Chapter 2

Aspects in Understanding Spatial Relational Terms

The question of how infants acquire the meaning of UNDER is bound to a semantic analysis of this preposition. Such an analysis aims to underpin the aspects relevant for this meaning and achieve, thus, a picture of the substance a child is supposed to learn in striving for adult competence of a language. Schwarz (1992: 24) characterizes semantic factors as context-independent meaning features (Schwarz, 1992: 24). From the perspective of cognitive semantics, however, the analysis should be guided by the question "[i]f expression is motivated by conceptualization, what then is being conceptualized?" (Sinha, 1999a: 230). Concerning this question, there are a great deal of studies mainly focussing on the semantics of static prepositions in adult language. This constitutes an important difference to studies on children's acquisition: while studies on adult usage concentrate largely on static prepositions (linked to a dative case), the studies in infants' understanding of prepositions mostly concern the dynamic form (linked to accusative case). Nevertheless, some of the studies on adults' usage of prepositions will be presented as a complement to the developmental studies, as the former nevertheless focus especially on the semantics. In developmental studies, in contrast, the issue of semantics is commonly neglected.

With regard to semantics, Sinha et al. (1999: 99) presume that different prepositions are variable in their semantic complexity. Accordingly, children have to cope with different semantic factors depending on what preposition they are learning. This fact may be reflected in cross-linguistic studies, in which it is remarkable that the spatial relational terms related to the IN- and ON-relations are understood earlier than terms related to the UNDER-relation (e.g. Parisi & Antinucci, 1970; Wilcox & Palermo, 1974; Ahnert, Klix & Schmidt, 1980; Halpern, Corrigan & Aviezer, 1983; Thiel, 1985; Sinha et al. 1999). The factors contributing to IN and ON should, therefore, be different from factors contributing to UNDER and easier to learn. Only when the factors will be identified, it can be answered which factors in what way make UNDER more difficult.

In the following, thus, different aspects in the understanding of spatial relational terms are discussed that might help to explain the late understanding of UNDER. They have been summarized into three main aspects. These are perceptual features, extrageometric variables such as functionality of objects, and the involvement of different context(s), which are activated via attention to objects.

2.1 Perceptual features of objects

The study made by Clark (1973) was an important milestone in research about infants' acquisition of prepositions. Many researchers (e.g. Wilcox & Palermo, 1974; Grieve, Hoogenraad & Murray, 1977; Paprotté, 1979; Halpern, Corrigan & Aviezer, 1983; Thiel, 1985; Vandeloise, 1994; Bowerman, 1996b) have taken up her theories in continuing this topic. In her study, Clark (1973) investigated infants' understanding of spatial prepositions to instructions. The following summarizes the setting and observations of the study:

> Imagine a child with a small toy mouse and a box on its side in front on her. She hears Put the mouse in the box or Put the mouse on the box, and has then to do something with the mouse. Or she has a small wooden block and a toy crib in front of her and hears Put the block in the crib or Put the block under the crib. In such settings, one-year-olds systematically place small objects inside containers; if there is no container present, they place them on top of flat surfaces like tables. Yet these children do not yet understand the meanings of in, on and under (Clark, 1993: 60).

Instead, at the age of 18 to 27 months, children rely on "non-linguistic strategies" (Clark, 1973: 168). More generally, if one assumes a "partial semantics hypothesis" as Clark does (1973: 163), children's responses to instructions are based on a combination of incomplete semantic knowledge and non-linguistic strategies. The term non-linguistic strategies refers to the observation that children are guided by their knowledge about the "properties of objects" (ibid: 162). This is the reason why the accompanying instructions are not complied with consistently. Clark (1973) observed that if, for example, an object includes a surface, the infants' behavior is influenced insofar as they will always put something on this surface, regardless of the semantic meaning of the accompanying instruction. Clark (1973) observed the same type of influenced behavior when the landmark-object (LM-object) was a container. In conclusion, Clark proposed two rules of non-linguistic knowledge based on the perceptual properties of objects:

Rule 1: If the LM-object is a container, place the TR-object (trajector-object) inside;

Rule 2: If the LM-object has a horizontal, supporting surface, place the TR-object on top (cf. Clark, 1973: 168 and Clark, 1993: 60).

In accordance with these rules[1], the order of acquisition of locatives can be explained by reference to the percepts involved. In other words, children, being guided by non-linguistic strategies, respond to the "perceptual properties" (Grieve, Hoogenraad and Murray, 1977: 236) of an object such as a surface or a hollow space with the possibility of containment. Prepositions corresponding to the two proposed non-linguistic strategies (i.e. ON for support and IN for container) are acquired earlier, as these non-linguistic strategies are "the

[1] Twenty years later, Clark (1993: 60) argues for "strategies for locative placements" instead of rules, which is more advantageous, as this new term avoids being interpreted in a deterministic way (see below).

basis for [...] first linguistic hypotheses" (Clark, 1973: 180) and, thus, ground the first spatial relational meanings. The prepositions IN and ON can, therefore, be regarded as "cognitively simpler than others" (ibid). If an instruction involves the preposition UNDER, infants' responses at the age studied will "never [be] correct because the options are always either 'in' or 'on'" (Clark, 1973: 168). It is argued that "[i]t is therefore the child's interpretations of his percepts, his knowledge about the properties of objects, that provide a basis for some linguistic hypotheses for assigning meaning to 'new' words" (Clark, 1973: 162).

From the developmental perspective, however, it is difficult to imagine how the basis for such linguistic hypotheses functions. Clark does not elucidate what these "linguistic hypotheses" (1973: 180) consist of and how exactly they function in the process of language acquisition. Rather, the non-linguistic strategies give the impression of regulating infants' behavior in an almost sensomotoric and deterministic way: the child responds to a perceptual property of an object as soon as she or he perceives it because of her or his experiences with containment or surface (Clark, 1993: 59).

Moreover, the perceptual basis for the "first linguistic hypotheses" (Clark, 1973: 180) in the form of non-linguistic strategies – which are described as functioning in a deterministic way – logically leads to perceptual meanings. What is lacking in this argumentation is a suitable transition stage from perceptual to conceptual / semantic knowledge. Although Clark (1973: 177) admits the existence of different stages, "a stage where they [infants] rely on non-linguistic strategies plus partial semantic knowledge of the words; a transition stage; and a stage where they rely on full semantic knowledge of the words", the transition to the eventual use of semantic knowledge remains unclear: when or why do infants cease to follow these strategies and modify their behavior on the basis of semantic knowledge? These questions enforce the deterministic way the strategies influence infants' behavior, which is objected to explicitly by Grieve, Hoogenraad and Murray (1977). According to their argumentation, such strategies may merely constrain but do not necessarily determine infants' responses.

