis in language acquisition, Johnston and Slobin (1979) argue for an interaction between conceptual development and the degree of difficulty in linguistic processing. Against this background, they predict “a roughly universal sequence in the development of the underlying notions expressed linguistically by the child, as a reflection of universals of cognitive development interacting with standard communicative settings” (Johnston & Slobin, 1979: 530). In accordance with the broad literature covering the order of IN, ON to UNDER in language acquisition and understanding that was mentioned at the beginning, it seems plausible to ask whether there are universal relations that are first comprehended and then marked via a preposition related to them. Especially for the preposition order studied, it seems reasonable to assume that the relations IN and ON are universals that are acquired first (cf. Thiel, 1985; Vandeloise, 1991; Thorseng, 1997a). This hypothesis will be proven in chapter 5. Theoretically, however, there are important findings against the spatial cognition hypothesis, which will be considered in the next section.

I.5.2 Two-level-connection

Similar to Tomasello (1987; cf. 1.3), van Geert (1985: 7) questions whether it is necessary to assume that a child acquires a “preverbal conceptual organization of spatial relations” and then has to employ spatial relational concepts when learning prepositions like IN, ON and UNDER “in order to fill in the meaning of these words” (ibid: 7). Instead, he approaches the learning of prepositions using modularity theory. According to it, “the human information processing system is divided into a number of relatively dependent vertical ‘faculties’

connected with a central system" (ibid: 7). Van Geert further points to three main modular systems: the perceptual or sensory system, the praxis or motor system and the linguistic system (ibid: 8). In keeping with this, the semantic and conceptual representations are treated as originating from two different modules of cognition. Semantic representations are affiliated with the lexical items (cf. Knauf, 1997: 119) more than with conceptual units. As lexical items, semantic representations follow the principles of language systems (cf. Schwarz, 1992: 17). The conceptual system, in contrast, is language independent and responsible for human experiences. Besides the above mentioned modular systems, there is a "central, non-modular system" (v. Geert, 1985: 8), which makes the output of one module accessible to other modules. In this way, the "visual perception of a state of affairs can be transformed in a verbal description of it" (ibid: 8). Slobin (1973: 182-183) supports the modular view of language implying that "[c]ognitive development and linguistic development do not run off in unison. The child must find linguistic means to express his intentions".

For the acquisition of spatial relational terms van Geert (1985) postulates:

> Within the present modular approach, however, the structure of spatial relational knowledge in language consists of the lexical distributions of the prepositions. Therefore, one should first investigate how the child uses spatial prepositions within the language; that is, which lexical contexts are associated with which prepositions. [...] The hypothesis here is that the language-specific meaning of the preposition is a function of three mappings, not of some pre-established connection with a concept". (ibid: 13-14)

Van Geert's main argument seems to rest upon the conviction that "there is no evidence of a-modular, preverbal concepts of spatial relations" (ibid: 13). In his argumentation, van Geert refers to studies by Sinha (1982 – see section 2.4) and repeats that not the meaning or conceptual complexity was crucial in the task, in which children had to put one object under another. "[T]he problem with in, on and under is not the mapping of words on to concepts, but the mapping of words in contexts on to praxis action" (ibid: 16). To this data, van Geert adds the results from his study, in which he observed the language production of his Flemish speaking son between the age of 21 to 33 months.

The results confirm the order of prepositions in acquisition found in other languages, i.e. from IN to AAN [ON] to ONDER [UNDER] (ibid: 17-18). However, the child studied starts the process of learning ON with strong evidence that ON does not refer to a spatial relational meaning (cf. ibid: 19, also Hallan, 2001: 115), but for example to verbal phrases. Van Geert interprets the results as suggesting "children are basically learning which lexical contexts belong to which prepositions. Mappings on to the perceptual and praxis domain apply to prepositions in lexical contexts, not to lexically isolated prepositions" (ibid: 23). Van Geert concludes that children learn language specific rules for the lexical distribution of the prepositions and these rules are not based on preverbal spatial relational concepts (ibid: 7). Again, this argumentation is reminiscent of Tomasello's (e.g. 2000a) approach. However, while Tomasello argues for a usage-based model of language, van Geert aligns his view to the two-level semantics.

With regard to the spatial domain, the assumption of a two-level-semantics implicates an existence of language-independent spatial concepts, which do not reflect the meaning of spatial terms (cf. Knauf, 1997: 119; Bierwisch, 1996: 31). Rather, semantic representation is regarded in a more abstract way, as it allows different interpretations of one concept (Knauf, 1997: 120). In the two-level connection, the meaning of a locative expression is supposed to be objective (i.e. context-independent) and the goal of research in semantics is to capture this meaning (cf. Schwarz, 1992: 24). Knauf (1997: 119) explains this view using the example of the preposition HINTER [BEHIND]: if we attempt to capture the meaning of the preposition HINTER [BEHIND], it is sufficient to analyze situations to which people refer to this word. In this sense, researchers following the modular theory are proposing rules rather than schemas determining the meaning of a word. The mental lexicon plays a central role in this view of semantics and fulfills a crucial function in structuring information (Schwarz, 1992: 17). Lexical semantics raises questions about the organization and structuring of lexical components and their relationship to other cognitive knowledge systems.

