Chapter 4

Why is UNDER more difficult?

In the previous chapter, an experimental approach to the question what infants know about a spatial preposition was presented. The focus of investigation was on the preposition NA [ON], which children understand well in known situations. The question, however, why spatial relational terms are acquired and understood in a certain order, i.e. why children have difficulties in understanding terms linked to the relation UNDER at this age, needs still to be clarified.

The spatial prepositions ON and UNDER belong to the seven[1] basic locative relations which, according to Johnston and Slobin (1979: 530), develop when children initially start to use language. As already mentioned in chapter 1, many cross-linguistic studies displayed that these basic locatives show not only the peculiarity of preceding other spatial relational terms, but also emerge in a certain order. Especially considering the arguments for a correlation between spatial words and spatial concepts presented in the previous chapters, from a developmental perspective, it is of particular interest why spatial terms emerge in a relatively consistent order and why it is difficult or even impossible for two-year old children to understand instructions containing the spatial preposition UNDER — while children at this age have less difficulties with the preposition ON, as suggested in the last chapter.

This chapter, therefore, opens a part, in which the understanding of UNDER is focussed. The long tradition of investigating the order of prepositions in acquisition is reflected in a variety of issues, some of which were already discussed in chapters 1 and 2. Four perspectives will be revisited in this chapter, from which the main arguments for the late understanding of UNDER are summarized below. These will form the background for methodological considerations in the training study in chapter 5.

4.1 UNDER: less present in the input

Probably the most obvious answer to the question about the particular order in the acquisition of UNDER refers to the frequency of the relevant preposition in everyday communication. Recently, studies summarized in Bybee and Hopper (2001) have

[1] In Johnston and Slobin (1979), the other basic locative relations are IN, BESIDE, BETWEEN, BACK and FRONT.

emphasized that “frequency of exposure and use is an important factor in the establishment and maintenance of linguistic structure” (ibid: 3). Since, as for example Tomasello (2000c: 161) states, children learn from adult input, it is plausible to presume that UNDER is acquired later because the other basic prepositions like IN and ON are more frequent in adult communication, and the child thus has more opportunities to perceive them. In apparent confirmation of this, Kucera’s and Francis’ (1970) analysis of present-day American English shows that IN appears three times as often as ON which, in turn, is nine times more frequent than UNDER. Nevertheless, it should be noted that Kucera’s and Francis’ analysis is based on written texts which do not reflect the every day experiences of children. To examine to what extent frequency influences language acquisition, it is necessary to analyze adult input to children.

Concerning the order in the acquisition of spatial relational terms more specifically, Gentner and Boroditsky (2001: 233) reviewed various studies related to whether word frequency determines the acquisition rate. The authors focus especially on the acquisition of open-class terms such as nouns and adjectives before closed-class terms like prepositions. They concluded that “word frequency must play a role” (ibid: 234) but this could not by itself account for the predominance of certain terms. Similarly, Grimm (1975: 98) already points out that the relation between frequency and sequence in acquisition “does not lead theoretically very far”. She is of the opinion that the argument about widespread usage should also be included in the considerations, and reports that the prepositions which occur frequently are also the prepositions which can be used in many different senses. To what extent the factor frequency is relevant for the order in the acquisition within the closed-class terms could be optimally proven in a longitudinal study, in which the adult input for the children were recorded and children tested in parallel in comprehension tasks. Such a study would allow a direct comparison of the adult input to children’s performance in understanding.

Currently, the analysis of the input to the children is possible only within a language production database[2]. Using such production data, there is no direct possibility to establish the influence of adult input on children’s understanding, particularly since competence in understanding is almost always ahead of competence in production. Nevertheless, as the order in acquisition of locatives is observed in both language production as well as in language comprehension, it is interesting to take this data into consideration.

The database of language production and the corresponding input to the German children K. and A. records the input of spatial prepositions (other particles like drunter were excluded) to the child A. (1.11.14 - 2.0.30) and K. (1.3.22 - 2.1.1) up to 25 months of age (see Table 9).