> What he [a child] can do is of course physically constrained by the objects and also by his skill, but more importantly it is constrained by how he has decided to view the objects. While this is constrained by the physical characteristics of the objects it is not determined by them (Grieve, Hoogenraad & Murray,1977: 248).

What seems both crucial and controversial in Clark's account is – as Nelson (1974: 272) puts it – the notion of feature. Semantic features, in Clark's schema, appear to be identical to concrete perceptual attributes such as 'surface'. At a later point, however, the features the child pays attention to are more abstract such as 'time', 'simultaneous' (Nelson, 1974: 272). Nelson describes Clark's connection of perceptual attributes to abstract semantic features as "obscure" (ibid) and also criticizes the lack of a transition stage, that is the specification of conceptual primitives, which would enable a child to apply linguistic hypotheses meaningfully: "what is overlooked here is the child's own independent organization of [...]

the existence of a cognitive level intermediate between perception and language (ibid). In addition, the results of the study by Bowerman (1977) suggest that the assumption that children pay attention to the one type of clues exclusively, is not tenable.

> Children need not adhere to a single classificational principle in the early stages of word acquisition (e.g. using only perceptual or only functional cues). Rather, they are capable of recognizing invariances of many different kinds, and consequently have a variety of methods of classification at their disposal (Bowerman, 1977: 253).

Nelson's criticism makes clear that, in Clark's view, "percepts are transferred directly to semantics, and meaning structure is derived from the language" (1974: 272). Nelson, on the contrary, proposes a cognitive level that is initially language-independent and that functions as a transition between perception and language acquisition. She notes, moreover, that semantic knowledge must conform to the target language while conceptual knowledge need not. She admits, however, that the interconnections between the two kinds of knowledge may change with development (Nelson, 1974: 270). It is obvious here that Nelson holds the view of two-level-semantics (see section 1.5.2). She justifies the necessity of a cognitive level using a developmental view. According to it, it is important to understand how infants cease to be dependent upon recognition through application of sensorimotoric knowledge and come to recognize objects on the basis of their properties and functions. Nelson's aim is, thus, to attempt an answer not only to the first aspect of conceptual level, "distinguishing entities on the basis of a set of currently useful roles or relationships" (ibid: 275), but also to the second aspect: "finding the stable characteristic of the set of entities grouped according to this principle and setting up an attribute hierarchy according to which new instances of the concept can be identified independently of knowledge about their participation in the defining relations" (ibid). Again, the question of which stable characteristics are important for understanding spatial terms is inseparable from the question of how infants use the information about the perceptual properties of objects, and whether this information is consistently used in the course of the child's development (cf. section 1.3).

The semantic aspect that is pointed out here is bound to the claim of non-linguistic strategies regardless of their nature that will be focussed in section 3.8. Clark (1973) constituted that geometric features of objects such as surface and hollow space play a role in infants' understanding. Geometry is, indeed, a foremost aspect related to the perceptual features of objects, and is commonly discussed with regard to the meaning of particular spatial prepositions in research into adult understanding. Depending on the preposition, the geometric description differs. For example, The pear is in a bowl means that the trajector (the pear) is located in the region described by the prepositional phrase in the bowl (Coventry, Prat-Sala & Richards, 2001: 376). The spatial relation, in turn, is expressed by the preposition IN corresponding to an IN-space of the landmark (cf. Klein, 1991: 83-84). The spatial alignment of a trajector and landmark can be more specifically described in different ways, for example, in terms of topology (see below).

2.1.1 Topology

From the Momos' perspective (see section 1.5.2), Herweg (1989) describes the spatial relations corresponding to various prepositions in terms of topology. Interestingly, the issue of topology is often viewed as a link to the issue of the acquisition of spatial prepositions. The prepositions IN and ON thus correspond to the topological relations containment and support while UNDER is linked to occlusion (cf., e.g., Bowerman & Choi, 2001: 478). In line with this view, the order in acquisition of locatives, from IN, ON to UNDER, should be able to be connected to the relative difficulty of the corresponding geometrical descriptions. A starting point for the discussion of what constitutes easier or more difficult relations is given in Piaget and Inhelder, who claim (1993[2] [1971]) that a qualitative change in the types of representation takes place in the development of children's representational knowledge (cf. section 1.3). In accordance with this, young children begin the task of representing space solely in topological terms (Piaget & Inhelder, 1993[2]: 19; Grimm, 1975: 99), then "advance to an understanding of projective and Euclidean information, and finally achieve a mature representation of space that relies heavily on the use of coordinate axes and metric information" (Mandler, 1988: 423). With regard to this view, in which the order of acquisition of IN, ON and UNDER is explained in terms of topological relations (e.g. Clark, 1993: 59), it is not clear why containment and support should be easier to learn than occlusion. However, precisely this conclusion can be drawn from the great number of studies emphasizing cross-linguistically that IN and ON are acquired earlier than UNDER.

An explanation of this question can be attempted within another classification made by Herweg (1989: 99) who classifies UNTER [UNDER] not as topological but as belonging to the to directional prepositions together with ÜBER [ABOVE], LINKS [LEFT TO], HINTER [BEHIND]. In his account, the term topological implies that the prepositions mentioned describe local constellations of objects. More specifically, a preposition localizes a particular region of an object that is specific for this preposition, and which can be characterized in topologic terms as neighboring region (vicinity) of another object.[2] Within Herweg's (1989) classification[3], the order of acquisition could, indeed, be explained by means of topology: prepositions correlating to topological relations such as IN and ON are acquired earlier than others that are nontopological (but directional) like UNDER. Precisely this view is taken by

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[2] "daß die genannten Präpositionen lokale Konstellationen von Objekten dadurch beschreiben, daß sie ein Objekt in einer für die jeweilige Präposition spezifischen Region lokalisieren, die in topologischen Begriffen als Umgebung oder Nachbarschaftsregion eines anderen Objekts charakterisiert werden kann" (Herweg, 1989: 99)

[3] Note, that Ahnert, Klix and Schmidt (1980) already propose a different classification concerning topological relations, which is split into General position and Contact and which belongs to the frame of reference of object relations (ibid: 227). General position-prepositions like IN are acquired before, e.g., UNTER [UNDER] which is acquired earlier than contact-prepositions like AUF [ON] and ÜBER [ABOVE]. Nevertheless, the suggestion that all topological relations are acquired earlier was not be confirmed by this study.