There are many approaches attempting to capture the context-independent meaning features of spatial prepositions and an extended summary is presented in, for example, Klein (1991), Knauf (1997: 118-121) or Nüse (1998), who emphasize two kinds of lexical semantics: the first group of researchers – termed by Nüse (1998:121) "Pomos"[10] – proposes a core-meaning in the form of a prototype (Klein, 1991: 92). The second group of researchers – termed by Nüse (1998: 121) "Momos"[11] – argue for "abstract basic meaning [abstrakte Grundbedeutung]" (Klein, 1991: 91) of a locative expression, which indicates appropriately the specific relational region. The difference between the two views on lexical semantics can be exemplified in the following two sentences (cf. Nüse, 1998: 119):

(1) The blackbird on the road sign.

(2) The number on the road sign.

The first group of researchers, Pomos, (e.g. Herskovits[12],1985, 1986 and 1998; Hottenroth, 1993) represents the prototypical core of a word meaning and views the meaning of the ON-

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[10] Pomos refers to the assumption of polysemy contained in the models "because they consider the crucial difference as a case of polysemy, i.e. meaning variation [weil sie den entscheidenen Unterschied als Fall von Polysemie, i.e. Bedeutungsvielfalt betrachten]" (Nüse, 1998: 121).

[11] Momos refers to models based on monosemy (Nüse, 1998: 121).

[12] In exemplifying the "Pomos"-research group using Herskovits' approach, it should be stated that it is questionable to allocate Herskovits' view to two-level semantics. There is an important difference between two-level semantics and prototype semantics. In describing the semantic features in terms of prototypes, prototype semantics rejects the classical view of categories, in which they are described by necessary and sufficient features. However, even Nüse (1999: 23) suggests that "the defining feature of two-level semantics is not that meanings are definitions, but the distinction between a semantic and conceptual level of mental representation". This suggestion is the reason why Herskovits' approach is viewed here as representative for two-level-semantics.

preposition as different in sentences (1) and (2). These meanings can be found in a network related to one prototype (cf. Nüse, 1998: 120). Deviating cases of use are coordinated by derivational rules. Grabowski (1999) therefore uses the term "prototype plus modification [Prototyp plus Modifikation]"-technique when referring to the conception of meaning in this group.

According to the Pomos' view on semantics, the first aspect that the lexical information consists of – namely, the geometric relation – is a result of "processes of geometric conceptualization and of metonymy" (Herskovits, 1985: 373). The level of geometric conceptualization "mediates between perception or mental images of scenes and language" (ibid).

> The meaning of a locative expression can then be represented by a relational formula involving a shifted ideal meaning applying to the geometric description. These shifts and transfers to geometric descriptions are in part a matter of convention, in part pragmatically controlled (Herskovits, 1985: 373).

Investigating the (proto-)typicality effects in early comprehension of spatial prepositions in infants, Meints, Plunkett, Harris and Dimmock (to appear) used the preferential looking task. In this study, 15-, 18- and 24-month-old infants were shown stimuli depicting objects or animals either ON or UNDER a table in a typical or atypical position. The typical position was defined as ON or UNDER the center of the table. Thus, centrality as a geometric feature contributes substantially to the core meaning. The results show that infants differentiate between typical and atypical situations. Furthermore, at 15 months they associate spatial prepositions initially to typical situations. By 18 months they "broaden the scope of spatial prepositions to include atypical situations" (ibid, to appear). The authors conclude that prototypical items are used as starting points in lexical development either due to parents' naming practices (parents are more likely to label typical instances than atypical instances) or to the nature of infants' preverbal categories (Meints et al., to appear).

According to the second group, the Momos' view, a spatial preposition is understood, because it conveys an abstract basic meaning. The function of the abstract basic meaning is to provide a "regulation for definition of a region [Regionsfestlegungsvorschrift]" (Nüse, 1998: 120). In other words, on the basis of this regulation, specifc relational region of an landmark-object can be identified for understanding a preposition. Correspondingly, in the two example sentences, a single meaning of the preposition ON is constituted in the Momos' group. The difference between the aforementioned sentences (1) and (2) is due to different instances or allocations of the meaning. If we assume that the meaning of the ON-preposition is abstract pointing to HIGHER THAN and CONTACT WITH (Nüse, 1998: 120), then this single meaning can be applied to both sentences. In these cases, the meaning remains constant but the instances of SURFACE differ. This is, what Grabowski (1999: 91) terms the "abstraction plus supplementation [Abstraktion plus Ergänzung]"-technique.

The semantic task

On the basis of the Pomos' view, a prediction can be made according to which semantic analysis of a preposition is transferred to a semantic task for a child learning a language. Correspondingly, a child has to pick up the prototypical core-meaning – which Herskovits names "geometric idealization" of Figure and/or Ground (1998: 150 and 158) – which consist of the geometric relation and additional derivational rules for deviating cases. Together these restrict the necessary and sufficient conditions for every conceivable situation and determine whether a particular preposition can be applied or not. Nüse (1999: 24) concludes that this means that people know these conditions in some way or the other. Consequently, a child has to learn these conditions.