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[2] The data for the K.-corpus was collected by Miller (1976), the data for the A.-corpus by the Max-Planck-Institute for Evolutionary Anthropology in Leipzig, Germany. Both corpora were checked and transcribed in CHAT format at the Max-Planck-Institute for Evolutionary Anthropology, under the supervision of Heike Behrens. Since the A.-corpus is not yet published, I am grateful to Kai Kiekhöfer for this extraction.

Table 9: Input to A. and K. up to 25 months of age

	to A.	to K.
IN	471	254
AUF [ON]	704	721
UNTER [UNDER]	35	18

In both cases, AUF [ON] is the most frequent preposition in the input to the children. In line with a strong hypothesis that the input's quantity influences the child's language production, there should be evidence for a direct correlation between the production and the input of certain prepositions. Accordingly, the production of the prepositions should develop in the order: AUF [ON] → IN → UNTER [UNDER].

However, K.'s and A.'s output of spatial terms does not reflect such an order (see Table 10).

Table 10: A.'s and K.'s output by 25 months of age

	A.	K.
IN	0	0
AUF [ON]	145	515
UNTER [UNDER]	4	5

The table suggests as an order of AUF [ON]→ UNTER [UNDER]→ IN. The output of the AUF [ON]-preposition thus appears to reflect the influence of the input. However, the output of the other two prepositions clearly does not correlate with the input, as can be seen from the lack of production of the preposition IN by the children. Thus, the strong hypothesis suggested above cannot be confirmed: output is not solely influenced by input.

A.'s and K.'s output also casts some doubt on the supposedly universal order of IN→ ON→ UNDER. It is important to emphasize, however, that the order is claimed primarily for children's understanding. Two plausible explanations are that the input has more influence on production than on understanding (cf. Tomasello, 1987 in the next section 2.5 arguing that infants acquire locatives holophrastically), or alternatively that input is not the only factor relevant to locative acquisition. Paprotté (1979) supports precisely this latter claim and argues that frequency is not the most important feature for the child's retention as prepositions do not have any particular "perceptual salience" (Paprotté, 1979: 210) that could help infants to understand some morphemes more easily than others:

> Weder durch phonetische Substanz, durch Akzentverhältnisse noch durch ihre serielle Position in Äußerungen kommt Präpositionen perzeptuelle Prominenz zu. [...] Ein Erklärungs-

> versuch für diese Erwerbssequenz sollte also nicht auf die an isolierten sprachlichen Ausdrucksmitteln konstatierbaren Eigenschaften zurückgreifen, sondern eigentlich alle am Verständnisprozess von Äußerungen feststellbaren Faktoren berücksichtigen (Paprotté, 1979: 210).[3]

A further interesting argument against the exclusive role of frequency is presented in relation to the data of a Japanese child reported in Sinha et al. (1999: 115). Even though Japanese has a different system for expressing spatial relational meaning, the data similarly suggest that frequency is not the most relevant factor in the acquisition of locative expressions. Japanese has a "very restricted system of locative particles, and at the same time relies rather heavily on subclasses of verbs and nouns in order to express spatial meaning" (Sinha et al., 1999: 113). The data show that the child's use of locative particles is initially very limited and he starts instead with the production of locative nouns. "However, Adam's mother used locative particles in all sessions except one, with higher overall frequency than she used locative nouns. Thus, input frequency alone cannot account for Adam's late acquisition of locative particles" (Sinha et al., 1999: 115).

Interestingly, with regard to the meaning of these first spatial expressions, the Japanese pattern in the acquisition of spatial relational terms shows similarity to the order of prepositions mentioned above.

> Turning to the question of which spatial meanings were expressed in Adam's early uses of spatial locatives, we see that these correspond fairly closely to the basic spatial relational meanings expressed by the locative particles first acquired by the English and Danish children, but that they are expressed by the verb class in Japanese (Sinha et al., 1999: 117).

