
Long-term word learning in 2-year-old children

How does narrative input about pictures and objects influence retention and generalization of newly acquired spatial prepositions?

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1. Introduction

*Children, then, are continually acquiring new words. ...
Network building happens gradually, and may continue
throughout a person's life.*

Jean Aitchison, 2012

Children all over the world experience the „miracle of word learning“ as Tomasello (2003, p. 44) named it. They learn the meanings of words on a daily basis, mostly from complex interactive situations. Children thereby begin to understand their first words during their first year of life and the rate of comprehension and production of words accelerates enormously during the first five years of language acquisition (Bergelson & Swingley, 2012; Fenson et al., 1994; Tomasello, 2003). Although the mechanisms of lexical development have been studied since decades, the interest in this research topic is not reduced today as there still remain open questions. All words that children and adults acquire are assumed to be organized like a semantic network in the mental lexicon of the brain (Aitchison, 2012). Thereby, the acquisition process is no binary state of having acquired a word or not. It is rather a gradual process which may continue throughout a person's life and which is characterized by different consecutive mapping processes: After the first establishment of a word-to-referent link in one particular context (fast mapping), the meaning of this word needs to be redefined in multiple contexts over a long period of time (slow, extended mapping). Although the creation of the first word-to-referent link is essential, it is not strong enough to be retained over a period of 5 minutes (Horst & Samuelson, 2008). This is where the present work ties in: The likewise fascinating and complex mechanisms of extended mapping gradually leading to robust semantic representations. This process is assumed to result first in increased word extensions as word meanings become more elaborately represented in the semantic memory and second in long-term retention of the newly acquired word as well as in generalization of this word to new situations (Carey, 1978; McGregor, 2004; Vlach & Sandhofer, 2012). Therefore, a child needs to retain an initially weak semantic representation in memory and to continually build new assumptions about the meaning to update the existing representation. After research has focused on fast mappings for years, several studies begin to focus on mechanisms underlying the extended word learning including factors contributing to rich semantic representations. For adults and

caregivers, it might be particularly useful to find out how, if at all, children can be supported on their way to build a semantic memory.

The present work is not going to address all of these issues, but will focus on one popular activity of children and adults in Western cultures: joint picture book reading. After presenting a theoretical background about research on children's lexical development and on factors contributing to the development of robust semantic representations, two training studies investigating the influence of distinct elements of book reading on children's extended word learning are described: While in the first study, a particular narrative input structure describing the content of a picture book was investigated, the second study focused on the specific role of different materials depicting the content of a narrative. In both studies, children's learning of real words was investigated, because this allowed for going beyond the fast mapping of word learning and for focusing on the enrichment of weak semantic representations. Children were taught the spatial prepositions *behind* and *next to*, of which they would only, if at all, have a nascent knowledge. As spatial prepositions are typically acquired in a fixed order (Bowerman & Choi, 2003; Grimm, 1975; Johnston, 1984; 1988; Johnston & Slobin, 1979), participants of a particular age, who would probably not have acquired the target prepositions, were invited to participate in the studies.

In the first training study, it was questioned whether a narrative input structure elaborating on the content of a picture book can provide a child with a useful context for embedding weakly represented words. A particular narrative context was thereby assumed to hold scaffolding elements for the integration of new words into the existing lexical memory. In the second experiment, the research focus was on the specific material used to depict the content of a narrative input aiming at a direct comparison of pictures and objects, because both materials are common in adult-child interactions, but contain different characteristics. Pictures as well as objects are known to be effective means in the investigation of word learning, either in picture book reading or in free play. But there is little research investigating their differential effect on children's extended word learning. In both studies, children's extended word learning was assessed in terms of their ability to retain the newly acquired preposition knowledge over several days and in terms of their ability to generalize this knowledge to unfamiliar situations. The results of both studies are finally discussed with respect to their scaffolding power for children's development of robust semantic representations.

2. Theoretical Background

The present work is concerned with long-term word learning in 2-year-old children and addresses factors assumed to influence the underlying processes. Before proceeding to the present studies investigating this concern, a theoretical background providing important information about relevant research findings is presented. The following chapter constitutes an overview of such research findings: First, characteristics of the acquisition of spatial prepositions are described (2.1) as the current work is mainly concerned with this word type. Second, general aspects of lexical development (2.2) are considered, including mechanisms of mapping words to their referents (2.2.1) and the involved general memory processes of encoding, consolidation and retrieval (2.2.2). Third, factors known or assumed to influence the robustness of semantic representations (2.3) are described, among them picture book reading (2.3.1), narratives (2.3.2), children's pictorial understanding (2.3.3) and children's object examination (2.3.4).

2.1. Acquisition of spatial prepositions

The grammatical form of locative expressions varies across languages (Johnston, 1988), but in German and English, like in many other languages, spatial relations are expressed by locative prepositions like *in* or *behind*. As Grimm (1975) described, prepositions „are morphologically invariant relators which serve to express relations of the locative, temporal, modal and causal type“ (p. 97) in a sentence. Compared to other word types like nouns and verbs, prepositions are acquired relatively late, when lots of other word types are already present in children's speech (Grimm, 1975).

In several studies of different languages, among them English and German, different authors have found that locative prepositions are typically acquired in a particular order and at a particular age (Bowerman & Choi, 2003; Grimm, 1975; Johnston, 1984; 1988; Johnston & Slobin, 1979) as this acquisitional process seems to be a function of the inherent cognitive complexity of the prepositions (Ahnert, Klix, & Schmidt, 1980). Johnston (1988) collected data from English, German and seven further languages that showed strong agreement concerning the age of typical comprehension and elicitation. Accordingly, *in* (under age 2;0), *on* (age 2;0 - 2;3) and *under* (age 2;0 - 2;9) are acquired first, followed by *next to* (age 2;0 - 3;0). The comprehension of *between* (3;0 - 3;8), *back*

and *in front of* (both age 3;0 - 4;8) follows in the third year of life. Generally speaking, children typically comprehend the spatial prepositions *in*, *on* and *under* before they acquire *between*, *behind*, *beside* and *in front of* (Washington & Naremore, 1978). The latter group of prepositions refers to the relative positions of two objects and can be described on two horizontal axes: the primary (in front of and behind) and the secondary axis (to the left / right side of). For the prepositions *in front of* and *behind*, one must always define the spaces adjacent to the front and to the back axis, even when talking about objects with intrinsic front or back (Washington & Naremore, 1978). Children's meanings of these terms seem to change during the preschool years: Early uses of *behind* and *in front of* typically occur with referent objects with intrinsic fronts and backs, whereas later uses typically occur in the context of featureless reference objects and depend upon the speaker's and listener's point of view (Johnston, 1984; Johnston & Slobin, 1979). Johnston (1984) found children's performance on spatial relations to scale in the following order of difficulty: *on* < *in* < *under* < *next to* < *back* < *front*. Thereby, the difficulty of understanding *back* changed depending on the reference objects: Reference objects taller than the located object were easier to map than reference objects with inherently featured reference objects and than reference objects being virtually flat. Thus, the meaning of the locatives *behind* and *in front of* includes notions of accessibility, visibility, proximity, object-part and order. Particular uses always seem to express some portion of the whole (Johnston, 1984). *Besides* limits the proximity character on the second axis as it means 'close to' and thus contrasts with *in front of/behind* (Washington & Naremore, 1978). For the study of these prepositions, like in the present work, these considerations have some implications. On the one hand, it is relatively easy to determine a particular age group that has not build a complete understanding of the prepositions, on the other hand, in order to do justice to a full application of their meaning, reference aspects with other objects, like visibility and proximity, need to be considered. Johnston and Slobin (1979) explain the occurring age ranges described above with differences among the languages concerning characteristics of the locative system such as lexical diversity and synonyms. They also argue that the order of acquisition can be explained by the complexity of the underlying spatial concepts. In each case, the comprehension precedes the production (Johnston & Slobin, 1979; Washington & Naremore, 1978). The variety of studies that prove the described acquisitional order of prepositions is impressive and demonstrates strong agreement for divers languages (Clark, 1973a; Dromi, 1979; Halpern, Corrigan, & Aviezer, 1983;

Johnston, 1984; 1988; Johnston & Slobin, 1979; Sinha, Thorseng, Hayashi, & Plunkett, 1994). This raises the question why prepositions develop differently from other word types like e.g. nouns. An answer comes from the close relationship between the development of locative prepositions and the underlying concepts of space. Different approaches (Halpern et al., 1983; Johnston, 1988; Johnston & Slobin, 1979; Thiel, 1985) discuss the influence of so called linguistic and non-linguistic factors and pursue the question what constitutes the meaning of a spatial preposition.

Non-linguistic / cognitive factors

Clark (1973b) was one of the first to propose non-linguistic strategies based on perceptual knowledge that guide children's early comprehension of the spatial terms *in*, *on* and *under*. In her studies with 2-year-old children, Clark argued that children's understanding of these prepositions in a task does not necessarily represent their word knowledge but might also reflect children's use of non-linguistic strategies that guide their behavior during the acquisition of these locative expressions. This acquisitional process follows three stages. First, children rely on non-linguistic strategies that are characterized by two ordered rules (1. If a reference object is a container, children put x *inside* and 2. If a reference object is a supporting surface, x is put *on* it) and only have some semantic knowledge of prepositions in this stage (namely that they are all locative). Second, children are in a transition stage with partial knowledge. Third, they develop full semantic knowledge (Clark, 1973b). According to Clark's assumptions, *in* is understood first, because it is cognitively easy for children to derive its meaning from the first rule. For the acquisition of *on* the second rule is important and is thus a bit more complex for children than *in*. *Under* is more complex to acquire than *in* and *on* as children cannot be guided by the expressed rules. Thus, Clark (1973) emphasized the physical characteristics of objects as an important factor of influence for the acquisition of prepositions and pointed to non-linguistic strategies that guide children's acquisition at the beginning - more than semantic knowledge. Rohlfing, Rehm and Goecke (2003) proposed to call these non-linguistic strategies co-linguistic as they are part of the semantic knowledge children develop, and children's understanding of spatial relations is guided through different strategies referring to children's object knowledge. This is in contrast to Clark's (1973) assumption that children's early comprehension of spatial relations is primarily determined by non-linguistic factors and not by semantics.

Other authors postulated *familiarity* as another important non-linguistic factor influencing children's understanding of spatial relations, as the function and physical appearance of familiar objects are likely to be known (Rohlfing & Choi, 2008). Wilcox and Palermo (1975) are in line with Clark's (1973) assumptions about the non-linguistic strategies, but they doubt the generality of these strategies. They postulate that it is the context in which objects are typically referred to each other as a reaction to a verbal instruction rather than the physical characteristics themselves that guide children's behavior. In their study, Grieve and colleagues (Grieve, Hoogenraad, & Murray, 1977) refer back to Clark (1973) and Wilcox and Palermo (1974) and describe children's reactions to an instruction as constrained by physical characteristics of the objects, by motor skills of the child, but most importantly by the child's personal experience with the material and by „how he has decided to view the objects“ (p. 248). This in turn is partially determined by the cultural environment. Thiel (1985) also focuses on the child's individual experiences with objects for the acquisition of prepositions and postulates a relational character of objects which depends on an active or passive usage of objects and different implemented relations. According to this, a table is typically used passively with an *on*-relation as well as a cup with an *in*-relation. Thus, these objects are known as landmark objects and other objects are actively put *on* or *in* them. In addition to the described positions, other authors see a particular role in children's experiences in the environment and assume an influence on their object knowledge and understanding of spatial relations (Coventry, Prat-Sala, & Richards, 2001; Freeman, Lloyd, & Sinha, 1980; Grieve et al., 1977; Wilcox & Palermo, 1975). Casasola and Cohen (2002) showed in a study with 10- and 18-months-old infants that they recognize a relationship between familiar object pairs prior to novel objects.

Canonicity is another non-linguistic strategy and refers to the function of objects and their typical handling. Children's comprehension of action knowledge is accordingly better, if, for example, in a search task a toy is hidden in a cup used upright rather than inverted. Freeman and colleagues (1980) observed this „canonicity effect“ (p. 259) in their studies with 8- to 15-month-old children and described that their „performance is affected by whether the experimenter uses the container for its canonical purpose or misuses it.“ (p. 259). They further state: „This must index conceptual behavior, for the infant is accessing an entry in memory which contains a knowledge of the predictable characteristics of an object in its canonical and non-canonical orientations.“ (p. 259). A

canonical function thus implies to use objects in their most common way. In contrast, relating objects in a non-canonical way does not imply their customary function, but also refers to a possible and plausible way (Rohlfing & Choi, 2008). Coventry and colleagues (2001) also conclude that geometry and functional relations play a crucial role in children's comprehension of spatial relations and differentiate two types of object knowledge: The functions objects usually have (like an umbrella protecting from rain) and objects (non-canonical) functioning in context (like a suitcase used to protect from rain). Accordingly, canonicity is highly culture-specific (Sinha & Lopez, 2001).

To conclude, early approaches on spatial language development focused on non-linguistic, cognitive factors thought to primarily influence children's acquisition of prepositions. What is particular about spatial prepositions is that their meaning depends on the composition of different reference objects. Contextual factors like children's object knowledge and familiarity with objects can contribute to the understanding of a locative expression on children's way to develop a full semantic representation.

Linguistic factors

The above described findings suggest that when children begin to comprehend and produce spatial language, they simply start to express concepts they already have learned. This might suggest that spatial concepts are acquired universally rather than depending on cultural background. Bowerman (1996) argues against this view and presents evidence that children's semantic categories for spatial terms are profoundly language-specific, as languages differ in their organization of spatial meanings. Bowerman and Choi (2003) „suggest that early semantic development involves a pervasive interaction between nonlinguistic conceptual development and the semantic categories of the input language, not just a one-way mapping from preexisting concepts.“ (p. 477). The authors (see also Choi & Bowerman, 1991; McDonough, Choi, & Mandler, 2003) made interesting analyses of the languages English and Korean that differ strongly in the way spatial relations are categorized. The English relation *in* is expressed differently in Korean depending on whether the relation is *tight fit* (kkita), like putting a piece in a puzzle, or *loose fit* (nohta), like putting an apple in a bowl. In their study, Choi, McDonough, Bowerman, and Mandler (1999) showed that children as young as 18 months of age are sensitive to language-specific spatial categories. Infants start to conceptualize spatial concepts like containment and support before language is acquired (McDonough et al., 2003). At 9-months of age they have these spatial concepts

at their disposal and use them to comprehend the language they hear. At that age, English and Korean infants from 9- to 14-months categorize different contrasts in a preferential-looking task the same way: 1) Tight containment was tested against loose support, corresponding to the English prepositions *in* and *on* and to the Korean verbs *kkita* and *nehta*, 2) Tight containment was tested against loose containment, both being grammaticalized as English *in* and separately as Korean *kkita* and *nehta*. The authors concluded that infants are conceptually ready to learn spatial relations in either language. Interestingly, results from adult data show that the input language influences conceptualization as English and Korean speaking adults categorized spatial contrasts according to their language: English adults categorized the first contrast (tight containment against loose support), but not the second (tight versus loose containment); Korean adults in contrast successfully categorized the second contrast (tight versus loose containment). The authors concluded that „both language and preverbal conceptual readiness play important roles in developing language-specific semantic categories of space“ (p. 254) and indicated that languages redefine already existing spatial concepts (McDonough et al., 2003). In order to investigate the degree to which children are guided by linguistic factors in executing a spatial relational task, Rohlfing (2001) observed that at 20- to 26-months, children do not have full semantic representations of spatial relations. She found that children understand syntactically correct instructions as well as the same instructions without prepositions and thus assumed that what guides children's behavior at that age are co-linguistic strategies rather than full linguistic knowledge of spatial concepts.