Regarding the Momos' view, the semantic task for a child learning a preposition is difficult to set up, because it is not clear how the abstract meaning develops: does the child acquire the abstract basic meaning initially and learn the different instances or allocations of the single meaning subsequently, or does the child learn the abstract meaning through abstracting from different instances of allocations of the single preposition? In the latter case, the child operates with incomplete semantic knowledge until she or he has collected enough different instances of using a certain preposition. Only then is the child able to abstract the general meaning and to use it appropriately. The question remains, however, how many experiences a child needs in order to be able to abstract the general meaning.

Problems emerging from this view

Preverbal spatial concepts. To reiterate, van Geert's (1985: 13) main argument seems to rest upon the conviction that "there is no evidence of a-modular, preverbal concepts of spatial relations". Ten years after the publication of his article, some important studies have been published shedding more light on infants' conceptual knowledge about space at a very early age of two to four months (e.g. Needham & Baillargeon, 1993; Baillargeon, 1995; Quinn, 2001), which cannot be disregarded in this discussion. The results suggest that children know a lot about space before they can talk about it (cf. Bowerman & Choi, 2001: 478) and make use of this knowledge, when starting to speak. Carey (2001: 210) argues that children show conceptual distinction (in her study: between individuated entities and non-individuated entities), which are not induced from experience with language. Rather, this ability to make conceptual distinction supports language learning from the beginning.

The most relevant evidence against van Geert's conviction is an experiment concerning infants' physical knowledge about support phenomena (Needham & Baillargeon, 1993). The support-relation is a topological equivalent for the ON-relation and therefore relevant for the meaning of the ON-preposition (cf. Grabowski,1999: 86). In their study, Needham and Baillargeon (1993) tested whether four-and-a-half-month-old infants expect an object to fall

when its support is removed. In the study, infants see a possible and an impossible test event. In the possible event, a hand deposits a box fully on a platform and then withdraws, leaving the box supported by the platform. In the impossible event, the hand deposits the box beyond the platform and then withdraws, leaving the box suspended in mid-air with no apparent source of support (ibid: 121). The effect of this study is that "infants look reliably longer at the impossible event suggesting that they expected the box to fall in the impossible event and were surprised that it did not" (ibid: 121). The authors conclude that infants "possess intuitions about objects' support and expect them to fall when their supports are removed" (ibid: 145).

Concerning knowledge about space and objects, Needham and Baillargeon (1993) presume that it is changeable with a child's growing experience. This presumption is due to the authors' further findings which suggest a change in 6-month-old infants' physical reasoning. At this stage, infants are more sensitive to the kind of support:

> By 4.5 months of age, infants expect a box to fall when it loses all contact with a supporting platform, and to remain stable otherwise. At this stage, any amount of contact between the box and the platform is deemed sufficient to ensure the box's stability. By 6.5 months of age, however, infants recognize that a box can fall even when partially supported, and that the amount of contact between the box and the platform can be used to predict whether the box will be stable (Needham & Baillargeon, 1993: 146).

What experience is crucial for this developmental change? The authors presume that "this development reflects advances in infants' manipulations of objects" (Needham & Baillargeon, 1993: 146). This can be motivated by a new position and perspective as infants at this age become self-sitters and have new possibilities to explore objects and events, for example, sitting in a chair and playing with an object on a table. This hypothesis is supported by studies surveying infants' locomotion which allow the interpretation that "locomotion creates a new level of interaction between the baby and the environment" (Bertenthal, Campos & Caplovitz Barrett, 1984: 177). This can be especially demonstrated in studies about visual cliffs. This method involves the caregiver person calling the infant to cross over the deep or shallow sides of a cliff table. Infants tested 1-3 weeks after they began to crawl crossed to the caregiver person on the deep side of the cliff. However, this behavior showed a "dramatic change" (ibid: 182) during the next few weeks of testing: "[a]ll infants began to show avoidance of the deep side either by refusing to cross or by crossing the deep side using detour behavior" (ibid). Experience in crawling plays a crucial role and changes their sensorimotor performance. Bertenthal (1996: 438) argues that "new perceptions and new actions are related through a dynamic process involving the selection of new behaviors in response to new sources of variability in the organism and the environment". The evidence that infants' concepts change under the influence of other information sources points to a dynamic, interactive information processing, which is used when children acquire spatial words (Bowerman & Choi, 2001: 478-479). The strong reading of a modal theory is, therefore, less tenable.