This observation suggests that despite individual differences and the potential importance of the input to children (cf. Bybee & Hopper, 2001), there seems to be a certain cross-linguistic regularity in the acquisition of spatial relational terms. This conclusion accounts generally also for early lexical development. Parisse and Le Normand (2001) report that children do not simply follow the frequencies of the input. In their study, the authors compared the most frequent early words in English and French. They found that the same type of words is used most frequently in English and French children beginning to speak. However, "a comparison with adult production shows that, in neither language, do the words produced by children match exactly the words they hear most frequently" (2001: 1). Since the languages differ in the syntactic structure, the authors argue for a cognitive origin and children's own semantic agenda of their initial words.

To summarize, the role of frequency in language acquisition cannot be denied — however, as the data presented above show, there is no reason to assume its role is determining:

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3 "Neither via phonetic substance, accenting nor their serial position in utterances are prepositions prominent. [...] An attempt at an explanation for this sequence in acquisition should therefore not refer to definable properties of particular isolated linguistic means. Rather, it should take into consideration all observable factors contributing to the understanding process".

> In short, it would seem that the semantic content of the first phase of acquisition can be best accounted for by a hypothesis emphasizing the interaction of cognitive with linguistic structural determination, modulated (but not, as the Japanese data clearly show, substantially determined) by input frequency (Sinha et al., 1999: 120).

For the established order of development in spatial relational terms, arguing that frequency of linguistic symbols in the input modulates the process of their acquisition means raising the question of why UNDER is less present in the input to the children. This fact – confirmed, for example, by the analysis of English and Danish data by Sinha et al. (1999: 109) – could be due to the intuitions of the caregivers who do not mention the relation UNDER because it is more complex to explain or because they believe that the UNDER-localization is describable in a better or more salient way by other relations (see section 4.3). In addition, it should be considered why the ON-preposition should at least (in the case of A. and K.) appear so frequently, i.e. which environmental constraints make the ON-relation seemingly more basic for human language than for example UNDER. The design of the training study (see next chapter) will approach this question.

4.2 UNDER: linguistically more complex

The role of linguistic knowledge for the acquisition of spatial relational terms was already discussed in 1.4. In this section, the question of how linguistic factors – such as "linguistic complexity" (Johnston & Slobin, 1979: 541) – may contribute to the late acquisition of UNDER is raised anew. Approaching the acquisitional order of prepositions from this view means relating the difficulties of understanding the preposition UNDER to the fact that "language is a system of ways to codify experience and that children are learning that system" (Gentner & Boroditsky, 2001: 243).

Slobin (1973) and Dromi (1979) refer to the morphological challenge children face when learning a preposition. In keeping with this view, the explanation for the late acquisition of UNDER seems simple: the preposition is morphologically more complex than IN and ON. Precisely this thesis is presented in Dromi (1979: 561) using examples of Hebrew speaking children. The Hebrew data (for which the order of locatives in acquisition has been confirmed twice, firstly in Dromi's study and secondly with results obtained by Halpern, Corrigan and Aviezer, 1983) indicates that Hebrew-speaking children acquire one-morpheme terms for spatial relations earlier than two- or three-morpheme terms, to which the Hebrew term for the UNDER-relation belongs (ibid: 560). Dromi (1979: 561), therefore, suggests that "morphological complexity is a determinant in the order of acquisition of locative prepositions".

There are, however, empirical findings that reveal a different picture and thus display arguments against this thesis. Firstly, in Polish, the term for the UNDER-relation, POD, is still understood later than terms for IN and ON, even though all of the terms involved consist of one morpheme (see section 3.2). Thus, morphological difficulty on its own cannot account

for the order in acquisition of spatial relational terms. Secondly, Thorseng's (1997a) analysis of the locative particles produced by Danish and English children showed that, even though the Danish locative particles system shows a greater lexical diversity than the locative system in English, "no delay in the acquisition of locative particles was found for the Danish children" (Thorseng, 1997a: 33). That means that even though Danish children are confronted with more different locative particle when referring to a situation, they cope with such a morphological challenge as well as English children, who have the advantage to learn a smaller number of locatives. Morphological complexity seems therefore to be a weak candidate in explaining the late understanding of UNDER.