As could be seen, there is strong agreement to the fact that infants begin to acquire spatial relations by universal co-linguistic strategies that are gradually refined by the native input language during slow mapping (Bowerman & Choi, 2003; Göksun, Hirsh-Pasek, & Golinkoff, 2010; Mandler, 2010; Rohlfing & Choi, 2008). According to Rohlfing (2001), 2-year-old children do not have a complete knowledge of spatial concepts and make use of lexical and syntactic knowledge they already have to infer the meaning of prepositions. As outlined in the following chapter, the same processes for word learning in general also underlie the acquisition of spatial prepositions: A learned label must be mapped to a given referent and extended to new exemplars of the referent, with the latter building upon the former. Two-year-old children might already have built a semantic representation of some spatial prepositions, but are still guided by context

knowledge about the objects involved as the semantic representations are still weak (Rohlfing, 2001). The full acquisition of the meaning of spatial prepositions implies then multiple exposures referred to by different reference objects each depicting a portion of the whole, from which the child can finally extract the right meaning (Johnston, 1984). In the ensuing chapter, lexical development in general is considered in order to describe how children accomplish the complex task of acquiring new words and which mechanisms are assumed to drive this process.

2.2. Lexical development

Lexical development is one of the key components children must acquire on their way to learn a language. It refers to the acquisition of word meanings and, as McGregor (2004) suggests, results in the development of a semantic network. Typically, evidence of word comprehension first appears in 6- to 9- month old infants, when they comprehend the meanings of many common words (Bergelson & Swingley, 2012). Children exceed 50 words at around 11 months and 169 words at 16 months and begin to produce their first words around their first birthday (between 10 to 14 months) (Fenson et al., 1994). The production of the first words is rather slow until at around 18 months children have about 50 - 100 words in their lexicons. Some researchers describe this point in development as the starting point for vocabulary acquisition to speed up: The vocabulary burst begins (Grimm, 2003; Tomasello, 2003). Although the nature of this vocabulary spurt is still under debate (Bloom, 2000a; Szagun, 2008), there is strong agreement about the fact that children, beginning the second half of their second year of life, are very quick at mapping words to their referents. Besides the quantity of the lexicon, the quality of words is broadened and includes more and more different word types like verbs, adverbs and functional terms, which allows children to combine words to sentences (Grimm, 2003; Tomasello, 2003). As described above, some word types like spatial prepositions are even acquired relatively late (Grimm, 1975). A very good predictor of children's vocabulary development is the input language children hear (Hart & Risley, 1995). Parents seem to give children intuitively the kind of language they need, particularly at the beginning of language development, e.g. children seem to be sensitive to highly salient words and sentences, mostly placed in the beginning or the end of a sentence (Tomasello, 2003). The more the language acquisition process advances, the more children can make use of the input language surrounding them.

First, they can contrast new words with known ones and this lexical contrast then provides the child with crucial information about the extension of words and thus helps to specify the meaning more precisely over time (ibid; Bloom & Markson, 1998). Second, children can make use of the surrounding linguistic context to make inferences about meanings, word learning is thus facilitated by the linguistic context in which a new word is embedded (Tomasello, 2003). The author cites several studies that provide evidence of this phenomenon for nouns and verbs; and concludes that linguistic contrast and context are facilitative factors for word learning and can also serve to explain the high rate of vocabulary acquisition in preschool children. Findings coming from different research groups are in line with the increasing linguistic knowledge facilitating further acquisition: The number of word types and tokens that parents address to their children as well as the length and variety of the utterances in which these words occur are positively associated with children's vocabulary growth (Hart & Risley, 1995; Hoff & Naigles, 2002). Hoff and Naigles (2002) argue that when more familiar words frame a less familiar word, the child's interpretation of that word will be enhanced. A fascinating question is how children manage the process of mapping words they hear in the input language to their referents. Since decades, the succeeding processes of fast and slow mapping are assumed to drive this mapping. But although there is a lot of research investigating this phenomenon, it is not yet completely understood. In the following, it is sketched what is meant by the processes of fast and slow mapping. In addition, general memory processes assumed to be involved in word learning are considered.

2.2.1. Mapping words to their referents

According to Gupta (2005, 2009), his functional framework of word learning provides a useful description of important aspects of word learning. Accordingly, the mapping process of learning a new word entails the learning of a word form, a meaning and the link between both (Desrochers & Begg, 1987; Gupta, 2005) and the learner's task is to map the right word form to the corresponding referent. Thereby, the word form is an auditorily experienced stimulus, which is stored in form of an internal phonological representation in the cognitive system of the learner and is build through exposure to the word form. The meaning of this word form to an individual is an internal mental representation of an object, an action, an event or an abstract entity (a semantic representation) that exists independently of the word form. A link between the word

form and its meaning finally connects both representations that can then activate each other (Gupta, 2005). For the learning of new word forms, this means that a learner is first faced with the problem of segmenting the experienced speech stream into single word forms, which must be attended to and processed (even when spoken by different speakers in different contexts and different speaking rates etc.) (ibid). Second, the learner must detect which word in the speech stream refers to an intended referent. Although most research refers to the learning of nouns, Rohlfing (2005) comes to the conclusion that the same processes as described above also underlie the acquisition of spatial prepositions: A learned label must be mapped to a given referent and extended to new exemplars of the referent, with the latter building upon the former.

2.2.1.1. Fast mapping

Interesting research questions concern the temporal dimension of the word learning processes (i.e. the creation of the link) and the depth of the developed representations. Carey (1978) was the first to describe children's impressive ability of *fast mapping*, referring to the fact that the meanings of new words are acquired very rapidly, after only one or two exposures. In their often-cited study, Carey and Bartlett (1978) taught 3-year-old children the color adjective „chromium“ by contrasting it to other color adjectives that children already knew, e.g. „You see those two trays over there. Bring me the chromium one. Not the red one, the chromium one.“ (p. 18). This way, children could infer the meaning of the new word as a color term and interpret the contrast. Even one week after the introducing event, 50 % of the children remembered the new word after this single exposure. Accordingly, due to this skill, children learn an average of about 9 new words per day, resulting in over 14.000 words (comprehension vocabulary) by age six (Carey, 1978). Thereby, learning some words seems to prime the system to learn more words (Gershkoff-Stowe & Hahn, 2007). Receptive fast mapping occurs already in 12-months-old children, whereas expressive fast mapping skills could be demonstrated later, by approximately 24 months of age (Dollaghan, 1985; Gupta, 2005). The initial lexical representations that are formed on the basis of fast mapping are preliminary and based on little information, in a way that they are grounded on a single, context-dependent experience. These fast mapped words are thus only weakly represented (Horst & Samuelson, 2008) and include incomplete lexical and semantic knowledge and few connections to other words. However, this initial phase is important, because it firstly establishes a word-referent link in the mental lexicon in memory

(Aitchison, 2012; Capone & McGregor, 2005) and thus builds the basis for robust word knowledge. More correctly, children do probably not learn up to 9 or 10 new words a day, but details of several different words (Bloom, 2000b). Markson and Bloom (1997) pursued the question whether the fast mapping mechanism is specific to language learning and taught 3- and 4-year-old children a novel name and a novel fact about an object. They found that the capacity to learn and retain new words is the result of general learning and memory abilities that are not specific to language as participants were as good at remembering a presented fact about an entity as they were in remembering its name. Behrend, Scofield, and Kleinknecht (2001) criticize Markson and Blooms (2001) conclusions as to their opinion, word learning does not only imply to retain knowledge but also to extend the meaning of words to other category members. When testing 2- to 4-year-old children, they observed that participants extended a novel word to significantly more category members than a novel fact. This extension ability is crucial to the slow mapping of word learning.

2.2.1.2. Slow (extended) mapping

Given the fast mapped word, the lexical entry, i.e. the semantic representation of the word, is slowly completed and refined in multiple contexts and exposures to the word over a longer period of time, including even months or years. This so called *slow, extended mapping* involves increased word extensions, increased elaboration of meaning and the development of a semantic network (Carey, 1978, 2010; McGregor, 2004). While during slow mapping, word meanings become more elaborately represented in semantic memory, an increasing decontextualization and flexibility of acquired word knowledge is established (McGregor, 2004). As Vlach and Sandhofer (2012) state, this extended mapping finally results in long-term retention of a new word as well as in generalization of this word to new situations. Therefore, a child needs to retain the weak representation in memory and to continually build new assumptions about the meaning to update the existing representation. Thus, the semantic representation is gradually enriched during the slow mapping phase (Capone & McGregor, 2005). The result is an elaborate representation that consists of the word form, possible meanings and associations to other words or concepts (Carey, 1978). It is assumed that a robust representation is integrated into a strong associative network in permanent memory, which affords less information to be activated (Ackerman, 1985). An important insight for children to understand is the fact that a word does not only

belong to one specific referent (like the family car), but to a whole category of this referent (like all cars). This category extension ability is crucially developed during slow mapping. Children's lexical-semantic representations are thereby sometimes limited: They often build over- and under-extensions on their way to complete word knowledge (McGregor, 2004). This process may take months and years; and is dependent on the number and types of experiences individuals have with a particular word (Capone & McGregor, 2005).

The processes involved in word learning are memory based, because stored semantic representations develop and get interconnected in a semantic network. Particularly during the process of slow mapping, existing semantic representations are continuously updated, which includes the maintenance of the existing representations and a concurrently executed update to new information coming from new experiences. In the following, memory processes assumed to be relevant for word learning are considered.

2.2.2. Involved memory processes: Encoding, consolidation, retrieval

The process of learning new words is a memory process, because for communication, new words and their meanings need to be remembered, recognized and recalled (Wojcik, 2013). Of particular importance are the memory processes of encoding, consolidation and retrieval. *Encoding* refers to the perception and very first registration of a memory trace and follows exposure to new information (Munro, Baker, McGregor, Docking, & Arculi, 2012; Wojcik, 2013). *Consolidation* follows the encoding and relates to the fact that a perceptual trace is translated into a cortical memory trace and maintained over a longer period of time. Consolidation is thereby not driven by exposure, but instead the passage of time and the absence of exposure drives this process (Munro et al., 2012). This post-encoding and re-encoding processes continue for weeks after the encoding and finally result in a stabilized and robust memory trace that is integrated with other memories. This stage is important in long-term retention, as memory traces can only be retained, if they are successfully consolidated (Munro et al., 2012; Wojcik, 2013). *Retrieval* finally means the reactivation and recall of existing memory traces and is also important for retention; retrieval strengthens existing memory traces and thus influences continued retention (Wojcik, 2013). Several studies referred to these memory processes and found that children can successfully encode a new word, and although encoding is an important ingredient for long-term retention, it does not

necessarily imply successful retention. Horst and Samuelson (2008), for example, showed that 2-year-old children successfully encoded new words during fast mapping and demonstrated their knowledge in a referent-selection task, but could not retain their acquired word knowledge over a 5-minute-delay. Munro and colleagues (2012) have recently pursued the question, whether encoding or consolidation is the bottleneck to successful retention. They found that 29- to 36-month-old children could not retain the ability to produce newly learned words after a 1-min-delay, i.e. their established memory trace was not strong enough to support the production of the new words. The authors come to the conclusion that this finding was due to the process of encoding which finally led to poor retention, because children produced words correctly immediately after training, but much poorer after a 5-min-delay. Furthermore, the encoding of the word forms themselves rather than encoding the expressive link between word and referent seemed to be problematic for children. The representations they had established were too weak to stand the decay and support word production. In contrast, children's performance at the 5-min and multi-day intervals were similar, which made the authors conclude that consolidation was not the primary bottleneck to retention of word forms (Munro et al., 2012). In general, long-term retention implies both processes of successful encoding as well as successful consolidation. The consolidation thereby takes weeks or months after encoding and finally results in a stable and robust memory trace integrated in the semantic system, where words are interacting with other familiar words, as long as there is no interference to this consolidation process (McGaugh, 2000; Wojcik, 2013). The memory for new words is also liable to forgetting. Vlach and Sandhofer (2012) demonstrated that 3-year-old children as well as adults forget newly learned words over the time span of one month following a curvilinear pattern rather than retaining them. Although participants showed successful encoding of the new words immediately after training, their word memory decayed over time. The authors assume that the phenomenon of forgetting words parallels domain-general memory processes and thus also serves a similar function: Forgetting promotes abstraction and successful generalization of newly learned words. The authors explain this interesting finding by arguing that relevant features of a category are likely to be present at multiple learning times, so that the learner tends to forget the more irrelevant features and, when asked to generalize word knowledge, the learner will more likely recall the relevant features. The authors conclude that extended mapping includes successful retention as well as successful generalization and that

forgetting might play a crucial role for both processes (Vlach & Sandhofer, 2012). During the slow mapping phase and the evolving of semantic representations, more scaffolds may be necessary to recall a weakly represented word (Capone & McGregor, 2005). Generalization tasks usually require to abstract across variable learning experiences to generalize information to a new situation instead of recalling information from memory (Vlach & Sandhofer, 2012).