Psychological reality. Grabowski (1999: 93) objects to the psychological reality of the Pomos' approach to lexical semantics. A model claiming psychological reality also has to be applicable to language production and not only to understanding. He points out a circularity in the argumentation and raises questions about how the participant objects could be cognitively accessed, when a cognitive concept of this kind is already involved in the meaning of a preposition:

> Wie sollte die kognitive Auffassung der beteiligten Objekte in ihrer räumlichen Verhältnisse, die die Grundlage der Generierung eines bestimmten sprachlichen Ausdrucks (und damit auch der Wahl einer Präposition) bildet, bestimmt werden, wenn die Art der räumlichen Auffassung der Objekte als integraler Teil der Bedeutung einer Präposition konzipiert wird, die es doch erst zu verwenden gilt? Die kognitive Auffassung eines Dorfes ist ja nicht immer ein approximierter Punkt (zum Beispiel wenn es um "die Kirche im Dorf" geht) [...] (Grabowski, 1999: 93).[13]

Another problem with Pomos' models resides in the objectivity this argument implies. The meaning of a locative expression is, according to Herskovits (1985: 324), "a proposition predicating the relation denoted by the preposition of the objects referred to by the noun-phrases". In regarding meaning as objects Herskovits is following a traditional dogma of linguistic communication (cf. Sinha, 1999a: 224), "which is in essence Reddy's (1978) Conduit Metaphor" (ibid). The philosophical question that is hard to explain in this view is "[i]f there is a mental content which precedes its linguistic organization in expression, what (if any) is the relationship between this content and the world outside language, towards which language points?" (Sinha, 1999a: 230).

In the pursuit of psychological reality, Nüse (1998) designed a sentence completion experiment which showed that both views, Momos and Pomos, cannot be confirmed as psychologically real. According to their assumption, the views of each group make certain predictions about the cognitive effort needed to read and understand a certain instance. Nüse (1998: 126-127) hypothesizes that in accordance with the Pomos' view understanding the core-meaning implies a different level of processing, because for the reading which drifts from the central way, additional processing is needed. In this sense, Auf der Tapete [on the wallpaper] is more difficult to process than Auf dem Tisch [on the table] (cf. Nüse, 1999). On the other hand, in accordance with the Momos' view, the abstract basic meaning involves no additional processing for different readings. The results of the reading experiment clearly show effects as predicted by Momos' view. There are no effects comparable to the predictions made from the Pomos' perspective. Nüse's (1998: 135-136) outcome supports, thus, the view of the Momos group, albeit making some modifications necessary. Interestingly, the results of the experiment do not state anything about the separation between the cognitive and semantic level (ibid: 137).

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[13] "How could we determine the cognitive conception of participant objects in their spatial relations, which are the basis for processing a certain linguistic utterance (and the choice of preposition as well)? Especially when the kind of spatial conception of objects is a part of the meaning of a preposition [...]".

Based on these critical points, the Pomos' approach to the semantics of prepositions seems beforehand to be a weaker candidate for accounting for how children acquire the meaning of a spatial preposition. Nevertheless, this semantic task set up for children will be tested in the experimental part in detail.

Modularity: starting point or result of the development? Another argument against the modular view is presented in Weinert (2000). She questions whether the modularity of language should be viewed as a starting point for or as an effect of the developmental processes. She points to studies suggesting that fast, complex and automatic processing that is partially detached from other sources is a result of learning processes (Weinert, 2000: 344, see also Thomas & Karmiloff-Smith, 1998). The fact that adult speakers display information processing only within the linguistic module and without the integration of other kinds of information cannot lead to the conclusion that the adult speakers' competence is based on an inherent, autonomous module of language. Empirical studies (reported in Weinert, 2000: 344) emphasizing a different type of information processing in childhood than in adulthood contradict modularity as a starting point for human development. Additionally, the conclusion that modular language processing is not the starting point but (if at all) merely the result of developmental processes is supported by aphasia studies in childhood, which show that not only anterior but also posterior lesions of the left hemisphere lead, almost exclusively, to nonfluent forms of aphasia (Weinert, 2000: 344)

In some approaches, the modularity is a consequence arising naturally from criticism of the one-level semantics as a conceptualist approach. This seems to be the case in van Geert (1985). His main argument against the one-level semantics aims at strong universal constraints: if an underlying concept was the explaining factor for easier understanding of ON before UNDER, then "each individual child would have to show the same level of understanding of these spatial relationships in praxis action, verbal understanding and perceptual discrimination" (ibid: 16). In contrast, as van Geert's data shows, there are noticeable individual differences in acquiring prepositions. However, this argument can be better explained using Tomasello's (1987) view on language, as already suggested above. Tomasello criticizes the connection between spatial concepts and their linguistic terms in a one-to-one-manner and argues for language as a communicative act. If the modular view should be accepted only because of the criticism of the cognitive determination hypothesis implied in one-level-semantics, the baby will be thrown out with the bath water. In this sense, van Geert's (1985) argumentation does not meet the variety of current conceptual approaches. If one assumes an embodied conceptual development, individual and cultural differences in a concept's content are possible — as will be shown in the further discussion.

I.6 Directions of influence between language for space and spatial reasoning

In addition to the two different views on the connection between the language used for describing space and actual spatial reasoning, there is also a difference in perspectives on the direction of influence between these two cognitive domains. From the perspective of cognitive determinism (see Figure 3), there is a deterministic influence of conceptual structure on semantic representations. In contrast, linguistic determinism refers to the thesis by Saphir and Whorf (cf. Whorf, 1956) and represents a view in which language is considered to influence the way we think. It should be noted here that even though there are some findings supporting each of these two different views on the connection between language and cognition, the strong reading form of each of these hypothesis lies beyond the current discussion (cf. Weinert, 2000: 315).