4.3 UNDER: difficult to discern

In the argument presented in Grieve, Hoogenraad and Murray (1977) the reason for the late understanding of UNDER is also approached from the linguistic perspective. The main focus is on the analysis of the "role of syntax" in instructions, in which the spatial prepositions occur (ibid: 247). The design of the experiment arises from the criticism of objects used in Clark's (1973) study. The novel approach in the study conducted by Grieve, Hoogenraad and Murray (1977) was the use of "neutral objects" (ibid: 247), i.e. large and small boxes. According to the authors, the aim of this was to reduce the cues coming from children's knowledge about objects and to thereby focus on the syntax of instructions.

The observations made by the authors from their studies concern the interplay between the children's correct responses and the kind of instructions given. They noticed that in a test for comprehension of the spatial prepositions IN, ON and UNDER in which children were asked to point to the correct arrangement in an array of alternatives, children made fewer mistakes when instructed Show me X under Y than when instructed to produce the correct arrangement in Put X under Y (Grieve, Hoggenraad & Murray, 1977: 246). The authors concluded that it depends on the kind of instruction as to whether a child can understand the relation UNDER or not. In any case, the reaction to the instruction Show me X under Y demonstrates that the child at least understands the relation of UNDER in principle.

> The present study provides clear evidence that the way 2 and 3 year old children interpret the prepositions in, on and under does not arise simply from the physical characteristics of objects [with reference to Clark (1973)], or from the child's knowledge of the customary relationships of objects [with reference to Freeman, Lloyd & Sinha (1980)]. Rather we must look to an interaction between such factors and the way the objects concerned are referred to in the instructions (Grieve, Hoggenraad & Murray, 1977: 247).

The conclusion that the instruction Put X under Y is more difficult is drawn from the assumption that this type of instruction requires the ability to handle X and to "conceptualize the required relationship, X under Y, since there is no aide-memoire" (ibid: 244). In the instruction Show X under Y the child's task is to "find X, the X such that X is under Y, and the

presented array can act as a form of concrete aide-memoire in his search" (ibid). In their conclusions, the authors mention that two aspects are important in understanding relational requests: "the lexical meaning of the preposition, and the grammatical meaning of word order" (ibid: 248). According to this conclusion, the child may understand the lexical content of a given preposition (i.e. given ON that one object should be placed on the other) but fail to understand the "grammatical meaning of word order with respect to preposition" (i.e. to appreciate which should go on which). What the authors are pointing to can be more explicitly described using attention to objects as an important aspect of understanding spatial relations developed in section 2.5. Within this framework, the difference between the two types of instructions resides in a kind of overview. Understanding an instruction, a child has to ascribe the roles of trajector and landmark to the objects presented to her or him. In the case of the instruction Show me X under Y, the roles of objects are already given in a situation to which the instruction refers. Moreover, in the instruction the trajector, X, is named first and the landmark, Y, second. It is easier for a child to follow the instruction Show me X under Y because this already contains the order in which attention should be drawn to the objects.

Not only the role of syntax (as called by the authors) is crucial in their approach but also the conception of the lexical meaning of prepositions. Grieve, Hoggenraad and Murray (1977) argue that in order to understand the instruction Put Y under X, children first need to convert it into Put X on Y which on the whole is cognitively more challenging than just reacting to the instruction Show me X under Y. However, this leads to question of why the semantics of UNDER should require conversion to the ON-relation? In the explanation given by Grieve, Hoggenraad and Murray (1977) they give the impression that in order to understand language, children have to develop a mental representation of a single linguistic symbol, the meaning of a spatial preposition. The representation of the UNDER-preposition is accordingly linked to the ON-preposition and a child has to discern this linkage and to convert the ON-relation in order to understand the UNDER-preposition. This seems to be a complicated view based on both formal semantics and the classical view on concepts (cf. section 1.6.1)— and the argument about syntactic difficulty is tenable only in this perspective.