Parisi and Antinucci (1970: 205): "Inside, outside, in, on are among the easiest locatives, and these are locatives whose meaning is based on simple topological relations". If this is true, and the topological relations are acquired earlier, because they are topological, then the effect of topology should also found with other, non-spatial, relations.

However, J. Johnston (1988) gives the example that there are topological relations such as order, "which are themselves clearly derivative and emerge later, during the fourth year. It is only when we ask about the child's ability to represent locations that the priority of topological notions emerges" (ibid: 200). The hypothesis that topological relations must be more accessible to young children than metric ones merely because they are topological can, therefore, not be confirmed. "Yet many topological concepts are highly sophisticated" (Mandler, 1988: 428). Thus, not the topological system by itself accounts exclusively for the easier understanding and development, but at most the topological system with regard – or limited – to spatial relations.

In line with this conclusion, developing the concept for a topological spatial relation should be easier than developing a Euclidean one. But why? Mandler (1988) argues at this point that the topological concept of neighborhood has been widely used to mean proximity to a landmark. But neither in topology nor Euclidean geometry is one point designated as a landmark and another as a secondary object. Consequently, the proof of the use of a landmark by either child or adult implicates neither kind of information (ibid: 427). Mandler, instead, suggests that there is a sensitivity from birth to both types of information, the topological and Euclidean, with primary reliance on topological information at all ages (ibid: 424). An important aim of the empirical studies presented here is, therefore, to test how dominant the perceptual features are and which role the geometry of a landmark plays in infants' understanding. The role of the landmark and of the secondary involved object for the semantics of spatial relational terms will also be considered in 2.5.

2.1.2 Everyday concepts

Nüse (1999) makes the criticism that topology does not account for the level of generalization needed for covering several uses of one preposition. Instead, he proposes a geometric description in terms of everyday concepts rather than in terms of topology. Nüse (1999: 24) argues that the understanding of language in general, and the word meaning of a certain preposition in particular, is dependent on knowledge about the world (i.e. on the humans' conceptualization of things, events, etc.). There is thus no need for a strict and consistent distinction between the conceptual and semantic level. Otherwise, the distinction would lead to a "redoubling of meaning" (see Nüse, 1999: 24 for more details). He therefore defines the specifications of regions for the trajector-landmark alignment in terms of everyday concepts such as SURFACE, SIDE, UNDERSIDE and INSIDE (Nüse, 1999: 87). These notions have the advantage of being well-known and therefore do not have to be explained in contrast to topologic terms like vicinity. The other advantage of such everyday concepts is

that each of them can have different values or instantiations in different kinds of objects (ibid) thus allowing a coherent description of the same preposition in different topologically-composed scenes. In contrast, regions defined in topological terms have to have different extensions. What is referred to as surface in topological classification is viewed by Nüse (1999: 86-87) as "three areas from the viewpoint of everyday conceptions, namely surface, side, and underside". The point worth noting in Nüse's approach is that the geometry allocated around everyday concepts is more object-oriented. In other words, it depends on the particular object and such issues as where are its surface, sides, etc.

Interestingly, at this point, at which Nüse's (1999: 181) idea of defining the regions of the landmark in which the trajector is located – as specified by prepositions – in terms of everyday concepts like SURFACE, SIDE, UNDERSIDE and INSIDE, the modular semantic theory meets the holistic view on semantics. As can be demonstrated on the example of the meaning of the preposition ON, the abstract basic meaning of the modular Momos' view and the image schema of the ON-preposition of the holistic view both have the concept of a SURFACE in common (Nüse, 1999: 19; Johnson, 1987: 126). Similarly, the preposition IN is explained as "CONTAINED_IN [ENTHALTEN_IN]" (Klein, 1991: 97) and can be related to the CONTAINMENT image schema (Johnson, 1987: 21-23). This means that when trying to describe the semantic content of a spatial relational concept, the Momo's approach in two-level-semantics makes use of similar constructs for the concept and, hence, converges with holistic semantics.

Nevertheless, in terms of relating Nüse's (1998; 1999) approach to infant's understanding of UNDER, the question remains unanswered as to why it should be more difficult to apply a preposition to an UNDERSIDE than to a SURFACE or an INSIDE? An approach for answering this question is presented in chapter 4.

2.2 Function

An important characteristic of spatial prepositions is that the same preposition used in different situations describes different geometric alignments (Herskovits, 1985). One of the chief aims of semantics is to tie down the conditions under which such terms are used. "Traditionally, geometric constructs have been invoked to underpin their lexical entries" (Coventry, Prat-Sala & Richards, 2001: 376). However, limiting the semantic conditions to geometric descriptions does not seem to account for every usage of a preposition. Recent research (Vandeloise, 1991; 1994; Feist & Gentner 1998; Garrod, Ferrier & Campbell, 1999; Coventry, Prat-Sala & Richards, 2001), therefore, highlights the importance of the aspect of functionality in the understanding of spatial prepositions. Functionality as a semantic aspect of prepositions is commonly defined in terms of extralinguistic knowledge of space and objects (Vandeloise, 1991: 13) and is related to "extrageometric variables" (Coventry, Prat-Sala & Richards, 2001: 377). However, the conclusions drawn from research conducted with adults may not necessarily correspond to the way children use this type of extralinguistic

knowledge. The findings of German and Defeyter (2000: 708), who studied 5-7-year-olds, suggest that young children's intuitions about function "may be subtly different from those of adults". As an alternative, the authors plead for a more fluid notion of object function in order to account for children's broader criteria for what can count as an object's function than those of adults (ibid: 709). In more specific terms, German and Defeyter (ibid) suggest that instead of taking into account only the proper function of an object, young children adopt an 'agents-goals' view of function where "any intentional use of an object can be its function" (ibid).

Vandeloise (1991; 1994), Feist and Gentner (1998) and Feist (2000) emphasize that, along with geometry, functionality is a part of the core-meaning (cf. 1.5.2) of a spatial preposition. The difference is that the Momos group is focussing on the "abstract-spatial [abstract-räumliche]" (Klein, 1991: 93), in other words, geometric basis of the meaning while Vandeloise's (1994) and Feist's (2000) analyses point out to a functional basic meaning of a preposition.

In the explanation of the spatial relation IN in the "functional approach" (Vandeloise, 1994: 157), the content is seen as the target and the container as the landmark. It is a general claim by all functionalists that a preposition cannot be adequately described if one relies only on the shapes and geometry of the objects designated by the prepositional subject and object. To give an example, for the preposition IN "the dynamic interaction between the container and the content is indispensable for the usage of this preposition" (Vandeloise, 1994: 172). These ideas about the meaning of prepositions are based on Vandeloise's studies, in which he examined how French-speaking children learn prepositions such as DANS [IN]. Vandeloise (1994) noticed that children overlooked the contrast between partial and total inclusion. They disregarded the important topological difference between the two situations and use DANS [IN] as readily for partial as for total inclusion "because the dynamic factor (the position of the landmark determines the position of the target) prevails over the spatial criterion" (Vandeloise, 1994: 173). Vandeloise's argumentation displays similarities with Mandler (1988; see last section). Vandeloise also puts forward the asymmetry of the landmark and trajector as an argument against the semantic description of spatial prepositions by means of topology alone, but in addition uses it for highlighting the role of functionality.