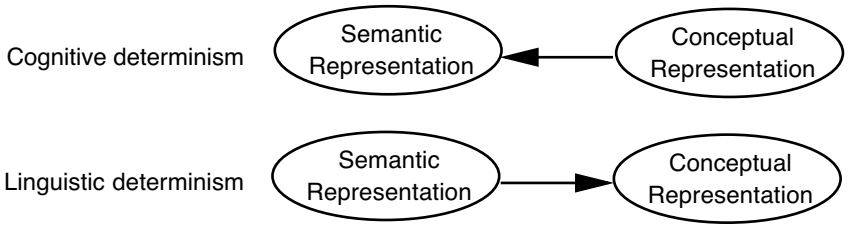

Figure 3: Directions of influence between language and thinking

Similarly to the sections above, the different views on the direction of influence will be discussed with regard to the understanding of spatial prepositions. Starting with an explanation of each view, the semantic task for a child acquiring a spatial relational term will be described, followed by critical points and problems resulting from the view in question.

I.6.1 Cognitive determinism

J. Johnston (1988: 197) hypothesizes that there is universality in cognitive prerequisites necessary for learning locatives: "[t]he "universality" and protracted nature of locative learning suggest that nonverbal conceptual development plays a major determining role". As already suggested, the support for this hypothesis can be found in cross-linguistic studies indicating that spatial relational terms are acquired in a particular order — despite the fact that across languages spatial expressions vary in grammatical form. The cognitive requirements which may determine the order of IN, ON to UNDER, are discussed by Ahnert, Klix and Schmidt (1980). The authors postulate developmental stages of cognitive structures corresponding to the spatial morphemes:

> That means, we start from age-specific developmental stages of cognitive structures underlying the corresponding phonemic patterns, from a direct correlation between concept and

> word, i.e., between conceptual feature sets (and connections with other sets) on the one hand, and concatenations of phonemic features as verbal units on the other. The interlinkage between conceptual features and verbal components develops with language acquisition (Ahnert, Klix & Schmidt, 1980: 226).

It is obvious that in this view, a concept is regarded as a universal propositional representation and can be evoked in different tasks and different situations. Moreover, it is assumed that the interface between the two subsystems of human cognition, namely language and conceptualization, is a strong one, and it is the conceptualization that determines language. This viewpoint is also shared by the cognitive determination hypothesis (Zlatev, 1997: 246), which can be divided into three subhypotheses (Zlatev, 1997: 244):

H_1: Cognitive structure A_{cog} is more basic then cognitive structure B_{cog}

H_2: Cognitive structures A_{cog} and B_{cog} are mapped onto semantic structures A_{sem} and B_{sem} making A_{sem} more basic than B_{sem}

H_3: The combination of H_1 and H_2 determines the acquisition order $A_{form} > B_{form}$ (where A_{form} expresses A_{sem} and B_{form} expresses B_{sem}).

In accordance with the second subhypothesis, Ahnert, Klix and Schmidt (1980: 226) expect the child to analyze the relations "between cognitive and verbal structure": the more features a verbal structure requires, the more cognitively complex it is supposed to be, and, respectively, the longer its acquisition is delayed:

> [...] there should be a rank of the acquisition of conceptual feature sets depending on their increasing complexity. This order is: (in, bei) < (am, neben) < (unter) < (auf, über), and it is defined by the number of decisions referring to the number of features or dimensions mentioned above (Ahnert, Klix & Schmidt, 1980: 227).

This approach resembles assumptions from Artificial Intelligence explaining a cognitive process by creating a concept as a representational unit. In this view[14], concepts are defined as "structured mental representations that encode a set of necessary and sufficient conditions for their application, if possible, in sensory or perceptual terms" (Laurence & Margolis, 1999: 10). As a necessary and sufficient condition[15] is a mathematical term, it

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[14] Laurence and Margolis (1999: 8-10) characterize this view as a classical theory on concepts which can be compared metaphorically to making packages (cf. Mandler, 1996: 380). In this view, the content of the representation is more interesting than its transfer process: on the one hand, there is a physical world — on the other hand, a human perceiving the world and having experiences within it; her or his experience and impressions about the world are packaged (perceptual data) and become compensated (conceptual data). This format is stored in the human mind where every package stands for a certain experience.

[15] A good example where necessary and sufficient conditions can be given, is the concept of an odd number. In the domain of natural numbers, an odd number is defined as a number which cannot be divided by two. Accordingly, in the case of an odd number, this division constitutes the necessary and sufficient conditions.

implies objectivity: either it is necessary and sufficient or it is not. Thus, the content of the concept has to be objective or, to put it in other words, universal. If objects – or even relations – possess relevant properties, they should possess them for everyone perceiving this object and establishing a related concept. The dimensions Ahnert, Klix and Schmidt propose for classifying features (1980: 227) have this aim of objectivity.

The semantic task

Commonly, the view of cognitive determinism is accompanied by a particular view on concepts. According to it, the child first has to discover the objective features of, for example, a spatial relation and then create a list of necessary conditions as the concept for it. Finally, she or he has to map this concept (or set of conditions) onto a particular morpheme, for example the appropriate preposition. In this way, a word-concept-correlation is achieved. Language acquisition is seen, therefore, as a constructing process.