To sum up, already in 1978, Carey and Bartlett have introduced the idea of slow or extended mapping of word learning, but today there still remain several open questions concerning the processes and factors influencing this long and complex acquisitional process, at which end a decontextualized and elaborated semantic representation of a word has developed. The extended mapping of words includes long-term retention of these words as well as successful generalization to new situations (Vlach & Sandhofer, 2012). Thereby, language-specific as well as domain-general memory processes, like encoding, consolidation and retrieval, are crucial for understanding the underlying word learning mechanisms. Word knowledge - like other memory traces - is liable to forgetting and to decay over time. Nevertheless, as Wojcik (2013) points out in her recent review, the complete role of memory processes in infants' and toddlers' word learning is still unclear and needs further investigation. It is thereby particularly interesting how children develop a robust semantic representation that can be retained over time and generalized to new situations.

2.3. Factors influencing the robustness of semantic representations in word learning

As could be seen, word learning is a long and complex process beginning with a first and still fragile semantic representation. Several factors are assumed to contribute to the development of a full and complete semantic representation, but details of how this extended mapping of word meanings develops are still lacking. Some studies face this issue and intend to figure out factors influencing the robustness of semantic representations. These studies suggest that particular context variables - like different exposures to words and their meanings - can support and facilitate the development of strong semantic representations resulting in stable long-term retention, extension and generalization. Existing semantic representations can thereby be enriched by a

structured context elaborating on the existing representation either quantitatively or qualitatively (Capone Singleton, 2012). Along this line, some studies focused on conditions present at encoding of new words and demonstrated that stronger representations last longer in contrast to weakly represented early word forms, which are more likely to decay over time. Booth (2009) investigated the comprehension and retention of newly acquired words for new objects in 3-year-old children under different encoding conditions, i.e. the word labels were described in terms of their causal or non-causal properties. New labels were introduced after children were exposed to causal (e.g. “these are used to grind up food.“, p.1244) or non-causal properties (e.g. „these have a part inside that is made of gold.“, p. 1244) of the objects. Interestingly, the results revealed that children’s retention performance was better when new words were trained with causal descriptions rather than in terms of their non-causal properties. But differences between conditions became apparent only after several days of delay, and not when tested immediately after training. The author concludes that the likelihood of learning a label is increased when provided with causal information, but that a period of consolidation or recovery from training may be necessary to make this effect obvious (ibid). A more robust long-term gain in word knowledge for real words could also be documented when the word training was supplemented by a symbolic gesture, which served to reduce cognitive load during the acquisitional process (McGregor, Rohlfing, Bean, & Marschner, 2009). In this study, an advantage of the scaffolding training became apparent again at delayed posttest, but particularly when asked to generalize word knowledge to unfamiliar materials. Thereby, drawing children’s attention to a target object by focusing their attention or directing attention away from competitors aids in the retention of novel words (Axelsson, Churchley, & Horst, 2012). In addition, children’s individual learning history also plays a crucial role for their ability to learn new words. In a study conducted by Thom and Sandhofer (2009), 20-month-old children were trained with either two, four or six different color words in multiple training sessions. Their results revealed that children trained in more words were better at extending their word knowledge within the same domain than children who were trained in fewer words. The authors argue that the more experienced children are in learning words of one particular domain, the more they are focused in their attention on relevant features which in turn helps them to extend new labels (Thom & Sandhofer, 2009). Rohlfing (2006) presented another interesting approach of making use of children’s learning history for teaching children the real word *under*. Based on the

assumption that the spatial relations *in* and *on* function as basic relations for the relation *under*, she designed a training study with 23-month-old children, who have typically not acquired the target preposition, to investigate whether the easier prepositions *in* and *on* can be used to facilitate the acquisition of the more complex preposition *under* by contrasting them during the mapping process. Results revealed that, when tested with familiar items, children's performance was equally well in all experimental conditions, but the mapping process of the preposition *under* was not facilitated by the additional semantic information given in terms of *in* and *on*. However, when extension of the preposition to unfamiliar items was requested, children could benefit from the additional semantic information provided by the already known prepositions *in* and *on*. Furthermore, the author observed a hierarchical structure of processes underlying language learning: The extension of the newly learned preposition seemed to be based on the former mapping process. Focusing on differences of the depth of semantic representations for word retrieval, Capone and McGregor (2005) taught children new words by gestures cued to shape or function of objects or without additional semantic cues. For the analyses, the level of scaffolding necessary for word retrieval was varied and results revealed that „less scaffolding was necessary for word retrieval when words were learned under semantically enriched conditions“ (p.1475). In contrast, children who learned words under control conditions needed the most scaffolding task for word retrieval. The authors concluded that depth of semantic representation influences word retrieval.

Taken together, these studies demonstrate convincingly that different encoding conditions, like semantic and linguistic (verbal or non-verbal) symbolic support during training, can influence long-term retention and extension of newly learned words. A consolidation phase (see Booth, 2009) as well as word retrieval processes can also have an impact on long-term retention, because with every word retrieval the memory trace of that word is strengthened; studies with 2-year-olds showed that when hearing a word label, they activate the corresponding semantic representation, which is strengthened accordingly (Wojcik, 2013). Having seen that the emergence of robust semantic representations can be supported by context variables, it would be interesting to take a closer look at how children's early semantic representations can be strengthened in situations children experience in their everyday life, like in the popular activity of joint book reading. However, there are few studies systematically investigating the influence

of narratives told while looking at a picture book. That is why in the following, it is argued for the idea that a book reading situation implies some distinct characteristics that provide a useful context for supporting the memory processes involved in children's extended word learning. Therefore, current research about the influence of joint picture book reading on children's lexical development is considered, followed by an outline of the characteristics of what constitutes a narrative. It is argued that narratives hold a typical structure assumed to be particularly beneficial for the memory processes involved in word learning. Towards the end of this chapter, children's understanding of the symbolic nature of pictures as well children's object examination in free play situations are considered as different contexts for children's play with respect to their potential influence on children's extended word learning.

2.3.1. Picture book reading

In Western cultures, picture book reading is known to be a popular activity for parents and their children and is also promoted as an important activity for children's language and literacy development (Fletcher & Reese, 2005; Snow & Ninio, 1986). Most research over the last decades focused on preschool aged children from 3 to 5 years of age, but today, there is also strong agreement about the fact that early picture book reading experiences influence language development during the first 3 years of life already (Fletcher & Reese, 2005; Ninio, 1983). Particularly during the phase of rapid language learning between 8 and 36 months of age, children's exposure to vocabulary and concepts during picture book reading is increased (De Temple & Snow, 2003). Thereby, parents make use of different conversational strategies while interacting with their children: They often label what is depicted, comment on it, ask questions and talk in more complex ways than in free play settings (Blewitt, Rump, Shealy, & Cook, 2009; De Temple & Snow, 2003; Ninio, 1983). Children learn words better when the child's focus of attention is already on the object which is labeled (Tomasello & Farra, 1986) and during joint picture book reading, parents and children create this beneficial context of joint attention, which implies several important and useful characteristics for establishing robust semantic representations.

Repetition

In her study, Senechal (1997) identified different didactic techniques used by adults that have a differential effect on children's receptive and productive vocabulary. Vocabulary

gains are thereby bigger after multiple book readings than after a single reading and lead to enhanced expressive as well as receptive vocabulary; the active responding of children to multiple questions raised by parents particularly enhance the expressive vocabulary. This finding is in line with more recent research coming from Horst, Parsons, and Bryan (2011). The authors systematically investigated the effect of repetition on children's fast and slow mapping abilities and compared word learning directly between children who listened to the same stories repeatedly with children who listened to different stories. Results revealed a strong increase in children's ability to recall and retain newly learned words when they listened to the same stories multiple times, whereas children who heard new words within different stories only immediately recalled the words and failed to retain them.

Discursive strategies

The above mentioned strategy of asking questions while picture book reading was investigated in detail by Blewitt and colleagues (2009). The authors intended to identify the exact features of questions that facilitate the learning of new words during shared book reading. Asking questions about new words during and after a story improved children's production and comprehension, whereupon children with larger vocabularies benefitted more than children with smaller vocabularies. The initial mapping of a word-referent association (fast mapping) was supported by any type of questions in the presence of a pictorial representation of the referents. Interestingly, a particular scaffolding procedure, i.e. asking low demand questions (recall of story details and descriptions of pictures) when the unfamiliar words firstly appeared and asking higher demand questions (about inferences and predictions of the story) later, led to a deeper understanding of word meanings. The authors argued that high demand questions can help to access an elaborated word meaning only when a new word is already fast mapped. But in general, what makes the effect of asking questions to children during storybook reading so important is children's active engagement in the discussion about the novel words when they are asked to answer (Walsh & Blewitt, 2006).

Research from the area of children's memory development also investigated the role of questioning style on children's memory. Frequently asked questions like who, where, what or when are discussed as being one factor contributing to the so called 'high elaborated style of speech' in mother-child conversations about the past (Boland, Haden, & Ornstein, 2003; Reese, Haden, & Fivush, 1993). Apart from that, highly

elaborating mothers also build associations between children's already existing knowledge and a current event, follow in on the child's focus of attention and react positively to spontaneous elicitations of the child. In contrast, low elaborating mothers (also called repetitive by Fivush & Fromhoff, 1988) mainly talk about pragmatic aspects of a situation, give relatively short answers to questions of their children and ask simple who- and what-questions (Bauer & Wewerka, 1995; Fivush & Fromhoff, 1988; Reese et al., 1993). The core characteristic of elaborating mothers is that they provide their child with information about a current event, keep a conversation going and involve their child in this conversation by asking questions. By doing so, they create a social event in which actors, actions, motivations and emotions are verbalized (Bauer & Wewerka, 1995; Reese et al., 1993). Thereby, exposure to the elaborated style enables the contact to a narrative function by providing the child with a narrative frame into which the event details can be inserted (Bauer & Wewerka, 1995). The findings about different parental conversational styles are important, because they relate to children's memory development. In several studies, positive effects of the high elaborated style on children's memory skills were observed (Bauer & Wewerka, 1995; Boland et al., 2003; Reese et al., 1993; Tessler & Nelson, 1994). Elaborations while an event unfolds improve 1-to-2-year-olds remembering about the event (Bauer & Wewerka, 1995) and influence encoding and later recall of a situation shared with an adult (Tessler & Nelson, 1994). Thereby, comments that link children's prior experience with an ongoing experience facilitate understanding, either provided while an event unfolds or later (*ibid*). In older children, the maternal conversational style as well as children's language skills influenced the ability to remember the experienced event: Children of mothers talking in a high elaborated style and children with high language skills remembered more details about the experienced event than children of mothers talking low elaborated (Boland et al., 2003). The verbal exchanges thus serve to focus attention on salient aspects of an event and provide additional information that possibly affects children's interpretation of the event. Thus, embellished and long discussions about an event and encouraging a child to talk about the event enhance memory skills even years later (Ornstein, Haden, & Hedrick, 2004). The authors report that children as young as 2 ½ years show mnemonic benefits from joint conversations, because these conversations affect what is encoded and what children are able to recall later. Ornstein and colleagues also addressed the issue of explaining the benefit of the elaborations on memory like Bauer and Wewerka (1995) did, as described above. They argue that the particular effect

of asking questions cannot be found in the question itself, but in the following verbal elaboration a child produces when asked to answer. This leads to a more enriched representation of the event. Children's engagement in a conversation created by following in on children's interests and attention and positively evaluating children's contributions to a conversation finally also leads to an enriched construction of the event which is more accessible later. A whole body of research on memory development demonstrates that verbal elaborations about actions and events influence the encoding and consolidation of the event and thus facilitate and enhance children's memory for the event by creating an enriched representation which is more robustly accessible.

Associative talk

Rohlfing (2011) explored the aspect of „associative talk“ as a discursive strategy in task-oriented mother-child interactions with 2-year-old children. She observed that mothers make use of so called 'bring-in'-strategies that are similar to 'associative talk' (Ornstein et al., 2004, p.382), i.e. relating to children's prior experiences, in order to instruct children to accomplish a task. Mothers give their children additional information and make use of joint past events by elaborating on the objects involved in the task or on the whole situation. For example, when the task was to put a girl under an umbrella, a mother said: „Look, this should be a sunroof. So the sun does not come here.“ (Rohlfing, 2011, p. 9). With her detailed category system about the bring-in strategies, the author specified what associations in mother-child conversations can be like, what is being associated with what and by which stylistic options in a specific task. These strategies finally enhance children's comprehension of a task. In younger children between 12 and 20 months of age, Nachtigäller and Rohlfing (2011a) developed the concept of proto-narratives. This is an early form of narratives elicited by mothers and directed to infants with emerging language skills. The caregivers also make use of background knowledge about objects or events while reading a picture book to help the child understand what is depicted. A proto-narrative was defined as mothers' talk about something that was perceptually not accessible on a picture. For example when exposed to a picture depicting a spoon on a cup, a mother said: „Who put the spoon on it? Who does something like that?“ (p. 200) in contrast to a mother saying: „A cup with a spoon on it.“ (p. 200), which would not be considered to be a proto-narrative. Early picture books containing events rather than single objects seemed to elicit more proto-narratives in mothers talking to their children. These studies add to findings about the nature of

‘associative talk‘ in mother-child interactions. However, the influence on children’s lexical development is unclear and still needs further investigation.

To conclude, shared picture book reading between children and their parents is a joint activity which is since a long time assumed to be beneficial for children’s language development. Research from different areas has begun to systematically investigate the advantages for children’s early lexical development, also focusing on the processes of fast and slow mapping of newly learned words. Some characteristics of this activity, like frequently asking children questions, are known to be effective in children’s memory development in general. It might thus be that children are aided by a picture-book situation in strengthening their semantic representation of the new word. Thereby, repetitions of the same stories over time as well as an active engagement of the child are scaffolding elements, which can be applied actively by the caregivers. But there is still only few research investigating the influence of discursive input structures (other than the questioning style) on word learning used by adults. As described below, a recently published study by Nachtigäller, Rohlfing, and McGregor (2013) revealed first insights into how a particular discursive strategy influenced 20- to 24-month-olds comprehension of a newly learned spatial term. Furthermore, findings from the area of memory development indicate that an elaborated child-directed input might strengthens weak semantic representations by providing additional information helping the child to place the new word into the semantic system. Along the same lines, narratives containing syntactically and semantically organized input provided during book reading as well as during parent-child conversations might scaffold children’s linguistic development (Reese, Leyva, Sparks, & Grolnick, 2010a; Reese, Sparks, & Leyva, 2010b), because narratives provide a useful frame for experienced events.