It is worth contrasting these findings with results concerning the relative dominance of form over function in studies investigating infants' attention in object-examination tasks (Madole, Oakes & Cohen, 1993). In contrast to spatial relations, in perception of objects, a clear developmental progression can be observed. This begins with attending only to the form of objects (ten-month-olds), progresses to attending to form and function as separate properties (14-month-old), and finally ends with attending to the relationship between form and function (19-month-old) (ibid: 189). This progression is explained not in terms of the way that infants process information but rather in terms of the kind of information that they process (ibid: 207). The authors plead for attention to the functional properties of objects as an important step in a fully developed understanding of object concepts (ibid: 206).

However, their studies did not demonstrate that "function has any special status for infants at this age: It may simply be another feature of the object" (ibid: 207). The contrasting results that Vandeloise (1991, 1994) achieved may be due to the age of children or the domain of spatial relations he investigated.

The relative importance of geometric and functional information for understanding the meaning of English spatial prepositions in adult communication was addressed in a study by Feist and Gentner (1998). The design of this study considered the importance of information about the geometrical relation between the Figure (trajector) and the Ground (landmark), the conceptual / functional information about the Ground, and the nature of the Figure (Feist & Gentner, 1998: 346). In their experiment, the authors examined the effect of geometry on the IN / ON distinction by varying the concavity of the Ground objects. In order to investigate the influence of conceptual / functional information, Feist and Gentner (1998: 346) used different nouns to refer to the Ground. In one condition, the inanimate Ground was called a dish, in the second a plate, and in the third a bowl (Feist & Gentner, 1998: 347). This manipulation was based on two assumptions: "First, if conceptual / functional information is important to the selection of spatial terms, then the perceived nature of the Ground (LM-object) should influence this selection. [...] Second, the label applied to a Ground should influence participants' interpretation of the Ground" (Feist & Gentner, 1998: 346). The participants' task was to circle IN or ON on their answer sheets, which contained sentences of the form The Figure is IN/ON the Ground. Participants were also told to choose the term that best described the corresponding picture on the computer screen.

The results of this study suggest that the "use of spatial prepositions in English is influenced by multiple factors" (Feist & Gentner, 1998: 348), namely geometry and functionality. Moreover, the factor function is accorded a higher weight than the factor geometry (Feist, 2000; personal communication, 10.5.2001).

2.3 The interplay between geometry and function

A more detailed study concerning the semantic aspect of functionality in the understanding of spatial relations is presented by Coventry, Prat-Sala and Richards (2001). Their study focuses on the role of geometry and functional relations in the comprehension of different spatial prepositions (OVER, UNDER, ABOVE and BELOW). They take functional relations to mean how objects interact with each other and what the functions of objects are (Coventry, Prat-Sala & Richards, 2001: 377). In the design of their study, the authors manipulated three levels of geometry and three levels of functionality (see Figure 4).

The ratings given by participants were expected to be high for a sentence describing a picture in which one of the objects appeared in its canonical position. In this case, the geometric relations were hypothesized to have an effect on the comprehension of these prepositions. The hypotheses predicted the lowest ratings when the same sentence

described a variant of the picture containing the same object tilted at 90° (Coventry, Prat-Sala & Richards, 2001: 380).

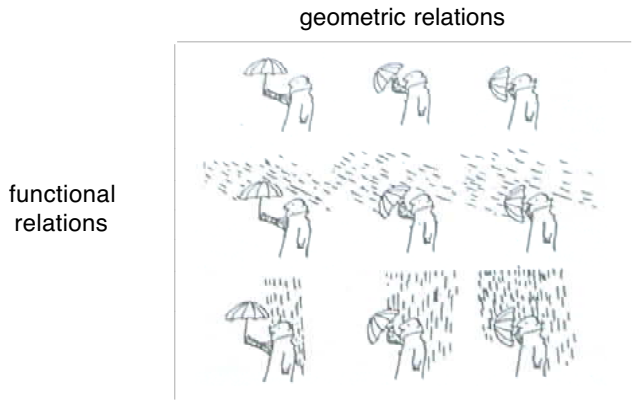

Figure 4: Stimuli in the study by Coventry, Prat-Sala & Richards (2001)

The results show that both functional relations and geometry are important factors in determining the appropriateness of a preposition for describing a spatial scene (ibid: 380). The knowledge needed for assigning functional relations to objects is characterized as object knowledge and the authors propose two different types (ibid: 393):

a. knowledge of the functions that objects usually have (in this case for both protecting and containment functions) and

b. knowledge of how objects function (noncanonically) in context (e.g. in the presence of rain coming from the side).

The overall conclusion from the results obtained in this study is that different factors have differently weighted influences on different prepositions. In this sense, OVER and UNDER were affected by functionality predominantly while ABOVE and BELOW were more heavily influenced by geometry (ibid: 395). The authors thus conclude that object knowledge is more important for OVER and UNDER than for ABOVE and BELOW. In other words, the knowledge of how objects function and the wider context in which the language and/or the visual scene occurs are more important for specifying or modulating the meaning of UNDER and OVER in specific situations “on-line” (ibid: 395). In the case of experiments, where abstract objects are used without any function, the application of different prepositions appears to behave in the same way. From this, Coventry, Prat-Sala and Richards (2001: 395) infer that, where there are no object properties of functional relevance in a scene, “geometric properties alone can still be used to evaluate the appropriateness of these spatial terms”. This is an interesting issue to be discussed with regard to the quantitative results obtained in different types of situations in the first experiment (see next chapter).