Problems emerging from this view

Overemphasis of representations. It was argued that Ahnert, Klix and Schmidt explain the conceptualization of space by creating a concept as a corresponding representation. Jones and Smith (1993), however, warn against an overemphasis of non-perceptual knowledge in the process of conceptualization. In their study, they found that the development of concepts is task-dependent: in certain situations different information sources are involved.

> By our view concepts are not represented entities that exist as a unit. What we call "categories" and "concepts" are the emergent products of multiple knowledge sources in specific task contexts. By this view, there is no set intension (definition in the head) of extension (category in the world). Both are transient and emergent in the task at hand. (Jones & Smith, 1993: 136)

In their view, arguments for early conceptual knowledge imply the reduction of human cognition to the establishment of concepts. The complex development of human processing is reduced to merely computational functions (ibid: 185). Consequently, in a certain situation an appropriate representation should be found for the processing of information. However, this does not seem to be realistic if one admits that concepts emerge task-dependently, as the findings by Jones and Smith (1993) indicate. In certain tasks, finding a specific representation among others would require additional processing time and would delay the reaction. Jones and Smith (1993) make clear that in this reductionist view, important aspects of cognition like dynamism and task-dependency get lost. A concept remains dynamic and task-dependent only if human cognition keeps being connected to the here-and-now — this can be guaranteed by the continual influence of perceptual information, which is our only means of contact with the here-and-now (Smith & Jones, 1993: 188).

Smith and Jones (1993) oppose the classical view of concepts as this implies a reduction of human cognition for computation and plead instead for a view of human cognition without representations. Another alternative is to regard concepts in a dynamic way (see Madole & Oakes, 1999). Within this view, for increases in knowledge, it is not only the input of information gained by interaction with the environment that matters but also the connection to existing conceptual information (Madole & Oakes, 1999: 278).

Weak points in the argumentation. Ahnert, Klix and Schmidt (1980: 233) interpret their result as indicating that the application and comprehension of prepositions develop from spatial coordinates, first the vertical then the horizontal ones. These findings are understood as a support for the cognitive determinism as infants first develop spatial coordinates, which are then reflected in their language. However, according to the connection and the findings from Ahnert, Klix and Schmidt's (1980) study, the preposition ON should be comprehended later than UNDER (ibid: 227) — which as numerous studies have shown is not the case (e.g. Clark, 1973; Thiel, 1985). The relation between cognitive and semantic structure, therefore, does not seem to be straightforward.

Another methodological problem in the study made by Ahnert, Klix and Schmidt (1980) is the age of the children studied: at the age of three to five years, the acquisition of prepositions is more or less completed in the sense that children respond consistently to the relevant preposition. Thus, the meaning of most spatial relations seems to be established before the age of three, followed by a stage in which the relevant concept gains schematicity and content correlating with a classification of relevant features.

Furthermore, Zlatev (1997: 244) emphasizes that the cognitive determination hypothesis may be said to fail with respect to the third subhypothesis: "factors such as language-specific (paradigmatic and syntagmatic) relationships and input frequency appear to have an important effect on acquisition order" — these factors were discussed at the beginning of the chapter in detail. In addition, the cognitive determination hypothesis can be refuted in a more direct way on the basis of van Geert's (1985) results: if we assume that spatial concepts establish the basis for abstract uses, then the corresponding spatial use of prepositions should occur earlier than their non-spatial reference. However, the child in van Geert's study used prepositions in their non-spatial meaning initially (see also Tomasello, 1987). Also, according to Bowerman and Choi (2001: 478-479), the stronger supposition that the meanings of children's early spatial words reflect nonlinguistic concepts directly cannot be demonstrated. Given this observation, the strong cognitive determination hypothesis cannot be borne out.

I.6.2 Linguistic determinism

The view that language can influence the way we conceptualize space is tied up with the controversy regarding the universality of concepts described above (1.5.1). Findings suggesting that the adult's conceptualization space is influenced by the language they learn, were presented in Pederson, Levinson, Danziger, Kita, Wilkins, and Senft (1998). The study by Choi & Bowerman (1991) provides important evidence from language acquisition against the holistic view and universals such as image schemas. In casting these doubts, Bowerman (1996a, 1996b) established two key hypotheses on the connection between semantic and conceptual representation. The first one is formulated for testing the holistic view and, at last, Bowerman argues against it:

H_1: The structure of spatial semantic representations is provided – at least initially – by nonlinguistic spatial cognition (Bowerman argues against this hypothesis).

The alternative hypothesis that expresses the view of linguistic determinism was:

H_2: If language-specificity is early, then children must have relatively weak language-independent preferences for classifying space and they must pay careful attention to language.

With regard to H_1, Bowerman made the following predictions:

P_1: We would expect language specificity to be preceded by a period of crosslinguistic uniformity

P_2: H_1 predicts extensive errors at first in the use of spatial morphemes, possibly suggestive of the guiding influence of "child-style" spatial concepts that are similar across languages. (Bowerman, 1996b: 403).