2.3.2. Narratives

Narratives are broadly defined as a sequentially organized representation of a sequence of events. In this sense, events can be understood as „time- and place-specific transitions from some source state S (e.g. a battle is imminent) to a target state S‘ (the battle has been won or lost)“ (Herman, 2003, p. 2). Thereby, event-sequences are a necessary, but not sufficient condition for a narrative. What really makes a narrative, is the structure into which states and events are slotted (Prince, 1973). In 1973, Labov and Waletzky published their often cited paper about narrative analysis. They described the whole

structure of narratives comprising an orientation, a complication, an evaluation, a resolution and a coda as being the normal form of adult personal narratives, which also allows for deviations: There exist differences in the degree of complexity as well as in the amount of elements and their functions. The orientation serves the purpose of informing the listener about actors, place or time of the narrative. The complication implies a sequence of events which typically come to an end and are solved (the resolution). The authors defined the evaluation as the part of the narrative that illustrates the narrator's attitude towards the narration. The resolution always follows the evaluation. Some narrations end with the resolution, in others the coda is the last part. This is a functional instrument to bring the narrator's perspective back to the present. According to Bamberg (2012), narratives in this sense can be seen as linguistic structures, with a narrative consisting of at least two clauses that are temporally or causally connected. Linguistic devices are thereby used to create spatial and temporal contiguity of the content and to bring different characters into a relationship. According to this, a methodological approach to narratives would imply lexical-syntactic units that tie clauses cohesively together.

In the 1980s, cognitive psychology began to investigate the cognitive structures needed to understand and produce narratives. Mandler (1984) developed her notion of a story grammar (regularities found in one kind of text) and a story schema (a mental structure about the way in which a story is processed). The author described:

„The contention of all story grammars is that stories have an underlying, or base, structure that remains relatively invariant in spite of gross differences in content from story to story. This structure consists of a number of ordered constituents.“ (p. 22).

Accordingly, stories begin with a setting, introducing a protagonist and often including a statement about the time and place of the story. One or more episodes, which also consist of one or more events, typically follow the setting. The setting and all episodes finally form the overall plot structure of a story. While the setting provides mainly background information and is typically connected to an episode atemporally („and“), episodes themselves and events within an episode are either causally or temporally connected (Mandler, 1984). Story schemata are thus characterized by a hierarchical and ordered organization and by their abstractness, as they do not specify the content of a story in detail. These characteristics finally account for the story schemata's beneficial effect on understanding and recall, as Mandler (1984) explained:

„These results provide clear evidence for the psychological validity of the constituents posited by the story grammar, in the sense that they have been shown to affect the rate at which stories are understood and recalled.“ (p. 57).

In this sense, a story is more than its linguistic components. Here, the focus lies on the conceptual units - the universally shared story grammars - with the components being viewed as a function of the whole (Bamberg, 2012). Story schemata are assumed to be top-down processes guiding a story listener in the processes of encoding and retrieving particular aspects of a story (Bamberg, 1987). In the author's view, the purpose of a story „is to encode information, and the way the information is structured is relevant for the effect of the story on the audience. The linguistic and conceptual structures of the story are functions in the service of the theme, the overall plot, and the content.“ (Bamberg, 2012, p. 83).

These notions of story grammars and story schemata are important, because they imply the idea that people do not have to reorganize their narrative behavior in each new situation, but they can refer back to their approved well-known schema structures. This reduces cognitive load and saves memory capacities for other things (Boueke, Schülein, Büscher, Terhorst, & Wolf, 1995). This aspect is particularly important for cognitive psychologists interested in memory development and the cognitive basis of creating and understanding stories. In 1975, Schank and Abelson published their ideas about scripts, a structure made out of slots that describes a predetermined sequence of actions defining a well-known situation. The authors assumed: „Stories can invoke scripts in various ways. Usually, a story is a script with one or more interesting deviations.“ (p. 151). Script implications then do not have to be made explicit, because this knowledge is usually stored in the script and used to understand stories. According to Gibbs and Tenney (1980), „script knowledge finally enters into the understanding of story episodes no matter whether they are spoken, written, illustrated, filmed, or acted.“ (p. 283). The script model that Schank and Abelson (1975) developed to describe narrative understanding in terms of action sequences also fits quite well for young children (Nelson, 1993). Nelson (1993) reports that preschool aged children already have good script-knowledge which enables them to represent familiar events in causal-temporal action sequences and which is highly functional for future encounters of a similar situation (ibid). Researchers of the event-based approaches also argue that children's event knowledge provides an important basis for their semantic and syntactic

development, because this kind of knowledge is one of the earliest forms of representation that children develop. It provides children with information about actors, actions and with causal and temporal links between event actions (Farrar, Friend, & Forbes, 1993; Nelson, 1986). Farrar and colleagues (1993) found that by gaining experience with an event, children's language use improved across different measures of lexical and grammatical development. They interpret their results as evidence in 2-year-old children that „event knowledge facilitated language development by providing both a conceptual framework for interpreting the event and by increasing processing space“ (p. 603). Thereby, the processing demands needed to understand an action were assumed to be reduced so that more capacity was free for language development. At the moment children knew an event, they began to acquire words applicable to it (ibid).

To conclude, narratives contain a particular structure assumed to be beneficial for encoding as well as for recall of the elements of a narrative content. Since decades, there is research investigating how narrative structures are cognitively processed and stored. As described above, there are hints to a relationship between these processing schemata and other cognitive domains like language development, indicating that knowledge about events can facilitate language development already in 2-year-old children. However, there is little research systematically investigating the differential role narratives play for the extended mapping after a word-to-referent link is firstly created. The present work aimed at investigating the beneficial role of a narrative input structure on the slow mapping processes of word learning in young children. Narratives were assumed to be particularly useful for strengthening already existing semantic representations, because they provide a child with additional causal and temporal information, an effect known to be beneficial. With this approach, the present studies were intended to replicate findings from Nachtigäller et al. (2013) with 20- to 24-month-old children as well as to add on their findings by addressing open questions.

2.3.2.1. A story about a word

In a recent study, Nachtigäller and colleagues (2013) pursued the question whether semantically organized input in contrast to unconnected speech influences word learning in early lexical children differently. The authors hypothesized that syntactically and semantically organized input might work as a scaffold for word learning. As the gradual memory process of word learning were focused (fast and slow mapping), a real

word functioned as the target word, because it was assumed that children would already have heard this target word before. This allowed for stepping into the slow mapping of word learning and for examining if word knowledge can be strengthened by embedding an unknown word into a narrative structure. It was assumed that the child builds a richer memory trace during the encoding of the word, which in turn would be stronger over time (retention) and less context dependent (generalization).

A training study with 20- to 24-months old children ($N = 40$) was conducted in a pretest-posttest design with control condition. Children's understanding of the spatial preposition *under* was tested by asking them to perform *under*-relations with real objects at a pretest and two posttests: one immediately after the training and a second posttest one day delayed. It was assumed that children at that age maximally have a nascent knowledge of the preposition *under* as it is typically learned quite late in development (approx. in the third year of life), later than the spatial prepositions *on* and *in* (Johnston, 1988; Johnston & Slobin, 1979). Half of the children participated in the experimental group (EG) and the other half in the control group (CG). During one training session, all children were trained with six different items in their comprehension of the spatial preposition *under*. The training in both conditions differed only with respect to the input children were exposed to. In the input to the EG, the preposition *under* was embedded into a narrative context with syntactically and semantically coherent sentences that were temporally and causally related. The stories resembled the beginning of a simple story structure with different narrative functions according to Labov and Waletzky (1973). However, these narratives had no completely described outcome. Children in the control condition were exposed to a control input containing a similar amount of sentences and words, but lacking an internal coherence. One example of the contrasting input in both conditions was as follows:

EG: It is raining. The man does not want to get wet. He goes *under* the roof.

CG: He is small. The man goes here. He is *under* the roof.

During the testing phases, children were presented with object pairs (e.g. a girl and an umbrella, a cup and a table) that differed in terms of familiarity: At posttests, some object pairs were known from pretest or training sessions and were thus already familiar to the child, whereas some object pairs were completely new and thus served as transfer items in order to test for children's generalization skills (by testing their ability to transfer their word knowledge to unknown contexts). An additional parent rating about

children's language comprehension and production (Grimm & Doil, 2000) ensured the assessment of children's language skills crucial for the training and testing procedure.

Results revealed a significant main effect of training group and a significant main effect of time for children's performance with familiar object pairs. These findings point to a larger learning gain for children who received the narrative training than for children who did not and also points to a larger learning gain in general at posttest 1 than at posttest 2. Thus, children who learned the target word embedded into a narrative context showed better immediate comprehension as well as retention. Also, it was remarkable that, despite a general learning decrease after the one-day-delay, children in the CG fell back to baseline whereas children in the EG still showed an improved comprehension of *under*. Concerning children's generalization skills to transfer their word knowledge to unknown object pairs, analyses focusing on transfer items revealed a significant main effect of vocabulary size and a significant interaction effect of training group and vocabulary size. These findings indicate a better generalization performance for children with high vocabularies than low vocabularies as well as the best performance for children in the experimental group with high vocabularies in comparison to the other groups. Thus, those children who already had good language skills upon entry in the study could profit best from the narrative context provided in the training when asked to transfer their word knowledge to unknown items.

To conclude, this study revealed first interesting insights into how a narrative-structured input might scaffold children's word learning during the encoding of a weakly represented word. After only one training session, children as young as 2-years who acquired a new word within semantically meaningful narrative context showed significant learning gains in performing *under*-relations immediately as well as after a one-day delay (retention). Furthermore, those children with high vocabularies at their disposal even showed improved performance in unknown situations (generalization). These first findings hint at how a particular narrative input might influence children's word learning processes. However, these findings also raise new research questions. First, if - as was the case in this study - children's language skills play a crucial role in benefitting from the stories, it would be very interesting to examine systematically the influence of stories in older children with - accordingly - improved language skills. It might be that, according to Vygotsky's zone of proximal development (1986), the appropriate age for all children to profit from a narrative training for word learning

independent of their language skills is in older children. Second, in this study design, there was only one training session. But multiple exposures to the same story over time resembles more how shared book reading in children's everyday experience is like. Apart from that, current research (Horst et al., 2011) suggests that multiple book reading exposures are particularly beneficial for children's learning of new words. It would thus be interesting to examine children's learning curve after multiple training sessions. Third, a detailed investigation of retention processes might give more insights into long-term storage of word representations and how they develop over time. In this study, the delayed posttest was only one day after the training. It would be interesting to investigate extended word learning when there is more than one night for consolidation and for strengthening newly built representations, as consolidation processes are assumed to be important for long-term retention of newly learned words (Booth, 2009). Fourth, in the present study, the content of the narratives was visually supported by a dynamic demonstration of the spatial preposition *under* with real objects. It can be questioned whether the present findings can be extended to different forms of visual presentation of the narrative content, e.g. to a static picture of the narrative content, like typically found in a picture-book situation. Before proceeding to the research assumptions of the present work, the last issues is considered again below by collecting current findings about children's pictorial understanding and their object examination.

2.3.3. Children's pictorial understanding

In the last paragraphs, some characteristics of the context of shared picture book reading, like repetitions and particular discursive strategies, were considered with respect to children's language development. As could be seen, a whole body of research investigates parent-child interactions during shared book reading as well as their effects on children's development. In this context, findings about when and how children start to understand the symbolic nature of pictures and to transfer between pictures and real objects are relevant, too. Children's pictorial competence develops gradually in the first years of life, what implicates a full understanding of pictures and their use (Callaghan, 2000; DeLoache & Burns, 1994; Ganea, Pickard, & DeLoache, 2008). Children at 18 months of age are able to transfer information from a picture book to the real world: Children who learned a novel name from a shared picture book interaction with pictures containing either photographs, drawings or cartoons extended this novel name to the

corresponding real object. When asked to generalize the novel name to a new exemplar of the depicted object, a task which is more demanding than extension is, the degree of iconicity of the pictures played a role. Children only generalized from photographs and realistic drawings, but not from cartoons. At that age, children's performance was highly reliant on physical similarity between the picture and the corresponding object. When tested the other way around, a similar pattern could be observed: 18-months-old children who learned a novel name for an object could extend the name to a picture of the object in a book, when the picture was a photograph but not when it was a cartoon. The same was true for the generalization task. Children at that age were able to transfer simple information like a novel name from objects to pictures, but the transfer was depending on the iconicity of the picture. The authors conclude that physical similarity is a key characteristic in children's transfer of information between pictures and objects. DeLoache and Burns (1994) studied older children and observed a developmental change in the way children make use of the information provided in pictures for a current situation between the age of 2 and 2 ½ years. The authors argued that picture-referent relations are not transparent to children and although they can understand the content of a picture itself, they fail to draw an inference about a current situation at 24 months. At 30 months of age, children's representational function of pictures developed and they managed to make use of the information provided on the picture.

Callaghan (2000) doubts the assumption that 2 ½ year old children understand the symbolic function of pictures and reports that it is still tenuous in the third year of life. According to the author, a methodological problem occurred in previous studies: Children could make use of verbal labels to enhance their performance in particular tasks. When controlling for this effect, results revealed that a full symbolic understanding of pictures did not emerge until the end of the third year of life and related to language and perceptual factors. Nevertheless, even younger children can already use information provided in pictures to guide behavior in the real world. 24-months-olds can apply a learned label depicted in a picture book to the corresponding real object and they can also learn a novel action sequence from a picture book (Simcock & DeLoache, 2006). Thus, 2-year-old children are capable of extending words from pictures to the objects depicted and show evidence of having at least developed the foundations of picture-object relations (Ganea, Allen, Butler, Carey, & DeLoache, 2009). According to Hayne's developmental representational flexibility

account (Hayne, 2004), a transfer of learning between 2D (e.g. picture books, televisions) and 3D (i.e. objects) contexts develops slowly over early childhood. Early in development, a successful memory performance depends on a close match between the attributes of the cues available at encoding and the attributes of the cues at later retrieval and mismatches at testing can disrupt children's performance. Over the course of development, children are increasingly able to cope with differences between encoding and retrieval conditions. The author argues that infants need to encode information in a variety of contexts and thereby collect a range of retrieval cues, which makes their memory performance more flexible. Performance is finally depending on children's age and experience as well as on the task. In case of transferring between 2D and 3D situations, an infant must match the 2D/3D symbol at encoding to the 2D/3D referent at retrieval; success in this task finally depends on the cognitive flexibility to recognize the stimulus independent of the dimension at the time of encoding. This account is consistent with the above reported iconicity effect, because highly iconic pictures share many features with their referents (Simcock & DeLoache, 2006).