2.4 Interplay between context(s) and situation

The above suggestion by Coventry, Prat-Sala and Richards (2001) of adding object knowledge in the context or given situation to the range of factors establishing the meaning of an expression builds on topics in language theory. In his thesis of Pragmatism, the philosopher Pierce (1991 [1878]) emphasizes this pragmatic level of linguistic symbols. The meaning of a symbol is its effect on human action (Pierce, 1991: 195). In this view, the meaning of an expression is understood as the effect on an interlocutor's action in a particular situation. The late work by Wittgenstein (1977 [1953]) picks up this idea and also emphasizes the social aspect in language. Arguing along the same lines, he explains that the meaning of an expression 'tells' us how to act appropriately on a pragmatic level. But what constitutes the meaning? Interpreting and extending Wittgenstein's ideas, the language philosopher v. Savigny (1983) argues that an expression has more than just one meaning possibility (i.e. types of action). V. Savigny (1983) argues for an open class of action possibilities which are accessible for every interlocutor. Context features such as, for example, a certain situation, restrict the open class (ibid: 30). From this pragmatic perspective, the competent speaker of a language knows which context requires which "Gepflogenheiten [customs]" (Wittgenstein, Philosophical Investigation 199).

What seems crucial here, is the notion of context and how language is viewed as restricted by it. Langacker (1997) emphasizes:

> Whatever form its [the speaking mind] representation takes, the apprehended context is a crucial facet of the ongoing conceptualization that provides the basis for linguistic structure (Langacker, 1997: 234).

Sinha (1983) asserts, furthermore, that the context as a semantic and social factor not only influences our language but also our thinking. This view corresponds with Strohner's Ecosystem- [Ökosystem]-metaphor (1995a) emphasizing the interaction of the human mind with its Umwelt:

> Die Ökosystemmetapher basiert auf der Überzeugung, daß Kognition aus dem charakteristischen Verhältnis zwischen dem Lebewesen und dessen Umwelt resultiert. Nicht das Gehirn allein bestimmt die Kognition, sondern das Gehirn in der Interaktion mit seiner Umwelt (Strohner, 1995a: 54).[4]

Consequently, not only our language but also our knowledge about the material world is viewed as "fundamentally social knowledge and the process of acquiring that knowledge is also fundamentally social" (Sinha, 1988: 204). Thus, not only the semantics of a linguistic expression but also the conceptualization of objects – since this is also a process of assigning symbolic meaning (cf., e.g, Mandler, 1992) – are viewed as belonging to social

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4 "The Ecosystem-metaphor is based on the conviction that cognition results from the relationship between the creature and its environment. Not only the mind alone determines cognition but the mind in the interaction with its Umwelt".

knowledge. For this reason, Freeman, Lloyd and Sinha (1980) address the issue of how the reasoning of children is influenced by the cultural environment. They presuppose that the fact that children at first do not grasp the preposition UNDER might be bound to the orientation of objects in the tasks:

> [...] younger infants might fail with an under task using cups, precisely because they have already learned that it is in implicit contrast with an in relationship: in that one cannot trust a cup to retain its contents if it be inverted, especially when horizontal location-shift is added. Therefore a grasp of in might produce the error with under (Freeman, Lloyd & Sinha, 1980).

To test their hypothesis, Freeman, Lloyd and Sinha (1980) created a search task and observed infants at the age of 12 to 15 months. In this task, two cups on a tray were presented to the child. These cups were either both upright or both inverted. A toy, in which the child had previously shown interest was hidden in one of the cups and the tray then pushed forward. This procedure was repeated until the child had successfully retrieved the toy from the cup three times in succession. On the final trial, the object was placed in a cup again, which was moved round behind the distractor cup in order to transpose them. Finally, the child was encouraged to find her or his small toy (cf. Freeman, Lloyd & Sinha,1980: 247). The authors found out that "the younger infants find the inverted cups difficult" (ibid: 248). In subsequent experiments it was confirmed that "if cups be used in their customary orientation, performance is better than if they are inverted" (ibid: 259).

The authors explain the results in terms of children's knowledge about objects and their function: because the children have a concept of an object in its upright position – or "customary orientation" (ibid: 259), – it is difficult for them to comprehend tasks, in which inverted objects are used. "Presumably they have learned that an inverted container is not to be regarded as a reliable cue to the location of its contents" (ibid: 259). Consequently, instructions with the preposition UNDER referring to this inverted position are more difficult to understand. This is because they collide with infants' knowledge about containment (cf. ibid: 259), and are commonly linked to a non-customary orientation of an object (e.g. under the cup means that something is in the cavity and the cup is inverted).

The point worth noting in Freeman, Lloyd and Sinha's (1980) approach is their argument that a child's experiences with objects are not due to their perceptual properties, but rather to their relational nature:

> What dominates their [infants'] performance is not the nature of the small objects [when placed in relation to potential containers], but the nature of the location-relations they enter into, not the rules governing the disappearance of objects so much as the characteristics of the things which seem to make objects disappear (Freeman, Lloyd & Sinha,1980: 259).

This effect is named "the canonicality effect" (Freeman, Lloyd & Sinha,1980: 259; cf. also Lloyd, Sinha & Freeman, 1981, and Sinha, 1982: 140) and expresses that children know about the "canonical orientation" (ibid: 243) of objects and their "performance is affected by whether the experimenter uses the container for its canonical purpose or misuses it" (ibid: 259).

Against this background, a new explanation for the observations made by Clark (1973; cf. 2.1) is possible. This is apparent in Sinha (1983) criticism of Clark's (1973) hypotheses:

> [...] Clark's (1973) proposed nlr's [i.e. non-linguistic strategies] are indeed, as suggested by Wilcox and Palermo (1975), artefacts of the interaction between (a) response biases rooted in the conceptual representation of objects in terms of canonical function; and (b) performance biases rooted in the difficulty or simplicity of the execution of particular motor programmes (Sinha, 1983: 287-288).

In examining the order in the acquisition of spatial prepositions, it is important to consider the potential for canonicity to affect a child's performance in responding to a task. Consequently, we cannot be confident about correctly accessing child's semantic knowledge about spatial relations without respecting her or his cultural environment. The environment as a co-factor in language acquisition presents the child with the relational nature of an object and is also mediated to the child "through social-interactive structure" (Sinha, 1982: 139). As the infants do not respond to the tasks on the basis of perceptual parameters of the information presented, it is plausible to argue that they already have a kind of concept about objects, i.e. they know what the objects are supposed to do (ibid: 155-156). Therefore, the learning process cannot be reduced to an internal processing of linguistic information, but has to consider contextual information as well as the child's experiences in the Umwelt.

In keeping with this idea, there are consequences for the view of language, which is summed up in the Embodiment thesis formulated by Sinha and de López (2000: 36-37). The concept of embodiment originates from the view that "[...] minds are embodied; [...] mental processing lets us interact with our surroundings and is strongly shaped by these interactions; and [...] the processing constitutive of language has to be studied and described with reference to the social and contextual interaction of actual language use" (Langacker, 1997: 248). In this view, the interlocutor is characterized as "the speaking mind" who is observing, interpreting, and affecting the interactive context and bringing it within the realm of cognition (Langacker, 1997: 234). Consequently, language development should be surveyed as an embodied (Zlatev, 1997) or – as Sinha (1999b: 34) puts in – socio-naturalistic process:

> In general, we may say that the question of the priority of linguistic or cognitive factors for the development of language in childhood tends to dissolve with a conception of language which emphasize its embodiment and situatedness (Zlatev, 1997: 249).