To test these predictions, Choi and Bowerman (1991) conducted a longitudinal study, in which they collected and compared spontaneous speech samples from children learning English and Korean. This study is especially important, because the languages differ significantly in how they classify spatial configurations: the English IN-relation is matched by two different Korean relations, depending on whether the relation is a tight fit – like a video cassette in its box – or a loose fit – like an apple in a bowl (cf. Choi et al. 1999: 241).

Choi and Bowerman (1991) found that both groups of children first produced spatial morphemes at about 14 to 16 months. The children began to use spatial morphemes productively between 16 to 20 months. Interestingly, the children talked about similar events, like manipulations such as putting on and taking off clothing; opening and closing containers, putting things into others and taking them out, and attaching things like LEGO® blocks. Thus, the spatial concerns of children learning different languages are quite similar revolving primarily around topological notions and the up and down motion.

However, the children's spatial semantic categories were not similar. By 20 months of age, the path that the semantic categories of the two groups of children followed were quite

different from each other and clearly aligned with the categories of the input language (Bowerman, 1996b: 407). For example the English learners distinguished systematically between putting things into containers of all sorts (IN) and putting them onto surfaces (ON), but were indifferent to whether the object fit the container tightly or loosely, or whether it was set loosely on a horizontal surface or attached tightly to a surface in any orientation. The Korean learners, in contrast, distinguished between tight and loose containment (KKITA 'to fit tightly' versus NEHTA 'put loosely in'), between attaching things to a surface and setting things on a surface.

In studies designed to test the second premise P_2, Bowerman and Choi (1991) focused on children's overextension in word use. They predicted that if H_1 is true, children should extend the words on the basis of their own spatial concepts, not the categories of the input language. Consequently, the authors conducted a production study in English, Korean and Dutch. Dutch differs from English because as already mentioned, the English spatial relation ON is further divided down into two subclasses OP and AAN. For each language, they tested 40 subjects: 10 adults and 30 children. They elicited spatial descriptions by showing the objects involved in each action indicating what kind of spatial action should be performed with them, but stopping short of actually performing it with phrases such as What should I do? Tell me what to do! 87 % of the children gave a relevant verbal response, although not necessarily the same one the adults gave. Typical responses from the children learning English and Dutch involved particles either on their own (IN, ON) or in combination with verbs (PUT it IN); from the children learning Korean they involved verbs like KKITA (Bowerman, 1996b: 409-410).

The results show that, even though children's errors in using spatial words have often been interpreted as a "direct pipeline" (Bowerman, 1996b: 416) to their nonlinguistic spatial cognition, a careful look across languages suggests that linguistic factors also play an important role in overextensions: in particular, the category structure of the input influences both, which words get overextended and the specific patterning of the extensions (Bowerman, 1996b: 418). Overall, the influence of the input language is quite strong: a statistical analysis of the results shows that in all three languages, the youngest age group of children classified the spatial actions more similarly to adult speakers of their own language than to children of the same age learning other languages. But their responses did not yet correspond perfectly to the adult system. The patterns seem to be influenced by a mix of linguistic and nonlinguistic factors.

These results contradict the predictions formulated in P_1 and P_2. Bowerman emphasizes that, in addition to their (non-linguistic) knowledge about space, children have the ability to discover how primitives are conceptualized in their language: "Children must be equipped to make sensible guesses about what might be relevant - about what recurrent properties to look for" (Bowerman, 1996a:168).

The semantic task

Following the argumentation presented by Bowerman (1996b), the language specific acquisition hypothesis can be formulated: "The process and content of early spatial semantic development is governed by the structure of the target language, i.e. children's early productive spatial semantic categories and their strategies for them are consistent with the spatial semantic categories of the language they are acquiring" (Sinha et al., 1999: 97).

As spatial semantic development is responsive to the properties of the input language (Bowerman & Choi, 2001: 497), the child does not necessarily develop concepts for spatial relations nonlinguistically, but can construct them on the basis of input.

> That is, hearing the same word across many different situations may lead children to identify properties that are shared by those situations, and that distinguish them from situations to which the word is not applied. This construction process presumably draws on children's perceptual ability to recognize many different kinds of similarities and differences across spatial situations, and on their ability to conceptualize what the situations picked out by a word have in common (Choi, McDonough, Bowerman & Mandler, 1999: 264).

Problems emerging from this view

Larger universal primitives. Which consequences do Choi and Bowerman's (1991) studies have for the concept of universal primitives? Evidently, they place considerable doubt on the idea of a period of cognitive universality in infancy, in which children perceive the world free from linguistic influence. The psychological priority of an image schema is questionable here because the results suggest that from the beginning children acquire spatial relations language-specifically. Thus, this raises the question of whether there are two different kinds of CONTAINMENT and therefore two different (non-universal) image schemas or whether Korean children first have to learn primitives that do not include the Korean tight fit-relation and are therefore not useful concepts in their language. The latter alternative is criticized as implausible and inefficient.