2.3.4. Children's object examination

Research investigating children's understanding of the representational function of pictures suggests that in their first years, children gradually develop a full understanding of pictures as symbols and already in their 3rd year of life, they begin to make use of the information provided on a picture for the real world. Haynes representational flexibility account (2004) can thereby be used to explain the demands children have to handle in transferring information from 2D to 3D contexts. Real objects in a 3D context hold some characteristics that also influence language development. During the first two years of life, children develop the ability to think about objects as separate entities, to relate them in different ways and to discriminate between different objects that are available for an action (Lifter & Bloom, 1989). While early in development, infants are mostly occupied with separating objects, they begin to construct relations between objects around the end of the first year of life. Therefore, children either have to recall a particular configuration from memory or create a new one with the objects that then serve as a perceptual cue (ibid). As described above (see 2.1.), the relations of containment and support are among the first ones children create. Important

requirements for actions with objects are their affordances. Sinha (2005) refers to Gibson (1979) and explains:

„Object properties of any segment of reality are relevant to an organism, to the extent that the organism can engage with these properties in its behavior. The affordances of things in the world (their graspability, edibility, or whatever) are thus relative to the organism, constituting its environment for effective action.“ (p. 1542).

Along the same lines, Rohlfing (2013) explicates that the human world provides actions only in accordance with the child's abilities, i.e. an object is not 'graspable' to an infant unless he/she developed the ability to grasp. These affordances always need to be considered in a social materialist sense as our object world is created by human activity, which in turn is strongly culturally dependent (Sinha, 2005). Children must learn how objects can be manipulated and bring this object knowledge based on former experiences into a current situation when referring to the object. When objects are related in a particular composition, one object typically serves the function of a landmark (a reference object in space, e.g. a bench) and the other object serves the function of a trajector (an agent who is related to the landmark, e.g. a child sitting on the bench) (Langacker, 1991; 1998). Beginning in the second half of the first year of life, children develop the ability to detect landmark objects. The importance of children's knowledge about objects and their affordances for children's language development becomes apparent, when realizing that children's linguistic development is guided by their perception of the world (Rohlfing, 2013). For example, when children are instructed to put two objects together, their performance is guided by the kind of landmark objects involved. Thereby, children's performance to linguistic instructions is influenced by the physical properties of the objects (Clark, 1973b). The author considered this behavior to be the basis for the development of first assumptions about the meaning of spatial prepositions.

Children's object knowledge influences their vocabulary development, as it is referred back to when children extract the meaning of objects or events from context. The nature of an object can thus codetermine the understanding of a word. In literature, there is a big amount of word learning studies based on real objects (e.g. Horst & Samuelson, 2008; McGregor, Friedman, Reilly, & Newman, 2002; Munro et al., 2012; Nachtigäller et al., 2013; Thom & Sandhofer, 2009). For example, Tomasello and Farrar (1986) observed that children in their second year of life learned words for objects best when

they engaged with their mothers in a joint focus of attention in a free play context with the objects. Kucker and Samuelson (2011) shed light on another aspect and investigated the effect of prior experience, i.e. before the mapping of a word and an object, on word learning. The authors were particularly interested in the investigation of whether prior familiarity to either the object or the word would be helpful for the extended word learning process. Their interesting finding was that 24-month-old children who were familiarized with the objects prior to the word-object mapping retained the link better following a delay; in contrast, prior familiarization to the word did not influence retention over a delay. The authors concluded that experience before fast mapping of the word-to-referent link might influence the extended learning process afterwards, in a way that prior experience with the object increases the likelihood of retention of the novel word-object mapping. In addition, as described in detail above, Nachtigäller and colleagues (2013) based their narrative training on the additional demonstration of the content with real objects. This strategy resulted in enhanced slow mapping of the newly learned preposition *under*.

To conclude, pictures as well as objects can promote word learning, as demonstrated in diverse studies on vocabulary acquisition with these materials. In each case, children map the meaning of a word to the referent, either depicted in a book or in form of a real object, and build a semantic representation. However, there is no research investigating the influence of both materials on vocabulary acquisition in direct comparison. Although children easily learn a first word-referent link, it is more complex to develop a strong and long lasting semantic representation and it would be interesting to find out whether one of both materials provides a particular advantage for strengthening children's semantic representations. The second training study was motivated by this research question and provides a first approach to compare the influence of pictures and objects in a testing as well as in a training procedure. The aim was to find out more about the differential effects of both materials on retention and generalization abilities of newly learned words in 27- to 29-months-old children.

3. Research Questions

The current studies build on reported findings from lexical development that children's word learning is composed of the ensuing processes of fast and slow (extended) mapping. Thereby, children firstly build up the initial links between new words and their referents, an essential step towards a complete semantic representation (Carey, 2010; Carey & Bartlett, 1978; McGregor, 2004). But this first semantic representation is still fragile and needs to be strengthened during a longer period of time and multiple exposures to the referents in different contexts. During slow mapping, a child develops a decontextualized word knowledge, which can be generalized to unfamiliar contexts that do not provide scaffolding cues (McGregor, 2004). Thus, the extended mapping process is complex, because it includes successful long-term retention as well as successful generalization to unfamiliar situations (Carey, 2010; Carey & Bartlett, 1978; McGregor, 2004; Vlach & Sandhofer, 2012). As Horst and Samuelson (2008) showed, the retention after having acquired a new label is not trivial and most 2-year-old children in their study failed to retain a new label after only a 5-minute-delay. However, there are factors contributing to the development of complete semantic representations, mostly affecting the encoding of new words by adding causal information to new labels (Booth, 2009), giving gestural support to new labels (McGregor et al., 2009) or by making use of children's experience and knowledge (Rohlfing, 2006).

These findings inspired the present studies to take a closer look at how the extended mapping of weakly represented words can be supported. Today, there still remain open questions about how general memory processes influence the extended mapping of words. This is where the present research ties in to further explore factors useful for strengthening the robustness of already existing weak semantic representations. It is thereby assumed that the context of joint picture-book reading and a narrative discourse strategy hold scaffolding characteristics. Picture-book reading between parents and their children provides a context of joint attention useful for lexical development. Thereby, multiple exposures to the same stories over time as well as an active engagement of the child in the conversation are known to enhance children's vocabulary development (Blewitt et al., 2009; Horst et al., 2011). Parents can support children in this process by using particular discourse strategies, e.g. frequently asking questions about the content of a story keeps a conversation going and also typically requires an answer of the child,

which in turn enhances children's engagement (Blewitt et al., 2009). Although lots of studies documented the positive effects of an elaborated style of speech, characterized by an embellished talk which associates details of a current event to experiences the child has already made, on children's event memory (Bauer & Wewerka, 1995; Boland et al., 2003; Reese et al., 1993; Tessler & Nelson, 1994), the direct effects on children's word learning have not yet been investigated. As Bauer and Wewerka (1995) stated, children's exposure to an elaborated style of speech enables the contact to a narrative function by providing the child with a narrative frame into which event details can be inserted. Narratives usually contain a typical structure, with single elements being causally or temporally related (Mandler & Goodman, 1982). Story schemata are thereby assumed to reduce cognitive load by guiding the processing of a story, because the listener can refer back to this well known mental structure and does not have to re-process the complete story (Boueke et al., 1995; Mandler & Goodman, 1982).

As findings from Nachtigäller and colleagues (2013) with 20- to 24-month-old children (see a detailed description in 2.3.2.1.) indicate, a narrative structured input can enhance the extended learning of a new spatial preposition by providing useful additional semantic information during training. However, this study raised further questions relevant to this research topic, which are addressed in the present study.

Study I

Study I aimed at replicating findings from Nachtigäller and colleagues (2013) with older children at the age of 27- to 29-months and at further investigating the influence of multiple training sessions and phases of consolidation on the extended word learning of spatial prepositions in the context of a narrative training embedding the target words. It was assumed that a narrative context scaffolds children on their way to establish a robust word representation, because the meaning of a new word should be more easily conveyed and understood by being embedded into a narrative input structure. This should become apparent by enhanced long-term retention and generalization to new contexts. In order to investigate this research assumptions systematically, a training study was created, in which children were taught the spatial prepositions *behind* and *next to* by embedding them into a narrative input structure. These narratives were operationalized by applying a sequence of sentences which were causally and temporally related and semantically and syntactically coherent. Children were exposed

to different narratives in repeated training sessions and tested before the training as well as immediately and delayed after training. A comparison to a control condition, in which children were taught the same words embedded into an unrelated speech, should then allow an explicit conclusion about the effect of narratives on word learning. In order to do justice to consolidation processes, the delayed posttest was conducted several days after the last training session. To sum up, Study I tested the following hypotheses:

Hypothesis I (retention): Children who learn the target prepositions embedded into a narrative input structure were assumed to show improved retention of the trained prepositions over time.

In order to test children's retention over the course of several days, children's performance in a familiar context (including familiar items as well as a familiar task) was examined at pretest as well as at immediate and delayed posttests. Performance of those children who were exposed to the narrative training was assumed to be improved immediately after the training as well as after a delay of several days, as compared to children who were exposed to a control input.

Hypothesis II (generalization): Children who learned the target prepositions embedded into a narrative input structure were assumed to demonstrate an enhanced ability to generalize their newly acquired word knowledge to new situations.

Children's ability to generalize the acquired word knowledge to unfamiliar situations was operationalized by unfamiliar items as well as by different tasks. Children who were exposed to the narrative input structure were assumed to show improved generalization of their word knowledge to unfamiliar exemplars and across tasks at posttests compared to control children.

Study II

Study II aimed at extending former findings from Nachtigäller and colleagues (2013) by additionally finding out whether a narrative structure is particularly suitable in the context of a special material, like pictures or objects. In their third year of life, children develop an understanding of the symbolic nature of pictures and make use of the information provided on a picture for the real world (Callaghan, 2000; Ganea et al., 2008, 2009). Already at the age of 2 years, children are able to learn labels for referents depicted in a book and to extend this label to real objects as well as to learn new action sequences from a picture book (Ganea et al., 2009; Simcock & DeLoache, 2006). Pictures and picture-book reading are thus useful means for young children's lexical development. But in the process of vocabulary acquisition, children's object knowledge is also known to be influential as it is referred back to when children extract the meaning of objects or events from context. As Nachtigäller and colleagues (2013)

reported, the learning and generalization of the unknown spatial preposition *under* was enhanced by being embedded into a narrative context and provided to 20- to 24-month-old children while being demonstrated simultaneously by real objects. According to Horst (2013), the mechanisms that support word learning in storybook reading should be the same that support word learning in natural play settings, if the same general cognitive mechanisms underlie word learning in a variety of contexts, because word learning requires attention to targets and decreasing attention to non-targets in both situations. Although both materials are known to provide a useful word learning context for children, there is no research directly comparing their influence on extended word learning when provided together with a narrative input structure. Thus, with the second study, it was aimed at finding out whether a weak semantic representation can be particularly strengthened by a special material used to depict the content of a narrative input structure focussing on whether the effect of narratives describing pictures can be extended to narratives depicting objects. Therefore, a second training study teaching children the spatial prepositions *behind* and *next to* embedded into a narrative input structure was created. One group of children was trained and tested with pictures while the other was trained and tested with objects. The extended mapping (retention and generalization abilities) was tested immediately after training and with a delay of several days. To sum up, Study II tested the following research hypotheses:

Hypothesis I (retention): Children trained with pictures as well as children trained with real objects depicting the content of a narrative input were assumed to retain the newly acquired preposition knowledge at immediate and delayed posttests.

In order to test children's retention over the course of several days, children's performance with familiar items was tested in a familiar task at pretest, immediate delayed posttest.

Hypothesis II (generalization): Children trained with pictures as well as children trained with real objects depicting the content of a narrative input were assumed to generalize the newly acquired preposition knowledge to unfamiliar situations at immediate and delayed posttests.

The ability to generalize the newly acquired word knowledge to unfamiliar situations was operationalized by unfamiliar items assessed in the context of different tasks. Children were tested in their performance with familiar items in a sparsely familiar task, with unfamiliar items in a familiar task and with unfamiliar items in a sparsely familiar task .

In both studies, children were taught real words, because this enabled the investigation of factors assumed to strengthen already existing weak semantic representations by

going beyond the fast mapping stage. Therefore, real words, that children at a particular age have usually not acquired were chosen: spatial prepositions. On the one hand, this word type holds an important methodological advantage, because across different languages, it was found to be typically acquired in a fixed order (Johnston & Slobin, 1979). It could be assumed that 28-month-old children would only have build a fragile representation of the prepositions *behind* and *next to*, if at all. On the other hand, research suggests that learners of this age are already experienced in learning language and should have established a system of meanings (Gershkoff-Stowe, 2002; Arias-Trejo & Plunkett, 2009) enabling a direct connection of a novel meaning to the established relationship among different words. The general support provided by the greater semantic network was expected to be reflected in children's ability to retain and generalize a novel word in the long term. As Rohlfing (2005) concluded, the mapping processes of word learning seem to apply to different word classes, among them prepositions. To ensure that learning would be due to the experimental manipulation in both studies and not due to a-priori partial word knowledge, participating children were pretested in their understanding of these target prepositions before the training procedures began (Horst, 2013). Apart from these theoretical issues, Nachtigäller et al. (2013) have conducted a study, where 20- to 24-month-old children were taught the spatial preposition *under* embedded into a narrative structure. The present study is based on these findings and aims at addressing the question, if with advancing age, children are still scaffolded by a narrative structure in their extended word learning.

4. Study I: The Influence of Narrative Input on Extended Preposition Learning

The present chapter ties in with the presented research questions of Study I. The study was designed to pursue the question whether a narrative input structure provided during picture-book reading creates a beneficial learning context for 27- to 29-month-old children, which helps to strengthen semantic representations of formerly new or weakly represented spatial prepositions. In the following, the methodological approach for the training study (4.1) and the results obtained (4.2) are described. At the end of this chapter, the findings are discussed (4.3) in accordance with current research on the extended mapping of newly learned words.

4.1. Methodological approach: A training study

The ensuing chapter delineates in detail the methodological approach chosen to investigate the research questions. After characterizing participants of the study (4.1.1.), the study design and procedure (4.1.2.), the stimuli applied in training- and testing phases (4.1.3.) and most importantly, the operationalization of the training conditions are focused (4.1.4.). The data analyses were based on a coding scheme described in 4.1.5. A pilot study was conducted before the data collection started to test the study procedure for practicability, which is described in 4.1.6., before finally considering the statistical approach for analyzing data (4.1.7.).