In light of arguments emphasizing the necessity of taking into account the influence of context on human cognition, Sinha, as early as 1983, proposes a "revision of the notion of 'context' as a variable. It should no longer be seen as standing in opposition to internal, mental representation, as a static property of the external environment, but instead be viewed as the dynamic product of organism-environment interaction" (ibid: 277). However, even though the notion of context seems to be crucial for the process of word learning and conceptualization, there is still a lack of comprehensive clarification as to its influence on reasoning, because a great many factors are summarized under the notion of context

(Graumann, 2000). In the following, the notion of context will be given a more concrete form and dissociated from situation in order to clarify their interaction (see also Rohlfing, Belke, Rehm & Goecke, submitted).

Situation. Situation is commonly used interchangeable with the term of context. For example, if something is dependent on situation, it is often said to be context-dependent. However, the term situation as it is used here differs from context in that it refers to the moment at which an action can take place. As such, it includes the spatial-temporal ordering of objects and individuals with corresponding physical constraints. An action is situated as it always takes place in a specific situation. In contrast, there are two notions of context that should be differentiated: the intra- and intercontext (cf. Rohlfing, Belke, Rehm & Goecke, submitted).

Intercontext. Any action, observation or interpretation (cf. Langacker, 1997: 234) by an individual is constrained by a socio-cultural intercontext — this notion refers to a social phenomenon that cannot be surveyed by an individual, but which nevertheless constraints how an individual will interact in a specific situation. An example are canonical rules, which emerge in a social group and constrain the handling of objects, for instance their canonical orientation. The "canonical rules"[5] Sinha (1983: 276) is arguing for are provided by the social interests and values of humans. Sinha (1983: 293) claims that canonical rules are also represented in the utterances and structures of interaction-episodes. Canonical rules structure the world of the child by being part of her or his environment. Such rules reflect historical consciousness and a particular cultural order and thus canalize the child's intellectual and communicative development (ibid: 293). When acquiring language, children are, therefore, pre-disposed "through their experiences of interaction with the material world as this is culturally presented, and through the mediation of cultural practices, to employ comprehension strategies that are consistent with the specific semantics of the language they are acquiring" (Sinha & de López, 2000: 35; see also section 5.3.1 for more details).

Another example is the context of a shop. Customers are expected to ask questions concerning the products in the shop and to pay for articles. Dining or stealing are not licensed by the situation. In this sense, an intercontext supplies patterns of behavior and ready-made analyses for situations that an individual may be confronted with. A situation becomes meaningful only against the background of such socio-cultural contexts, which also include the language spoken in a given country. In keeping with this framework, it is argued that there are a great number of different intercontexts such as a society as a whole, individual social groups, etc. (Rohlfing, Belke, Rehm & Goecke, submitted).

Even though it is necessary to elaborate the importance of intercontext as a factor contributing to the process of understanding, there is an insufficiency in these theories, which attempt to explain the phenomenon of meaning against the background of the

5 "and it is to this type of convential (but non-arbitrary) 'rule' that I shall refer by use of the term canonical (from the Greek, kanon=rule)" (Sinha, 1983: 276).

intercontext alone. This is because they disregard the intracontext (see below). This one-sided account evokes a perspective, in which an individual is involved in a language system only as a part of an intercontext. The intracontext and the intercontext thus coincide in language games of the type proposed by Wittgenstein (1977 [1953]). In consequence, the language theories by Wittgenstein and v. Savigny (1983; 1996) have difficulties trying to explain linguistic change, for example the creation of new words or meanings. The extensive discussion cannot be presented in its entirety here. It can solely be pointed out that the core of this argument leads to certain complications if one recognizes that a human speaking a language can be creative and develop new words and new actions in communication.

A further point of criticism against theories viewing the meaning of an expression as determined only by its use can be found in Zlatev (1997: 48). He argues that a view describing language solely in terms of language games as appropriate usage devalues the "subjective meaningfulness ("intrinsic intentionality")" of human communication and neglects aspects of linguistic and conceptual systematicity within a language. Moreover, describing language from the perspective of intercontext anticipates "boundless variation between language, which does not do justice to the linguistic facts" (ibid). Therefore, the process of representing language as a symbolic system cannot be neglected. In supporting this conclusion, Langacker (1997: 232) points to the evidence that speaking a language requires conventional knowledge that somehow has to be learned and stored by individuals.

Intracontext. The notion of intracontext prevents the complications mentioned by Zlatev (1997: 48). By her or his interaction in specific situations within a certain intercontext, individuals construct their own intracontext enabling them to make sense of the situations they encounter. Adding the notion of intracontext for marking individual human processing of information is an important addition to the language theories of Wittgenstein (1993[9]) and v. Savigny (1983; 1996). However, it has to be applied with some modifications. Otherwise, it could lead to the following contradiction pointed out by Zlatev (1997: 38): the notion of intracontext evokes the conviction that there is an individual conceptualizing the world and meaning coincides with his or her conceptualization. On the other hand, however, her or his conceptualization is viewed as influenced by intercontext as the involvement of background knowledge can be observed. It seems unclear whether the individual processing of language in the form of symbolic representations or the participation in the act of social communication establish the basis for acting and understanding. For Zlatev (1997: 44), a conception of language and linguistic meaning from the intracontextual perspective remains problematic because it signifies an "excessive mentalism", which cannot be redressed through grounding the intracontext in its environment as attempted in holistic semantics. In this sense, the notions of intra- and intercontext seem to mutually exclude each other.

Instead of a view from the perspective of either an inter- or intracontext exclusively, Zlatev (1997: 48) proposes a synthesis of inter- and intracontexts and argues for the concept of "situated embodiment". This view places "an equally strong emphasis on the social as well as

on the individual levels of linguistic reality" (1997: 51).

> Linguistic meaning, then, is continuous with both the embodied "having of a world" in schematized, subjective experience and the referential "sharing of a world" in intersubjective experience (Sinha, 1999a: 237).