However, Bowerman's understanding of the notion image schema seems to be very concrete. A closer look at M. Johnson's (1987; see 1.5.1) definition still allows a language-specific interpretation of image schema: different cultural uses or categories of CONTAINMENT have one package of an experience in common. To recall, a package such as CONTAINMENT contains experiences like "separation, differentiation and enclosure, which implies restriction and limitation" (M. Johnson, 1987: 22). In their recent studies, Choi et al. (1999) show that children's sensitivity to language-specific spatial categories begins at the age of 18 to 23 months. However, children have already acquired much knowledge about space, objects and events before the age of 18 months and are able to categorize spatial relations across a wide range of perceptually diverse objects (McDonough, Choi & Bowerman, 1999). Another

possibility therefore is, that, for example, in addition to CONTAINMENT and SUPPORT, children might also have a prelinguistic notion of TIGHT FIT (Choi at al., 1999: 264).

> [...] children do map spatial words directly to pre-established spatial concepts — it is just that this set of notions is larger and more varied than has typically been supposed; for example, in addition to 'containment' and 'support', children might also have a prelinguistic notion of 'tight fit' (Choi at al., 1999: 264).

If one accepts larger universal primitives, the argument made by Bowerman (1996a; 1996b) does not refute the holistic view and contradicts the influence of language systems on spatial concepts. The role language might play in the categorization of spatial relations is that "language may highlight aspects of an event but it does not necessarily constrain the interpretation of the event" (McDonough, Choi & Bowerman, 1999):

> [...] children learning English will need to ignore a distinction between tight- and loose-fitting when learning the spatial terms of their language, whereas children learning Korean can map the terms they learn onto such a distinction (but need to ignore containment). Thus, some categories distinguished in early infancy may become less salient with development because children learn to ignore such distinction (McDonough, Choi, Bowerman & Mandler 1998: 353).

With regard to these considerations, the rejection of cognitive universals does not entail accepting a modular view on semantics. Moreover, it is necessary to investigate how much influence the target language has on the acquisition of locatives — this question will be addressed in the first experiment.

Process replaces the content. As Sinha et al. (1999: 97) emphasize, these two apparently opposed hypotheses (universal spatial cognition in the holistic view and the language specific acquisition hypothesis) are not mutually exclusive. "The two hypotheses may account for different data (e.g. comprehension versus production), or for data at different ages and stages of acquisition" (Sinha et al., 1999: 97). Furthermore, Sinha et al. (1999) argue for a difference between the content and the process of concept formation — this is innovative with regard to the classical view[16]. The authors use the term content to refer to the categorial structure of children's early spatial meanings whereas the term process represents the mechanisms underlying their development. The fact "that the categories are language specific (in the sense of being consistent with the target language) does not necessarily imply that either the categories themselves, or the processes underlying their formation, are

[16] In the classical view (cf. Laurence & Margolis, 1999: 10), concepts are defined as (mental) representations. This means that these theories are first and foremost interested in the content and the nature of a concept as a mental unit, i.e. which information from the environment becomes input-information and how is it stored in the mind. The format of the representation is placed center stage as it plays a crucial role as a content bearer. In contrast to dynamic theories of conceptualization (e.g. Madole & Oakes, 1999), a change or modification of the concept's content is not possible. A child's concept remains incomplete until she or he assembles all its features. Given the changing nature of children's conceptualization, it is obvious that approaches to the conceptual level from the classical view do not account for the processes of child's development.

language specific (in the sense of being governed solely by linguistic factors, input and knowledge)" (Sinha et al., 1999: 97).

In process oriented approaches to concept formation, the development of the conceptual level is viewed as a continuum without any shift from processing of perceptual information to the development of conceptual information (cf. e.g. the developmental approach in Madole and Oakes,1999). At the same time, it is difficult to determine the content of a concept. Instead of determining the content and nature of a concept, it becomes more important to determine how infants interact with the environment when having different experiences and what are the processes / mechanisms they use for structuring these experiences (see section 3.9).

I.7 Summary of chapter I

The problems related to the question of what it means to learn a preposition have been looked at in terms of the correlation between spatial terms and conceptual representations of spatial alignments. As discussed, the four different views on the connection that were presented seem to be based on reasonable arguments but also display significant problems when it comes to defining a semantic task the child has to cope with.

Various problems in the four different views reveal similar issues as important for the semantic task set for the child. These are relevant for modelling the acquisition process (see chapter 6) and concern the interplay of perception and the conceptual level, the interaction of different sources in human cognition and the task-dependency of meaning formation. In this chapter, it was elaborated that meanings are formed from representations that abstract from perceptual experience but it was also pointed out that this kind of abstraction is already needed for early developmental stages. Concepts – as the basis for meaning – are, therefore, more than percepts, and are acquired early for social purposes. Understanding language is, thus, more than perceiving language, but it is also less symbolic than establishing lists of necessary and sufficient conditions of meanings, which are not flexible enough for variations in context. For a child acquiring the meaning of a spatial term, it is essential to make use of her or his knowledge from other non-linguistic sources (cf. Karmiloff-Smith, 1992: 188). This additional knowledge will be discussed in the next chapters. If there are indeed conceptual primitives, they are probably bound to both universal processes of perception but also influenced by social interaction.