The main aspect, therefore, that should be critically discussed in considering the approach presented by Grieve, Hoogenraad and Murray (1977) is their understanding of syntax. Obviously, what the authors view as a difficulty in infants' understanding of UNDER is not related solely to the syntax of the instructions but also to their semantics. The syntax seems to be the same in both sentences: they consist of a verb and two nouns (Show X under Y versus Put X under Y). The semantics of the verb put, however, is linked to a more complicated action and to another form of attention to objects than the verb show: the instruction Show me X under Y requires merely the trajector to be selected (this is an attentional action) and pointed to (motorical action). The instruction Put Y under X, in contrast, requires the trajector to be selected (attentional action) and the conditions be

created for lifting the landmark in order to place the trajector appropriately (motorical action). The crucial difference is that while Show me... requires the explicit specification of the particular relation (the relation is already implicitly given), the instruction Put... requires the active creation of this relation.

What Grieve, Hoogenraad and Murray (1977: 247) present as the "role of syntax" nevertheless remains an interesting aspect in understanding, even if the ability to understand should not need to be viewed in terms of syntactic difficulties only. As can be seen, the challenge of the syntax is directly linked to the semantics of the verbs, with particular emphasis on the factor of attentional change (cf. section 2.5). Correctly following the instructions requires the ability to profile an object in a relation. As soon as the roles are assigned, a motoric action is required to create the relation. This motoric action is less complicated in the instruction Show X than in Put X.

However, not only the motoric action required to establish the relation makes a difference in the apparent complexity in understanding UNDER. Another problem is brought to light in Halpern, Corrigan and Aviezer (1983). They also consider the difficulty children face in discerning the corresponding relation for UNDER and distinguish between two types of UNDER-space:

> The first type of 'under' exists because of the structure of one of the objects, e.g.: "a-ball-under-a-table" [=UNDER1]. The second 'under' involves space relations between two flat surfaced objects, e.g. "a-block-under-another-block" [=UNDER2]; in this case, the child has to mentally create the possibility of space before he can construct it because it was not visible originally (Halpern, Corrigan & Aviezer,1983: 155).

In testing infants' non-verbal reasoning linked to language understanding and production, Halpern, Corrigan and Aviezer (1983: 164) found out that UNDER1 is easier than UNDER2. This means that, if the landmark object has an easily discernible hollow space as a table does, it is easier for children to place the trajector under it. For landmarks which do not have an UNDER-space as part of their structure, but instead are flat, it is more difficult for children to perform an instruction correctly. The results suggest, therefore, that infants' understanding depend on the instruction insofar as the linguistic instruction refers to real objects with different properties. The difficulty children have in understanding UNDER is not due to the syntax in that instruction – as suggested in Grieve, Hoogenraad and Murray (1977) – but rather due to the different types of UNDER-space involved, which can be more or less difficult to discern.

The idea of difficulties in discerning the UNDER-space is also present in the argument of inaccessibility to perception as put forward by Vandeloise (1991: 190-192). According to this argument, trajector-objects placed in an UNDER-relation are often hidden or covered by landmark-objects, and are therefore not obvious to children's perception. This inaccessibility to perception makes the UNDER-relation difficult to learn, since associating a label to something that is not visible requires abstract reasoning. In keeping with this, relations

acquired earlier are easier due to their "perceptual salience" (v. Geert, 1985: 15). The ON-relation, for example, is constrained by gravity, which makes trajectors ON landmarks more salient.

An important objection against the inaccessibility to perception argument in relation to UNDER is presented in Sinha et al. (1999: 109). In many cases of the IN-relation, the trajectors are not directly perceivable when they are contained in the landmarks. Nevertheless, the relation IN is understood very early (see second chapter). This renders the argument of inaccessibility to perception less convincing as an explanation for the late understanding of UNDER, especially when regarded in isolation.