4.1.1. Participants

Children between 27 and 29 months were recruited from Bielefeld, Germany, and its surroundings. The study was promoted with a short note in one of the city's newspapers as well as with a handout for every interested parent (see appendix 8.1.). Also, it was reverted back to the database of families interested in participating in one of the word learning studies that take place in the university's Dialoglab. Except for the fact that the study was about word learning in 2-year-old children, parents remained uninformed about the real purpose of the study until the end of the testing procedure so that children's performance could not be manipulated. During the last visit, parents received information about the procedure and were answered open questions. Children were awarded with a little present and each family received 10 € for expense allowance. A

normal and monolingual language development was defined as inclusionary criteria for participation, i.e. children with abnormal speech and hearing development, twins and premature born babies were excluded from participation. All included children were native learners of German.

As outlined in the previous chapter, the decision for a particular age group of participants was closely related to the trained target prepositions *behind* and *next to*. It was likely that 27- to 29-month-old children would have heard the prepositions before, but that they would probably not have built a complete lexical representation of them. For the present study, it was only of interest that children could still learn more about the meaning of the prepositions. In order to control for their already existing knowledge of these prepositions upon enrollment in the study, parents were asked to report about their children's comprehension and production of *behind* and *next to*. Upon enrollment in the study, children in the experimental and the control condition did neither differ in their comprehension of the spatial preposition *behind* ($\chi^2(1, N = 31) = .00, p = 1.0$) nor in their production of this preposition ($\chi^2(1, N = 31) = .00, p = 1.0$). The same was true for the comprehension of the preposition *next to* ($\chi^2(1, N = 31) = 2.89, p = .09$) as well as for the production of *next to* ($\chi^2(1, N = 31) = .33, p = .57$).

38 children participated in this study, $N = 16$ in the experimental condition (EC) and $N = 15$ in the control condition (CC). Seven children were excluded due to fussiness or experimental dropout (e.g. illness, time shifting during our 14 day span). The mean age of the EC was $M = 27.94$ ($SD = .77$) and of the CC was $M = 28.0$ ($SD = .76$). Both conditions did not differ with respect to age ($T(29) = .23, p = .82$), gender ($\chi^2(1, N = 31) = .03, p = .86$), maternal status of education ($U = 111.50, p = .74$), maternal time spent with child per day ($U = 107.50, p = .63$) and older brothers and/or sisters ($\chi^2(1, N = 31) = .02, p = .89$).

4.1.2. Design and procedure

4.1.2.1. Design

The training study was conducted in a pretest-posttest-design with 2 posttests and a control condition. The training phase comprised 3 sessions on 3 different days. Children's comprehension of the target spatial relations was the dependent variable, operationalized by children's performance in a forced-choice picture-selection task as

well as by children's performance in an acting-out task to perform the instructed spatial relations with real objects. The study design comprised 2 independent variables: *time* (a 3-level repeated measure: pretest, immediate and delayed posttest) was a within-subject variable and *condition* was a between-subject variable with two levels: narrative input structure and unrelated control speech. Altogether, a 3 (time) x 2 (condition) design was tested and all possible factor combinations were assessed by the testing items. Participants were matched according to age and gender before the beginning of the first visit to participate in either the experimental or the control condition. Throughout the study, children's sentence understanding played a crucial role. It was necessary to understand the testing instructions as well as the training procedure. That is why children's reception of sentences (assessed with a subtest of the SETK-2, Grimm, 2000) was considered as an indicator of children's language competencies in the analyses.

4.1.2.2. Procedure

The whole study took place in a room of the Dialoglab of Bielefeld University. The room was setup appropriately for children without offering too many distractors. The testing as well as the training procedures were held at a table, with the experimenter and the child sitting next to each other around one corner. A box with all stimuli was placed next to the experimenter out of reach of the child so that every item could be taken separately and placed on the table in randomized order. Although parents were allowed to be in the room, they were not involved in the testing- and training procedures and instructed not to interact with the child during the procedures. Each visit was videotaped with two different cameras (one directed on the whole setting and one zoomed on the table) for coding purposes (see Figure 1).

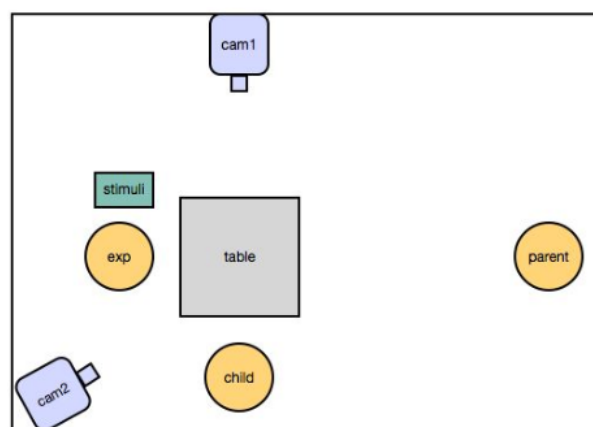


Figure 1: A drawing of the experimental setting

Altogether, four experimenters conducted the study in both conditions, but the same experimenter executed all visits for one participant. Experimenters were trained in advance how to accomplish the testing phases and how to train children in order to reach an optimal level of standardization.

The whole procedure comprised four visits and included different phases of testing and training. All visits were scheduled within two weeks following 2 conditions: First, there was only one visit per participant and per day and second, there were maximally 14 days between the first and the last visit. Thus the time range for all participants was from minimally four to maximally 14 days depending on parents disposability. In most cases, visits were scheduled on two days per week for each of two weeks. Up to the last visit, when families were completely informed about the purpose of the study, participants remained unaware of the experimental assumptions and were also told not to practice any of the tasks they saw with their child. Altogether, there were three testing phases (pretest, immediate and delayed posttest) as well as three training phases distributed over four visits. See Table 1 for an overview of the procedure. During the execution, transitions of test phases were created playfully in order not to disturb the interaction with the child. Every phase of the procedure is described in the following.

1. Visit	2. Visit	3. Visit	4. Visit
Warm up Pretest Training 1 Immediate posttest	Training 2 SETK-2	Training 3	Delayed posttest
approx. 45 min.	approx. 30 min.	approx. 10 min.	approx. 30 min.

Table 1: Distribution of every phase of the study procedure including the duration of each phase

4.1.2.2.1. Warm up

Children and their parents were invited to the Dialoglab at Bielefeld University, Germany. After the first arrival in the laboratory, children should first get familiar with the experimenter and the unknown room before the study started. This warm up phase was created individually with every child: While the experimenter informed parents about the procedure, the child was free to play with some interesting toys that were

placed in the room for this purpose. The experimenter then slowly got playfully in contact with the child until he/she felt comfortable enough to start the testing procedure.

4.1.2.2.2. *Testing procedure for pretest, immediate and delayed posttest*

The testing procedure was the same for all participants of the study. Two tasks testing children's comprehension of the target spatial relations were applied: a picture-selection task and an acting-out task with real objects.

Picture-selection task: In this forced-choice comprehension task, a child is asked to choose the best picture that matches a target sentence. This method is common in language studies and can be used with children as young as two-year-old (Schmitt & Miller, 2010). In the current study, the experimenter placed a book with testing items in front of the child on the table. Each item consisted of 4 photographs arranged on one standard paper size. One item set of objects showing 4 different spatial relations, e.g. *on, behind, next to and in front of*, was depicted on one page. After naming the depicted objects, the experimenter instructed the child to show the target picture. The instructions were as follows:

„Ich habe dir ein paar Bilder mitgebracht. Wir machen das jetzt so: Ich sage dir etwas und du, du zeigst mir das richtige Bild dazu. Es ist immer nur ein Bild richtig, okay? Wir probieren das einfach mal aus. Hier ist ein X, ein Y und ein Z. Jetzt zeig mir bitte das Bild: Das X ist *auf / hinter / neben* dem Z. Prima!“

[„*I brought you some pictures. We are now going to do the following: I will tell you something and you, you will show me the right picture. There is always only one right picture, okay? We will try this once. Here is a X, a Y and a Z. Now please, show me the picture: The X is on / behind / next to the Z. Great!*“]

The child's task was then to point to the right picture. If the child did not understand the instruction acoustically, the experimenter repeated it. In every other case, children's approach was simply acknowledged without any comment on the result. With respect to the material used and the pragmatical frame of the picture-based task, this task was thought to be familiar to children at posttests from the training: They had to recognize the right picture from memory.

Acting-out task with real objects: This open-ended comprehension task is well-known and widely used in language acquisition research (Schmitt & Miller, 2010) and has been proved in studies with children as early as 20 months of age (Nachtigäller et al., 2013).

Usually, the child is asked to act out sentences (i.e. instructions) the experimenter says. In this case, the task was to put object sets into an instructed spatial relation. For this purpose, the experimenter named the objects once, placed them on the table in the child's range and the child was allowed to play with them shortly. When the child's attention was not engaged anymore, the experimenter instructed the child to put the target trajector *on*, *behind* or *next to* the landmark object. Instructions were as follows:

„Ich habe Spielsachen für dich mitgebracht. Wir machen das jetzt so: Ich hole einige Sachen auf den Tisch und wir schauen sie uns gemeinsam an, okay? Hier ist ein X, ein Y und ein Z. Und jetzt, mach du mal das X auf / hinter / neben das Z. Prima!“

[„I brought you some toys. We are now going to do the following: I will put some things on the table and we will have a look at them together. Okay? Here is a X, a Y and a Z. Now please, put the X on / behind / next to the Z. Great!“]

The order of instructions of prepositions tested was not fixed. Children's reaction to the instructions was finally videotaped and coded later. There was no time span for the child to answer. In case the child did not hear the instruction correctly, the experimenter repeated it. In all other cases, the experimenter did neither repeat it nor comment on the child's approach. She simply acknowledged the child's engagement. After the item was done, the stimuli were placed back into the box, which was closed for the child. In contrast to the picture-selection task, this task was thought to be less familiar for children, because they were trained with pictures and had to transfer their knowledge to recall word meanings from memory to act the target relations out with real objects.

Consolidation processes, a time span of recovery from training without using the newly acquired meanings, seem to play a role in extended word learning. For example, McGregor and colleagues (McGregor et al., 2009) found only small effects immediately after a training session in their word learning study, but significant effects of their training on children's learning of the preposition *under* on a delayed posttest. A similar pattern was reported by Booth (2009), who observed an effect of causal descriptions while encoding of new words only after a delay of 6 to 15 days. Following these findings, the current study was designed with two posttests - one immediately after the first training and one with several days of delay. Each testing phase included both types of tasks, but the amount of items used in each testing phase changed as children's attention limited the possible total amount.

Pretest: The pretest comprised the same two items in each task (animate: rabbit / cat / barn and inanimate: spoon / tea bag / cup) and was thought to build a baseline of children's understanding of the relevant spatial prepositions. In this testing phase, the order of item presentation was fixed: Each participant started with the acting-out task and the animate item (rabbit / cat / barn) to enhance children's interest in participating, followed by the inanimate item (spoon / tea bag / cup). Also, the very first instruction of the first item was fixed: This instruction was meant to be the *on*-relation in order to check whether the child understood the instruction correctly, which was important for the whole following procedure. If not, the experimenter demonstrated the right approach. After this, the experimenter continued with the picture-selection task with the same item presentation order.

Immediate posttest: This testing phase - following immediately after the first training - started with the picture-selection task and included six items. Two of these items were familiar, i.e. they were already known from pretest and training. Four items were unfamiliar and served as transfer items that were completely new for the children. Two of these transfer items were functionally related whereas the other two were abstract items. A detailed description of the stimuli material follows in the next subchapter. The order of presentation was randomized and within one item, the order of instructing the spatial relations *on*, *behind* and *next to* was also randomized. The ensuing acting-out task captured a smaller amount of time and items: There was one familiar and two transfer items (one functionally related and one abstract item); the familiar item was chosen to be an animate one, whereas the functional related transfer item was intended to be an inanimate one. For one familiar and one transfer item in each task the preposition *on* and for all items the prepositions *behind* and *next to* were instructed, leading to a total of 14 instructions in the picture-selection task and 8 instructions in the acting-out task.

Delayed posttest: Testing children's word learning trajectory over the course of several days allowed for getting insights into children's slow mapping processes (i.e. retention and generalization of the target prepositions). This delayed posttest paralleled the immediate posttest. Nonetheless, in order to optimally differentiate children's learning gain and their task performance at the end of the study, two more items were used. The picture-selection task included eight item sets, four of which were familiar and four were unfamiliar transfer items. Again, half of the unfamiliar items were functionally

related and the other half were abstract items. There were again 3 items comprising the acting-out task: one animate familiar item, one inanimate functionally related transfer item and one abstract transfer item. This time, one item of each category (familiar, unfamiliar functionally related and unfamiliar abstract) in both tasks was instructed to create the relation *on*, for all other items *behind* and *next to* were instructed, leading to a total of 19 instructions in the picture-selection task and 9 instructions in the acting-out task. As in the immediate posttest, the presentation order for items as well as relations was randomized.

4.1.2.2.3. *Training procedure for each training phase*

The training procedure was the same for all children in both conditions and was designed like a picture-book reading scenario. Conditions differed only with respect to the input children were exposed to. The experimenter introduced this phase by instructing the child as follows:

„So, und jetzt machen wir etwas anderes: Ich zeige dir viele interessante Bilder und erzähle dir kurze Geschichten dazu. Und du hörst mir ganz genau zu, okay?“

[„*Now, we are going to do something else: I'll show you lots of interesting pictures and I'll tell you stories about them. And you, you listen very carefully, okay?*“]

A book including all training pictures in randomized order was placed on the table. For turning the pages, the child was involved if he/she wanted to in order to enhance engagement. After listening to each story, the child was free to comment on the items shortly, but was not asked to do so. Also, the experimenter tried to reduce talking about the items apart from the training input during this phase to a minimum. While the input was directed to the child, the experimenter pointed to the objects on the pictures while naming them. These were the only gestures the child was exposed to during input. See Figure 2 for a picture of the training scenario. Horst and colleagues (2011) investigated the effects of repeated book reading on word learning and found that reading the same stories repeatedly to children rather than reading different stories was beneficial for children's ability to recall and retain new words. Also, distributed exposure to new words over time is more effective for learning than massed exposure at a single time point, even if the overall amount of words is held constant (McGregor, Sheng, & Ball, 2007; Tomasello, 2003). According to these findings, three training sessions were

designed on three different days, in which children were provided with the same stories in randomized order to realize optimal training conditions.