This idea is also incorporated in the model of situatedness proposed by Rohlfing, Belke, Rehm and Goecke (submitted), where the mutual dependence of the inter- and intracontext is emphasized: the establishing of the intracontext, in other words, individual abstraction from concrete situations is learning. In the emphasis on the learning process resides the relevance of this model for the semantic analysis proposed here. In this approach, learning is viewed as situated, as it takes place in a certain situation. The action or events embedded in this situation are influenced by the intercontext, which supplies certain action and interpretation patterns. The relevant environment, therefore, provides not only certain information to the intracontext but information in a particular situation, i.e. "situated information [situierte Information]" (Strohner, 1995a: 56).

To sum up this view, it is important to test and discuss contextual and situational clues (for example in the form of non-linguistic strategies) on a child's reasoning in a certain task. It is also highly significant to include the impact a child's knowledge about the environment has on her or his language understanding, which will be considered when discussing the qualitative results in chapter 3.

2.5 Attention to objects

Carstensen (2000: 258) argues that certain phenomena of understanding prepositions in different situations that have been recently explained by functional aspects (cf., e.g., Vandeloise, 1994 and in 2.2) should be rethought if one admits that attention also plays a crucial role in processing spatial information. According to Carstensen (2001: 177), there are few approaches dealing with the aspect of attention with regard to spatial relational terms. He refers to one exception, which is the work by Logan and Sadler (1996), who emphasize the concept of reference frames that serve as a map between conceptual and perceptual representation (Logan & Sadler, 1996: 499). The authors assume that reference frames are flexible representations (ibid), which correspond to the micro-perspective presented in Carstensen (2000; 2001). As Carstensen (2001: 121) himself suggests, just how attention contributes to the meaning of spatial prepositions can be best explained in terms of Cognitive Grammar.

The central claims in Cognitive Grammar are that grammar is symbolic in nature and that lexicon, morphology and syntax form a continuum fully describable as assemblies of symbolic structures (Langacker, 1998: 4). To understand the work of Cognitive Grammar with regard to spatial relations, it is necessary to begin with the notion of profile. This creates a special degree of focal prominence (Langacker, 1987: 491) and performs the same function as the

notion of attentional change suggested in Carstensen (2001). The profile functions like a spotlight: it highlights a particular element and its immediate surroundings.

> This is best seen from expressions that evoke essentially the same content but nonetheless differ in meaning. [...] for instance, the conception of the human eye provides the common conceptual base for terms like iris and pupil, which are certainly not synonymous [...] They contrast semantically by virtue of profiling – referring to – different subparts of the base (Langacker, 1998: 4 –5).

Expressions can profile not only things but also relationships (Langacker, 1998: 5; Carstensen, 2000: 250). This means that a nominal predication profiles a thing, whereas a relational predication that includes a verb profiles a process or an atemporal relation in the case of predications including adjectives, adverbs, prepositions. Accordingly, an expression‘s grammatical class is not determined by its conceptual content, but by the nature of its profile (cf. Carstensen, 2000: 248). The meaning of grammatical elements tends to be “quite schematic” (Langacker, 1998: 4). Langacker (ibid) notes that “the more schematic an element is semantically, the more inclined linguists are to consider it ‘grammatical’ rather than ‘lexical’.” Langacker himself, however, views this as a false dichotomy.

In Cognitive Grammar, the trajector–landmark asymmetry is fundamental to relational predications and underlies the universal subject–object distinction (Langacker, 1987: 231). The trajector is “characterized as the figure within a relational profile. The term trajector suggests motion, and in processual predications describing physical activity (presumably the prototype for spatial relations) the trajector generally does move through a spatial trajectory” (Langacker, 1987: 217). The term landmark, according to Langacker, refers to a point of reference for locating the trajector prototypically (Langacker, 1987: 217). The terminology of this trajector and landmark asymmetry can be traced back to Talmy (1983), who uses notions from Gestalt psychology, i.e. Figure and Ground. However, the corresponding terms of trajector and landmark in Cognitive Grammar characterize the objects more generally as equal participants involved in a relation. Furthermore, Langacker (1987) uses the asymmetry not only for spatial relations but also for other relational predications.

The fundamental asymmetry of landmark and trajector in semantic structure is characterized in Langacker (1998: 5) as “focal prominence”:

> It is usual for one participant – termed the trajector (tr) – to stand out as the primary focal participant in the sense of being the one the expression is concerned with locating, characterizing, or assessing in relation to others. A secondary focal participant, with respect to which the trajector is located or evaluated, is called a landmark (lm) (Langacker, 1998: 5).

The reason why the trajector-landmark alignment is essential for relations is because events “do not simply present themselves as linguistically codable” (Nelson, 1996: 122). First by focussing a participant a “minimally adequate semantic descriptions” is provided (Langacker, 1998: 10). In a relational expression, focal prominence is accorded to one or more participants (Langacker, 1987: 5). The expression can, therefore, differ in meaning due to the degree of salience accorded to the participants in the profiled relation. An asymmetry in

participant salience is the only evident basis for distinguishing the meanings of pairs of expressions such as ABOVE and BELOW, which evoke "the same content and profile the same relationship" (Langacker, 1998: 10). Similarly, Carstensen (2000; 2001) notes that both prepositions refer to the same implicit relation. In Carstensen's (2001: 142) words, it is the "micro-perspective [Mikroperspektivierung]" – in Langacker's (1998) terms, the asymmetry of trajector and landmark – that makes an implicit spatial relation an explicit one. Implicit relations between objects cannot be processed directly. Only a change of attention, the micro-perspectives, determines which of various possible explicit relations for a single implicit relation is appropriate in the context of specific coordinate systems and thereby suggesting a particular preposition. Langacker (1998: 5) explains that in the ABOVE-relation, the lower participant is taken as a landmark for the purpose of specifying the location of the higher one. Thus, we will say The foot is **in** a shoe, when we focus on the foot, and The shoe is **on** a foot, when we focus on the shoe (example cf. Garrod et al. 1999: 186). In these examples, the preposition differs even though both sentences describe the same implicit relation. Interestingly, Carstensen (2001: 142) claims that the distinction between implicit and explicit representations already has to be made on a non-linguistic level. By this he means that canonical rules (see above), which determine how an object is held and how two objects belong together derive from social rules. These social rules, in turn, specify the change of attention in particular. In consequence, linguistic spatial relations require necessarily explicit relations based on the change of selective attention (Carstensen, 2000: 250).

Interestingly, this aspect of attention – more specifically, profiling or attentional change – is disregarded in, for example, Coventry, Prat-Sala and Richards (2001: 395), who attribute the difference between the relation ABOVE versus BELOW to functional factors only. This is a prime example for what Carstensen (2000: 258) was referring to in the criticism mentioned at the beginning of this section, i.e. that certain phenomena in the understanding of prepositions, which have been recently explained by functional aspects should be rethought in terms of attention as a characteristic of prepositional meaning.