Concerning the difficulty to discern, the connection of IN to UNDER just mentioned displays another feature in the semantics, which makes the UNDER-relation more complicated than others. This connection is evident in the Zapotec data presented in Sinha and de López (2000: 34). These data confirm that a single containment-relation is relevant for the semantics of English IN and UNDER in those cases, in which the trajector is inaccessible to perception. Such containment-relation is expressed in Zapotec by a single word láani. This word is glossed with the English "body-part" term of 'stomach' (ibid: 23; see Figure 18). In this sense, English IN- and UNDER- relations of this type are equivalent. The Zapotec-learning children also do not seem to pay attention to the orientation of the landmark-object, when using this relation. What is important is the function of this relation. In Zapotec culture, the inverted orientation of containers is common, for example as covers for food (Sinha & de López, 2000: 35). It seems likely that this function makes the English UNDER relation linked to the possibility of a containment more salient as it is useful and more common. For other UNDER-relations (not related to the possibility of containment, like the ball UNDER the table) there is another word in Zapotec nii associated with the body-part of 'foot' (Jensen de López, 1999).

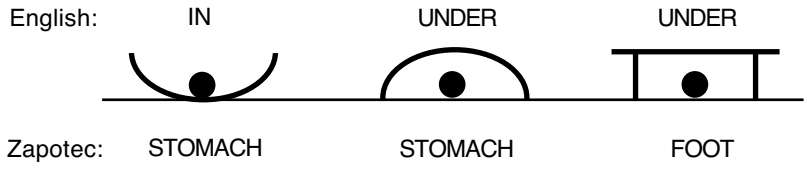

Figure 18: Selected spatial relation in English and Zapotec

This data suggest that the explicit relation UNDER in English relates to more implicit relations and is thus polysemous in comparison to spatial relational terms in Zapotec. It is therefore plausible to assume that this polysemy makes the English UNDER, German UNTER and Polish POD more difficult to process (cf. Sinha et al. 1999: 109). However, it is difficult to establish a set of objective criteria in order to describe the polysemy. The classification of UNDER in terms suggested by Halpern, Corrigan and Aviezer (1983) does not account for the difference made in Zapotec. UNDER1 in English refers to both of the spatial alignments

that are connected with the space relevant for the body-part terms of 'stomach' and 'foot' in Zapotec, and is, therefore, not adequate for the specification of the polysemy. A better semantic approach is promised by the classification of spatial relational terms developed in Nüse (1999). To recall, Nüse (1999; see also section 2.1.2) explains the semantic features of spatial relations (relevant for spatial terms) in terms of everyday concepts such as inside, side and underside. With regard to the late occurrence of UNDER, this classification should explain why it is more difficult to apply a preposition to an underside (related to UNDER and to the body-part 'foot') than to a surface (related to ON) or the inside (related to IN and the body-part 'stomach'). The English UNDER, German UNTER and Polish POD are polysemous due to the fact that they relate to the everyday concepts of both inside and underside, depending on the objects (cf. Nüse, 1999: 87), task and situation. The spatial description toy under a cup refers to the everyday concept of inside, when the toy is hidden, and the cup covers it in its inverted canonical position. It relates to the everyday concept of underside as well, when the toy is under the underside of the cup, and the cup is in its upright position. The criteria presented for the polysemy of UNDER correspond to the explanation given in Sinha et al. (1999: 109). The authors also argue for a more complex semantics of UNDER: "the semantics of under are such that it appears to combine some aspects of both the basic container-contained and bearer-burden relation [...], which receive canonical marking by respectively in and on". In other words, UNDER shows a more ambiguous and therefore difficult semantic structure.

To sum up this view, the English, German and Polish spatial relational terms referring to UNDER seem to be polysemous because they refer to different spaces, which are accessed in motorically different ways — this is suggested in terms of UNDER1 and UNDER2 by Halpern, Corrigan and Aviezer (1983). Furthermore, the term UNDER relates to two everyday concepts such as inside and underside depending on the objects involved. This most likely makes the processing of this spatial relational term more difficult than that for others. Thiel (1985) suggests, moreover, that for the processing of UNDER, children access other relations initially, which helps them to develop the understanding of UNDER — this idea will be considered in the design of the training study presented in the next chapter.