Figure 2: Picture of the training scenario

4.1.3. Stimuli: Testing- and training material

Word learning is assumed to proceed gradually and to include multiple exposures to a new word in different contexts, i.e. word learning is not a bidirectional process saying that one either knows the meaning of a word or not, as outlined in the introduction. The decision to teach real words (in this case the spatial prepositions *behind* and *next to*) was closely related to this assumption, as children at the age of 27- to 29-months would most probably have heard them before, but would only have a nascent knowledge of the target prepositions. This enabled the investigation of the slow mapping processes of the target words. The materials of the present study were chosen to be appropriate for teaching and testing spatial relations, i.e. they allowed the creation of several spatial relations in order not to focus exclusively on the target relations. Thus, each item set included 3 objects: one trajector, one distractor and one landmark. According to Langacker (1991; 1998), the creation of a spatial relation always involves one mobile and flexible trajector object that is moved towards a reference object, the landmark. The distractor object was functionally comparable to the trajector object and was intended to make the whole scene more complex.

4.1.3.1. Testing material

According to Ganea and colleagues (2008), physical similarity plays a crucial role in children's transfer of information between objects and pictures. Thereby, photographs involve a higher level of perceptual details and more information in common between object and depiction than cartoons or drawings do. In order to control for this iconicity effect, photographs of real objects were created for the testing and the training phases of

the present study. All of the item sets chosen were attractive for children and should make them curious for the tasks and the narratives they were told. But most importantly, they comprised objects which names were already common in children’s lexicons. Also, it was very important that each item set allowed more than the requested, but also plausible, spatial relations. As for children in the observed age group, animate objects are typically more interesting than inanimate ones, half of the item sets were designed animate and the other half were designed inanimate to create a high diversity in stimuli material. Additionally, items were intended to differentiate a wide range of children’s performance in order to get detailed insights into their word learning processes from pretest to immediate as well as delayed posttest, without receiving ceiling or ground effects. That is why three item categories with different levels of difficulty were implemented: 1) Familiar item sets that constituted functionally related objects and that children already knew from pretest and training (i.e. the same item sets as used during training), 2) Unfamiliar transfer items that also constituted functionally related objects, but that were new to children as they were not tested before in one of the other sessions, and 3) Unfamiliar transfer items designed not to afford a particular relation that comprised no internal logic according to what is thought to be a trajectory or landmark object and that were thus called abstract item sets. A detailed list of all items in each category for the picture-selection task follows in Table 2, Table 3 and Table 4 below.

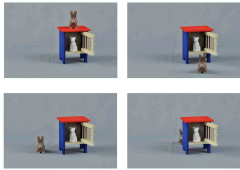
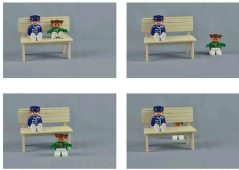
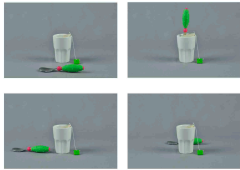
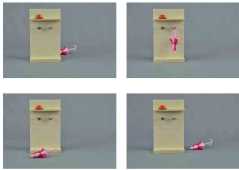
Animate items	<p>rabbit / cat / barn</p> 	<p>girl / boy / bench</p> 
Inanimate items	<p>spoon / tea bag / cup</p> 	<p>umbrella / hat / wardrobe</p> 

Table 2: List of familiar item sets as depicted in the picture-selection task


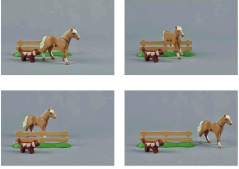
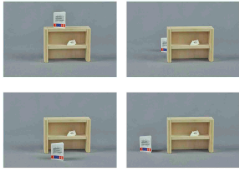
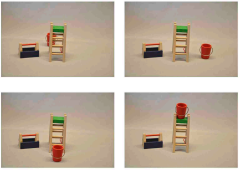
Animate items	child / bird / boat 	horse / dog / fence 
Inanimate items	book / iron / shelf 	bucket / toolbox / ladder 

Table 3: List of functionally related item sets as depicted in the picture-selection task

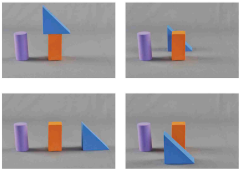
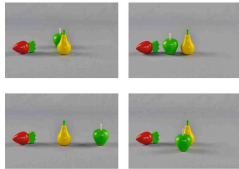
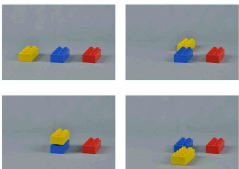

Geometrical figures: triangle / square / circle 	Three trajectors: apple / pear / strawberry 
Different feature (color): yellow / red / blue Lego bricks 	Three landmarks: sunshade / fir tree / table 

Table 4: List of abstract item sets as depicted in the picture-selection task

One test item for the picture-selection task included four photographs of one item set depicting four different spatial relations, including the target relations *behind* and *next to*. The position of the relations on one page varied so that children could not simply get used to one particular position instead of recognizing the instructed relation. For the familiar item sets, two different forms with varying positions on the page were used. For the acting-out task with real objects, the same objects in the same three categories that were depicted on the pictures were used, except that for this task, children were given one exemplar of the item set and the child was free to manipulate them.

4.1.3.2. Training material

Horst (2013) considered methodological aspects of using commercially available or purpose written books in research on storybook reading and word learning, and recommended the use of purpose written storybooks, because they allow for controlling for unintended differences between conditions. Following this recommendation, storybooks designed for the experimental purpose of the present study were applied for the training procedure. Therefore, realistic photographs, like also deployed for the testing material, were put together to build a picture book containing eight pages that were presented in randomized order. Four item sets that were each trained with both target prepositions *behind* and *next to* were created. As can be seen on the pictures (see Tables 5 and 6 below), the relation *behind* was always depicted in a way that the trajector object was still visible even behind the landmark object. The distractor object was placed somewhere else in relation to the landmark object, but always in a functional and plausible way. For the relation *next to*, the photographs were exactly designed in a parallel way as for the relation *behind*, i.e. the objects had the same position on the picture and the distractor was placed in the same relation to the landmark object. As *next to* semantically implies to the left side as well as to the right side, the trajector objects were placed on the left of the landmark on two pictures (one animate and one inanimate item set) and on the right of the landmark on the other two pictures (also one animate and one inanimate item set). According to Johnston (1988), factors like visibility and proximity are important for learning the complete meaning of *behind* and *next to*. With the stimuli chosen, different notions of reference in space were addressed.

4.1.3.3. Questionnaires and language survey

Additionally to the testing procedure with the child, data about related aspects relevant for the analyses were collected. Parents were therefore asked to fill in questionnaires providing information about demographical aspects, children's use of spatial language, picture book reading experience and children's level of shyness (see Appendix for a copy of each unpublished questionnaire).

According to Nachtigäller and colleagues (2013), children's individual language skills were found to be an important factor of influence to benefit from a narrative training to strengthen word knowledge. When tested with familiar items, retention and learning gain was not affected by the language skills, but by the narrative training. In contrast,

concerning the ability to generalize the newly acquired word knowledge to unfamiliar situations, children with advanced language skills who were exposed to the narrative input performed better than control children. Thus, for the present study with 28-month-old children, their individual language skills upon enrollment in the study were also tested in order to follow up on these findings. Therefore, at the second visit, children's language skills were tested with the *SETK-2 Sprachentwicklungstest für 2-jährige Kinder* (Grimm, 2000). With four subtests, this standardized test assesses children's receptive and productive language competencies on the word and sentence level from 24 to 35 months of age. Given critical values serve the identification of at-risk children in receptive or productive language processing. For the present analyses, the subtest of sentence reception was particularly considered.

The *questionnaire about demography* concerned parents education, the amount of time they spend with their children, if they have further children and some details about the participating child (questions concerning premature birth, weight at birth, normal hearing and sight).

The *language survey* (Rohlfing, 2007) is a parent rating to assess children's receptive and productive skills about spatial relations. It includes 49 items about actions (e.g. to open, to give), prepositions (e.g. in, on, under), adverbs (e.g. inside, behind) and deictic expressions (e.g. there, here). For the present study, it served the purpose of asking whether children already comprehended or produced the target prepositions *behind* and *next to* upon enrollment in the study.

According to Fletcher and Reese (2005), there is a relationship between reading to children early in life and their language development. Thereby, the age of onset of picture book reading is an important predictor of children's language development in a way that children beginning early to read have higher scores on language measures (ibid). That is why parents were asked to report about the age in months of children's first book contact to operationalize children's experience with picture book reading.

Children's individual temperament plays an important role in social interactions and conducts children's behavior in novel situations. Shyness as one aspect of temperament is defined as „slow or inhibited approach and/or discomfort in social situations involving novelty or uncertainty“ (Putnam, Gartstein, & Rothbart, 2006, p.399). In literature, there is debate about whether children's performance in language competency

assessments is affected by their shyness. On the one hand, as Spere, Evans, Hendry, and Mansell (2008) report, there are only few language differences between shy and non-shy children and unfamiliar contexts - like in experimental settings - do not lower children's performance scores (neither in shy nor in non-shy children). Although shy and non-shy children differ in the amount they talk, they don't differ in their receptive and expressive vocabulary (ibid). Interestingly, the authors also demonstrated that standardized testing conditions with an experienced experimenter are suitable for shy and non-shy children and shy children do not perform better at home than in an experimental setting (Spere et al., 2008). On the other hand, there is research reporting about lower test scores in vocabulary assessment for shy children, particularly in face-to-face testing situations (Crozier & Hostettler, 2003). The authors interpret their findings with respect to the anxiety-performance hypothesis indicating that shy children are more influenced by the form of administration of the test than their less shy peers as „a sense of being the focus of attention is one important factor in eliciting shyness“ (ibid, p.326). Following these concerns about the role of shyness in experimental settings, a German version of the *shyness scale* of the *Early Childhood Behavior Questionnaire (ECBQ)*; Putnam et al., 2006) assessed children's shyness.

4.1.4. Training conditions

The aim of the current study was to find out whether different narrative input in a picture book reading scenario influences children's slow mapping of word learning, focussing particularly on long-term retention and generalization to new situations. According to the operationalization of different narrative input, short narratives were created for both conditions, each containing four sentences and between 31 and 36 words. The amount of words per narrative did not differ in both conditions ($U = 19.500$, $p = 0.195$). But most importantly, the narrative input in both conditions differed structurally as well as semantically. See Table 5 for the input about the spatial relation *behind* and Table 6 for the input about the spatial relation *next to* for the experimental and the control condition, each table including corresponding pictures for each item (see appendix for the original German input). It is important to state that each target preposition was named once in a narrative, resulting in four depictions per preposition and per training session. The same was true for the naming of the prepositions in the

control input. Thus, in each condition, both prepositions were named four times per training session, resulting in a total of 12 times over all three training sessions.

Experimental condition (EC): As hypothesized, a narrative input structure containing coherent sentences with a temporal and causal relation facilitates consolidation and retention of weakly represented words. The meaning of these words should be more easily understood and remembered by being embedded into the narrative structure. To investigate this assumption, narratives of four sentences relating to different narrative functions were created. While the first sentence described a general situation introduction (e.g. about the weather), the second and third sentences introduced the trajector and landmark objects involved in the narrative and depicted a motivation for an action. In the fourth and last sentence, the action was finally carried out resulting in a consequence. The target preposition was introduced and named once in this last sentence. Corresponding pictures collected in a picture book depicted the end state of the short narratives. The narrative input structure was oriented on short narratives that were implemented in a previous study (Nachtigäller et al., 2013), but was created longer: The narratives consisted of four sentences as participants of the present study were older. The operationalization aimed at modeling real narrative structures age appropriate for children of 27 to 29 months without to claim all characteristics of full narrative structures. With regard to contents, narratives were designed likewise being pleasant for children, tying in with their already existing knowledge and allowing for different interests of participating children.

Control condition (CC): Children in the CG were also taught the target spatial prepositions and were exposed to input implying the same amount of words and sentences as children in the EC in order to guarantee a similar study procedure and the same amount of attention of the experimenter. However, the control input did not imply a coherent sentence structure and was created to be semantically simple, i.e. containing deictic expressions and some adjectives describing the items in order to be still ecologically valid and not to bore children too much with the input. Most importantly, trajector and landmark objects were also introduced in the second and third sentences and the target prepositions were named in the last sentence. Thus, the target prepositions were named equally often and positioned at the same place in input as in the EC. The control training procedure was inspired by Hayne and Herbert (2004), who applied an „empty narration“ in their memory study („Let’s have a look at this. Then, we have this

bit. That was pretty neat, wasn't it?" (p. 131), with which they intended to keep infants attention on the task without providing additional information about the target.




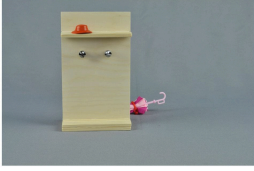
Input for the spatial preposition <i>behind</i>		
Item set	Experimental condition	Control condition
<p>rabbit / cat / barn</p> 	<p>It is a sunny day. The rabbit wants to visit its neighbor. That is why it jumps to the cat and the barn. And waits directly <i>behind</i> the barn to surprise her.</p>	<p>Let's have a look at this. This is a brown rabbit. And there is a grey cat and this is a big barn. And the brown rabbit is <i>behind</i> the barn.</p>
<p>girl / boy / bench</p> 	<p>It is afternoon. The girl and the boy play hide-and-seek. They run to the bench and the boy closes his eyes. The girl goes straight <i>behind</i> the bench, so that he can not find her.</p>	<p>Let's look at this briefly! Here is a cheerful girl. And this is a cute boy and there is also a broad bench. And the cheerful girl stands <i>behind</i> the bench.</p>
<p>tea bag / spoon / cup</p> 	<p>It is early in the morning. Someone has already prepared the breakfast. The spoon lies far away from the tea bag and the cup. But it can be found <i>behind</i> the cup and the breakfast can begin.</p>	<p>Let's look at this. This is a green spoon. And this is a tasty tea bag and there is also a round cup. And the green spoon is <i>behind</i> the cup.</p>
<p>umbrella / hat / wardrobe</p> 	<p>It is very windy. The umbrella is gone and is needed as protection. It is not with the hat and the wardrobe as always. Because this time it fell <i>behind</i> the wardrobe.</p>	<p>Look at this! There is a pink umbrella. And there is a brown hat and this is a wardrobe made of wood. And the pink umbrella is <i>behind</i> the wardrobe.</p>

Table 5: A detailed list of the input provided in both conditions for the spatial preposition *behind*

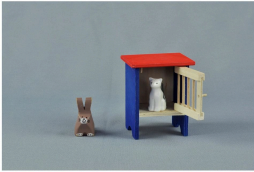



Input for the spatial preposition <i>next to</i>		
Item set	Experimental condition	Control condition
rabbit / cat / barn 	It is a warm day. The rabbit is hungry and wants to eat something. It firstly looks for it near the cat and the barn. And finally finds something to eat <i>next to</i> the barn.	Look at this! There is a young rabbit. And there is also an old cat and this is a nice barn. And the young rabbit stands <i>next to</i> the barn.
girl / boy / bench 	It is holidays. The girl and the boy want to have ice cream together. She looks for the boy and the bench to pick him up. Finally, she stands <i>next to</i> the bench and greets him.	Now, we look at his! Here is a friendly girl and there is a happy boy. And there is a long bench. And the friendly girl is <i>next to</i> the bench.
tea bag / spoon / cup 	The tea is almost made. It only needs to be stirred. The spoon lies there, where the tea bag and the cup are, too. It is directly <i>next to</i> the cup and one can stir the tea with it.	Let's look at the next one briefly! This is a little spoon. And here is a loose tea bag and there is a white cup. And the white spoon is <i>next to</i> the cup.
umbrella / hat / wardrobe 	It is bad weather. The wet umbrella is clamped and very big. Now, it does not fit, where the hat and the wardrobe are. That is why it lies <i>next to</i> the wardrobe and can dry there immediately.	Now we look at another picture. Here is a colored umbrella. And there is a dark hat and this is a high wardrobe. And the colored umbrella is <i>next to</i> the wardrobe.