The phenomenon of profiling is a part of a discussion about the cognitive ability for directing attention and concerns the creation of a reference point. Langacker (1998: 7) characterizes a conceptual reference point as providing mental access to a target found in its dominion.

> By serving as an **initial focus** of attention, the reference point tends to activate an array of associated entities which collectively constitute its dominion. This enables attention to shift to a **secondary focus** within it, the target (which activates its own dominion and may in turn function as a reference point) (Langacker, 1998: 7).

A dominion corresponds to Sinha's "background knowledge" (1983: 269). In this sense, creating an initial focus of attention means creating a basis for the discourse. Consider examples like (10) and (11), where highlighting indicates speech emphasis:

(10) The **ball** is on the table.

(11) The ball is on **the table.**

Depending on which reference point and its dominion is activated, the sentence will be continued differently in the discourse. In (10), the ball (TR) is the reference point, but in the second example, it is the table (LM). This can be pictured as follows in Figure 5 (heavy lines correspond to the profile in the sentence).

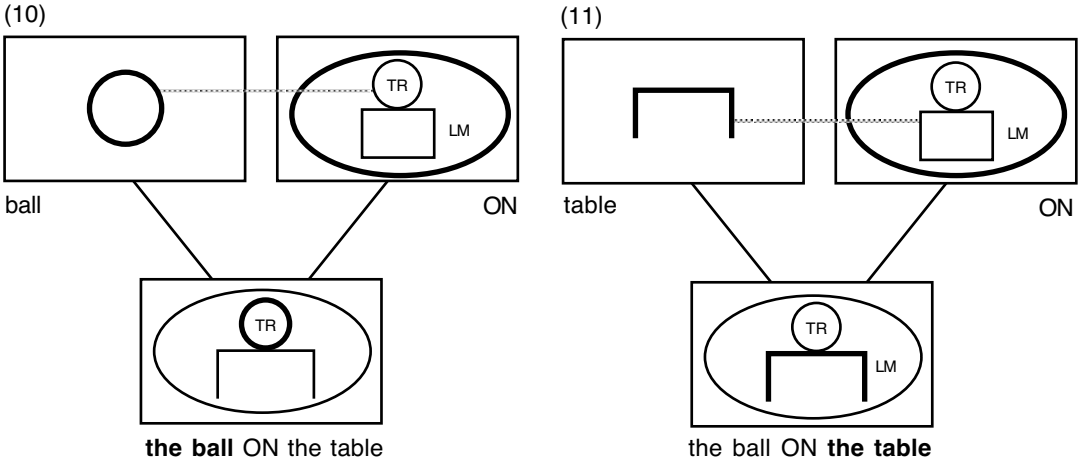

Figure 5: Different profiles in the expression: The ball is on the table (bold lines express the profile)

The first sentence emphasizes that the ball – not another object – is on the table; the second sentence highlights the location, the table (i.e. the ball is on the table, not for example on a chair). Thus, while sentence (10) will probably be continued focussing on the dominion of the ball, for example (12), sentence (11) pertains to the table, for example (13).

(12) Put it [= the ball] in the playbox.

(13) It [= the table] is the place for dinner not for your play.

In these examples, the nouns ball or table evoke an established "frame" (Langacker, 1998: 8) including such standard knowledge as playing or dining. The frame, consisting of our general knowledge, specifies the meaning of further utterances. Using this frame, the targets linguistically marked by it in both sentences, can be understood correctly.

Even though it seems plausible to assume that background knowledge, which is activated via attentional change, contributes to the understanding of linguistic utterances in the way described above, it remains unclear how such knowledge develops. Neither Langacker's nor Carstensen's theories attempt to account for the development of the general "ability to direct attention to some entity for purposes of then establishing 'mental contact' with another" (Langacker, 1998: 7).

Nevertheless, the process of attention may influence the weight of previously discussed semantical aspects such as functionality and geometry. A further conclusion by Carstensen (2000: 258) is that the semantics of relational terms is less determined by the functional relations than is commonly assumed. The phenomena previously linked to functionality can, in fact, be explained by means of attention. To characterize the location by focussing one object and activating thus a related background knowledge seems to be well-organized and therefore easier to achieve in contrast to having a vague criteria of functionality and to apply it in some way on the selected region. The description of a meaning in terms of attention has, therefore, an advantage in comparison to a description, in which the location is characterized objectively (e.g. in terms of geometric or functional features) as it clearly relates spatial means to the whole space the two objects take (Carstensen, 2000: 248). In other words, attention restricts the spatial descriptions of an object. If, for instance, we would like to point to a balloon in the sky, we will probably make sure that the person we are showing it to will focus attention in the same way we do, including the same standing position. Establishing joint attention is, therefore, an important prerequisite for communication, which can be developmentally supported in studies reported on in Tomasello (1999; 2001).

2.6 Summary of chapter 2

Coming back to Clark's results, even though the non-linguistic strategies she suggests are presented as a stage without detailed developmental description, the involvement of such a factor in the process of understanding remains a worthy candidate for explaining children's responses to instructions with prepositions. The question remains, in which way non-linguistic strategies constrain infants' reasoning. In their attempt to specify the constraints, Grieve, Hoogenraad and Murray (1977) include a child's "experience of the material, partially determined by the cultural environment" (ibid: 248) as part of their reasoning. Nevertheless, the authors do not specify how this partial determinism functions. Following the discussion of different factors involved in understanding spatial relational terms, it was argued that one can explain the process of understanding in terms of the interplay between the inter- and intracontext.

Furthermore, in the discussion above, different studies emphasizing functionality as a semantic aspect were reported on. This aspect has the effect of producing a complicated profile, which differs depending on the preposition (Coventry, Prat-Sala & Richards, 2001) and situations in which the trajector occurs, for example, with different distances to the landmark (Garrod, Ferrier & Campbell, 1999). In addition, the co-occurring objects in the scene (Coventry, Prat-Sala & Richards, 2001) contribute to the profile. These various dependencies are less important if one views functionality as a co-product of the change of attention, as suggested in Langacker (1998) and Carstensen (2001). In perceiving a certain situation, the interplay between functionality and geometry is an effect, which is called up within the background knowledge. This background knowledge is, in turn, provided when an

initial focus of attention is created. In this sense, profiling creates a link between the inter- and intracontext as it is a cognitive mechanism providing a social dominion.

The consequence of the view implied by the aforementioned aspects and the process of attention is that the semantics no longer involves context-independent factors as postulated in Schwarz (1992: 24). On the contrary, semantic factors generated due to the process of attentional change are situative. The contribution of situative aspects will be displayed in the qualitative results in the next chapter.