4.4 UNDER: on a more abstract level

Thiel (1985) makes the criticism that studies about the order of prepositions in acquisition do not regard acquisition as a developmental process, in which the prepositions children have already acquired are helpful for the acquisition of further spatial relational terms. Rather, in most studies, every preposition is treated as different within a single overall semantic task the children have to cope with. Thiel (1985), in contrast, regards the development of locatives as a gradual construction process. More specifically, he views the meaning of UNDER as established on the basis of infants' knowledge about IN and ON-relations. In keeping with this, the relations IN and ON adopt a crucial role in Thiel's developmental approach: he terms

them “basic relations [Basisrelationen]” (ibid: 201). The IN- and ON-relations are basic as they cannot be “boiled down” (Talmy, 1996: 267) further to other relations. In contrast, relations such as UNDER or NEXT TO can be derived from these basic relations which constitute a cognitive basis. In this theory, the reason why UNDER is acquired after IN and ON would be that these two relations are basic and therefore prerequisites for the other one.

Despite the skepticism about a cognitive basis for relational representation as manifested in the acquisition of prepositions[4], there are indications that children do indeed tend to express new meanings in old forms, while new forms take on established functions (cf. Weinert, 2000: 332). Correspondingly, in his observation and intervention study, Thiel (1985) observed that children viewed the relation UNDER as reducible: the subjects assigned UNDER either to the opposite of ON or to ‘IN(to) a cavity or hollow space’. The first designation of UNDER is predicted by the view of Clark (1993: 64), who argues that infants learn words contrastively. The second association of UNDER with the relation IN is based on various behavioral observations that Thiel (cf. 1985: 201-202) reports on from his study:

1. Nicole (27 months old):

   I put an animal UNDER the table and say look here!; she takes an animal, too and puts it UNDER this table and says hopp, hopp, rein [hopp, hopp, into]

2. Nicole (28 months old):

   I make two animals running UNDER a bed, she protests and says nicht rein [not into] and puts the animals IN the bed; [...]

3. Michael (33 months old):

   I say stell’ du mal den wauwau UNTER den Tisch [put the doggie UNDER the table], he says Tisch [table] and puts the dog ON the table.

4. Michael (34 months old):

   I put a dog in the front of a table (30cm distance) and say stell’ den Hund mal rein in den Tisch [put the dog INTO the table], he pushes it slowly UNDER the table, turns his head to me, looks at me and says rein [INTO]; then puts the dog immediately ON the table again and says kommt oben [comes on the top] and puts another dog ON the table.

As Thiel (1985) views semantic representations as having a direct interaction with conceptual ones, he interprets his observations as representing a “direct pipeline” (Bowerman, 1996b: 418) to infants’ non-linguistic spatial cognition. As a result, Thiel concludes that while adults perceive an object such as a table as a whole entity, the child perceives it in two different parts: the cavity under the table and the table’s surface. To put it in the everyday concepts for spatial terms developed in Nüse (1999), the child supposedly develops different

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4 This proposal remains within the framework of Artificial Intelligence and the classical theory of concepts, which have been exhaustively criticized in the last decade (cf. Laurence & Margolis, 1999; see also section 1.6.1).

representations of INSIDE and the UNDERSIDE and then combines them in understanding UNDER. According to Thiel (1985), the child starts the development of spatial relations with put IN and put ON, with put IN taking priority. Thus, infants initially do not understand the locative UNDER – exemplified in 3 and 4 (Thiel, 1985: 201), because at this early age, they cannot combine the concepts of INSIDE and the opposite of SURFACE: the UNDERSIDE.

Obviously, Thiel (1985: 200) supports a structuralistic view of meaning as he concentrates on the proposition of the morpheme and argues for the lexical form as a mature form of a notion: "[D]enn präpositionale Lokative sind vom Objekt getrennte sprachliche Einheiten und repräsentieren eine räumliche Relation als solche" [prepositional locatives are language units separated from objects which represent spatial relations as themselves]. Thiel's argumentation raises the question what the use of a morpheme displays, and when it displays the understanding or conception of a spatial relation. Again, in this view the difficulty of the acquisition of UNDER is linked to the issue of the nature of the connection between concepts in language and spatial reasoning. Thiel's view proposes a straightforward connection between cognition and language, which idea is criticized by Knauf (1997: 121).

Furthermore, although the examples presented above support Thiel's hypothesis, they cannot confirm it, because they do not originate from a systematic study. Thiel acknowledges this weakness:

> Aufgrund der Art des vorliegenden Materials kann es hier nicht darum gehen, abschließende Aussagen zu formulieren, sondern es soll durch einen vielfältigen argumentativen Umgang mit diesem theoretischen Konzept dessen potentielle Erklärungsmöglichkeiten aufgezeigt werden. Ein systematischer Einsatz der in dieser Studie entwickelten [...] Instruktionen würde weitere Klarheit bringen (Thiel, 1985: 196).[5]

Nevertheless, abandoning the idea of the straightforward connection that Thiel (1985) developed in his theoretical view does not necessarily imply rejecting the idea of basic relations in the semantics of spatial prepositions. On the contrary, in the language acquisition literature, various ideas can be found that are similar to these of Thiel's (1985). Thorseng (1997b) and Sinha et al. (1999) for example argue for IN and ON as belonging to a "limited subset of the most cognitively and semantically simple locative particles" (Sinha et al., 1999). In learning spatial prepositions, children gradually extend their repertoire to include cognitively and semantically more complex ones. This process of an extension may be started from impetus meanings linked, for example, to basic schemas of CONTAINMENT and SUPPORT. This is reminiscent of Vandeloise (1991) who proposes that the prepositions DANS [IN] and SUR [ON] are "basically motivated by the knowledge of some complex concepts (container / contained, bearer / burden) that derive from the first meanings that

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5 "Due to the nature of the available material, there can be no attempt to formulate conclusive claims, the aim is merely to show potentially possible explanations by using the theoretical concept in diverse arguments. Further clarification could come from a systematic use of the [...] instructions developed in this study".

children attribute to these prepositions" (Vandeloise, 1991: 57). These first meanings allude to the notion of the image schema, which is viewed as the form of basic and preconceptual meaning. From this perspective, infants acquire the meaning of IN and ON before UNDER, because the later-acquired prepositions derive directly from the initial image schematic meanings of these first two prepositions (cf. Vandeloise, 1991: 58).

The notion of image schema is problematic. As it was shown in section 1.5.1, the level of abstraction needed to determine the psychological reality of image schema is not clear in its definition. For the reasons presented above, the issue of to what extent IN and ON can be viewed as basic for UNDER will be investigated instead. Nevertheless, Thiel's (1985) proposal of viewing the understanding of UNDER as a combination of different relational representations will be abandoned for the reasons presented in the section 1.6.1. From the perspective of situative semantics (cf. 2.4 and 3.8). In contrast, the hypothesis concerning the learning processes underlying the acquisition of spatial relations is that a child initially acquires the meaning of basic relations, with the support of situational cues and her or his knowledge about the objects. The child is then able to continue learning and understanding other more complex relations with the aid of the meaning of basic relations already learned. It is this that determines the order of acquisition. The reduction or translation of UNDER to such basic relations might be a process, which initially helps infants to grasp the meaning of the new spatial relation and to extend their repertoire of expressions.

4.5 Summary of chapter 4

In this chapter, various factors contributing to the relatively late understanding of UNDER were considered from four different perspectives. It was argued that the most obvious factors, i.e. frequency and kind of input, cannot by themselves provide a plausible explanation. In addition, other non-linguistic factors such as the motoric complexity of enacting an UNDER-relation in contrast to an IN-relation seem likely to be involved in the process of understanding. In order to take into account cognitive factors, Nelson (1974: 272) argues persuasively for including the child's level of cognitive organization as a factor. By this she means that it is important to keep in mind that a child's understanding is not determined solely by factors coming from outside like frequency but also from internal factors. Consequently, the question was raised whether the meaning of UNDER is constructed from concepts or meanings of other more basic relations (such as IN and ON), which a child has to establish as cognitive prerequisites for conceptualizing and understanding semantically more complex relations. This issue will be pursued experimentally in the next chapter. From a semantic point of view, it is relevant to consider whether UNDER is more complex than IN and ON. This argument of more complex semantics, in turn, comes full circle as it is reliant on the input to the children: since UNDER is semantically more complex, adults will probably use it less frequently to describe situations.