 Table 6: A detailed list of the input provided in both conditions for the spatial preposition *next to*

4.1.5. Coding scheme

The ostensible interest of the study concerned children's performance on the target relations in the picture-selection as well as in the acting-out task (performance coding), which was analyzed statistically with quantitative methods. On a profound level, the types of mistakes children made when not answering correctly were also supposed to be informative for their word learning processes (error analysis) and were analyzed qualitatively. For data coding, different categories that complied with the correspondent

purpose were therefore needed. According to a predefined coding scheme, the coding was done after the completion of the study via video recordings.

4.1.5.1. Performance coding

Picture-selection task: This task included four pictures out of which the child had to point to the instructed one. Thus, there was a 25% chance level for the child to guess. The coding of this forced-choice task was quite simple: If the child pointed to the right picture (i.e. the picture with the instructed spatial preposition), he/she got 1 point; if he/she pointed to one of the other three pictures, he/she got zero points.

Acting-out task with real objects: For the coding of this open-ended task, children's behavior in creating the instructed spatial relations had to be categorized as being right or wrong. Children's performance was coded with 2 points, when the child arranged the instructed trajector and landmark into the instructed spatial relation. In case the child created the required relation, but implemented a wrong object (e.g. trajector and landmark were mixed up or the distractor object was involved in any way), the child received 1 point. The performance was coded as wrong (0 points), if the child created a wrong (i.e. not instructed) relation or if the child did not answer at all (e.g. the child refused to bring objects into a relation or simply played with them).

4.1.5.2. Error analysis

In addition to the analysis of children's correct performance, a descriptive analysis of children's errors was supposed to shed light on the semantic development of the constructed new word meaning. The idea behind was to get hints into how meaning develops by looking at the mistakes children make and if their behavior allows inferences about their current status of the lexical development of the target words.

Picture-selection task: Children's errors were categorized each time the child did not point to the requested picture. It was further differentiated what he/she did instead by categorizing children's behavior according to the spatial relations they pointed to: 1) The child did not point to a picture at all and did something else or even refused to do anything, 2) The child pointed to another topographically near relation like e.g. *in*, *on*, *under*, *between* or *in front of* and 3) The child depicted one of the trained, but not instructed relations *behind* or *next to*.

Acting-out task with real objects: The same three categories as described above were implemented for coding children's errors in this task, with further subcategories giving consideration to the fact that the task allowed more alternative operations with the items. Children not only had to create the right preposition, but also had to choose the instructed objects for a complete right approach. Hence, each category was subdivided depending on children's use of right (i.e. instructed) or wrong (distractor) objects to arrange the target prepositions with TR and LM and to ignore the distractor object. See the coding system for this task in Table 7.

Category	Behavior	
1.	no creation of a relation, child plays with objects or refuses to answer	
2.	other (topographically near) relation	right trajector and right landmark
		wrong trajector and/or wrong landmark
3.	trained relation	right trajector and right landmark
		wrong trajector and/or wrong landmark

Table 7: Coding system for the error analysis of the acting-out task

4.1.5.3. Inter-rater reliability

A second rater coded 4 randomly selected participants of each condition (corresponding approx. 25 % of the data). The result of the inter-rater analysis revealed a Cohen's Kappa of .92 indicating a high inter-rater agreement for the whole testing. In detail Cohen's Kappa was .95 for the pretest, .92 for immediate and .92 for delayed posttest.

4.1.6. **Pilot study**

After having designed the study, a pilot study was conducted with 6 participants of different gender and age (24 to 28 months), who passed through the whole procedure and visited the Dialoglab four times to test the stimuli, the experimental setup and the testing and training procedure. This pilot study revealed minor problems with the procedure that were solved afterwards. It turned out to be a good motivation for children to start the pretest with the acting-out task, because this way children were engaged in the procedure actively from the start. Also, it was determined that both tasks start with an *on*-instruction. As all participants were expected to solve this instruction correctly, it was made sure that children understand the instruction correctly and children were motivated to participate with a task easy to accomplish. Additionally, as children's

attention during the procedure allowed more items, two more items (child / bird / boat; bucket / toolbox / ladder) were added to the set of stimuli in order to realize an equal number of items in each item category. Finally, children's age was narrowed down to 27 to 29 months, because 24-month-old children experienced the experimental procedure as quite challenging and overburdened.

4.1.7. Statistical analyses

All statistical analyses were conducted with IBM® SPSS® Statistics Version 21. Given normality ($\alpha = 0.05$) in the sample for pretest (Kolmogorov-Smirnov-Z = .93, $p = .35$), immediate posttest (Kolmogorov-Smirnov-Z = .69, $p = .73$) and delayed posttest (Kolmogorov-Smirnov-Z = .71, $p = .69$), the following statistical analyses were conducted with analyses of variance with repeated measures on the variable time. T-tests for independent samples were conducted to test for differences between conditions. Correlations were calculated with Pearson's coefficient of correlations r . According to convention, results were interpreted as being significant on an α -level of .05. According to Cohen (1988), effect sizes were assumed to be small (.01), moderate (.06) and large (.14). For the statistical analysis of the data, means of the raw data taken together for the trained target prepositions *behind* and *next to* were calculated and presented in percentage. As the preposition *on* served as a control relation only, it was not taken into account for the analyses. The descriptive error analysis was based on categorical variables and analyzed qualitatively with frequency and percentage of the distribution.

4.2. Results

The ensuing chapter describes the results obtained in the quantitative and qualitative analyses. Thereby, the statistical analyses of children's performance is amplified first, with a description of children's performance at pretest (4.2.1.), followed by children's retention performance (4.2.2.), their generalization across tasks (4.2.3.), their generalization to unfamiliar item sets (4.2.4.) and their generalization to unfamiliar items sets and across tasks (4.2.5.). Afterwards, the relationship between retention and generalization competencies is considered (4.2.6.) as well as possible relationships between children's word learning and further influencing variables (4.2.7.). The chapter is closed with a descriptive error analysis of children's performance, anticipating possible insights into children's word learning processes (4.2.8.).

4.2.1. Pretest

Children's individual knowledge about the spatial prepositions *behind* and *next to* upon enrollment in the study was controlled in a pretest, because these target words were real words. As could be seen, children did not differ upon enrollment in the study concerning the comprehension and production of the target prepositions examined via parent report. In addition, children's comprehension before the training was tested to get a baseline measure of their performance in the picture-selection and the acting-out task. Children in both conditions did not differ with respect to their performance in the picture-selection task ($t(29) = .66, p = .52$). The performance of the EC ($M = .33, SD = .20$) was on a comparable level as the performance of the CC ($M = .38, SD = .27$). The same was true for the acting-out task: The EC performed on average $M = .28 (SD = .39)$ and the CC $M = .23 (SD = .31)$. They did not differ significantly ($t(28) = -.39, p = .70$). This is important, because it indicates that all children came into the study with a comparable level of comprehension of the target prepositions in both tasks.

4.2.2. Retention: Learning effect at posttests with familiar item sets

In order to test the first hypothesis, children's performance with familiar items was analyzed at all three testing times (pretest, immediate and delayed posttest) in the picture-selection task to get insights into children's general learning curve over the course of the study. As children were trained with pictures while listening to the condition-specific input, the picture-selection task addressed children's ability to recognize those pictures depicting the instructed target prepositions after the training. It was assumed that children who were exposed to the new prepositions embedded into a narrative input structure demonstrate enhanced learning of the target words and an improved retention over time compared to control children. This analysis was based on familiar item sets only. Thus, children's performance in the picture-selection task using familiar items served as dependent measure. To investigate the learning effect by training condition, a (3) time x (2) condition ANOVA with repeated measures on time was conducted. Results revealed no main effect of time ($F(2,28) = 1.92, p = .17$) as well as no main effect of condition ($F(1,29) = .70, p = .41$), but showed a significant interaction effect of time and condition ($F(2,28) = 3.26, p = .05, \eta^2 = .19$), with a large effect size indicating a remarkable effect. See Figure 3 as well as Table 8 for mean percentage and standard deviations. To analyze the interaction effect in more detail, a

subsequent split sample analysis revealed a significant main effect of time, $F(2,14) = 4.33$, $p = .03$, $Eta^2 = .38$, for children in the narrative condition, which refers back to a significant difference between pretest and delayed posttest ($p = .03$). However, performance neither differed from pretest to immediate posttest ($p = .87$) nor from immediate to delayed posttest ($p = .37$). For children in the control condition, a significant main effect of time could not be observed, $F(2,13) = .15$, $p = .86$. The post-hoc analysis revealed that children in both conditions start from a comparable performance level at pretest, but those children who were taught the target prepositions embedded into the narrative input structure improved their performance significantly over pretest and strengthened their comprehension of the target words at delayed posttest. In contrast to the EC, the learning curve of the CC remained on baseline level as demonstrated at pretest, indicating that children did not benefit from the control input for retention of the target prepositions.

The results confirmed the first hypothesis: Children in the narrative training condition learned and retained the target words better over the course of several days than control children, as tested with familiar item sets in the picture-selection task.

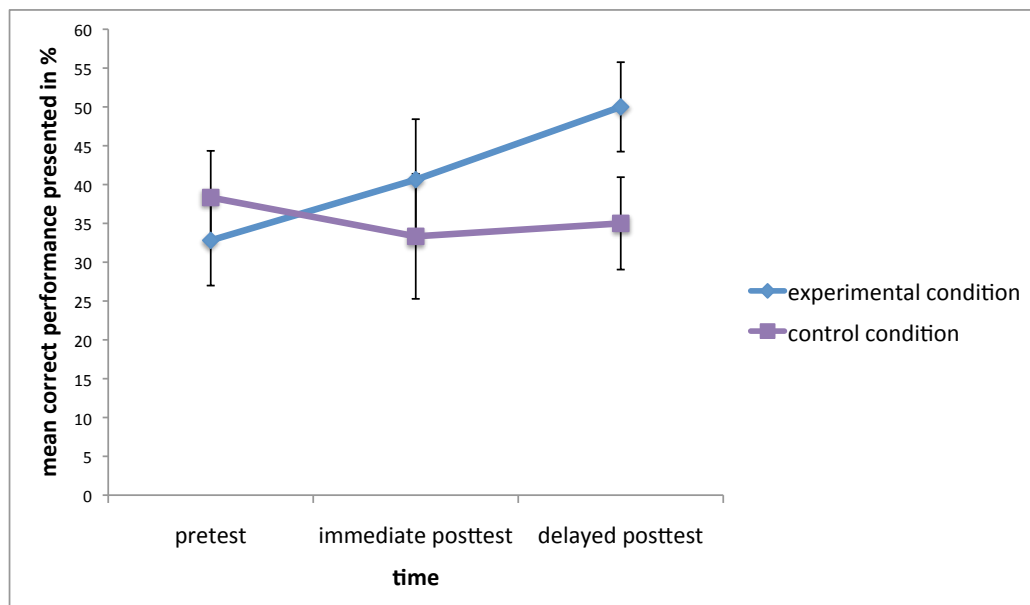


Figure 3: Mean correct performance presented in percentage of children in both conditions when tested with familiar item sets in the picture-selection task at all testing times

Condition	Testing time		
	Pretest <i>M</i> (<i>SD</i>)	Immediate posttest <i>M</i> (<i>SD</i>)	Delayed posttest <i>M</i> (<i>SD</i>)
EC	32.81 (19.83)	40.62 (27.20)	50.00 (22.36)
CC	38.33 (26.50)	33.33 (34.93)	35.00 (23.72)

Table 8: Mean percentage (*M*) and standard deviations (*SD*) of correct performance when tested with familiar item sets at all testing times

4.2.3. Generalization across tasks

An interesting question for children's generalization was, whether there is an advantage in one of the two conditions to transfer the acquired word knowledge to the less familiar acting-out task (task transfer). It was assumed that children, who were exposed to the target prepositions embedded into a narrative input structure, demonstrate an enhanced ability to generalize the acquired preposition knowledge to an unfamiliar task compared to children of the control condition. The first operationalization of decontextualized word knowledge was based on the idea to test children's ability to generalize the acquired new meanings to a new task implying another material (task transfer). Although children were pretested in this task, the training focused on pictures. This task was thus assumed to be less familiar to children, because it contained real objects and differed from the picture-selection task not only in the material used, but also in the memory demands required for performing correctly: Children had to demonstrate their comprehension of the word meaning by acting it out with real objects and thus by recalling it from their memory rather than recognizing it from pictures they were exposed to in the training. A (3) time x (2) condition ANOVA with repeated measures on time was conducted to analyze children's performance in both conditions in the acting-out task at all three testing times. The dependent measure in this statistical analysis was children's performance in the acting-out task with familiar item sets. Results revealed neither a main effect of condition ($F(1,27) = .73, p = .40$) nor a main effect of time ($F(2,26) = .16, p = .86$) nor an interaction effect between condition and time ($F(2,26) = .16, p = .86$). Interestingly, on a descriptive level, the mean performance of the EC was consequently on a higher level than that of the CC, and is even enhanced at posttests (see Figure 4 and Table 9 for mean percentage and standard deviations), but

this difference between conditions was not significant due to high variance in the sample. Accordingly, this generalization hypothesis could not be confirmed.

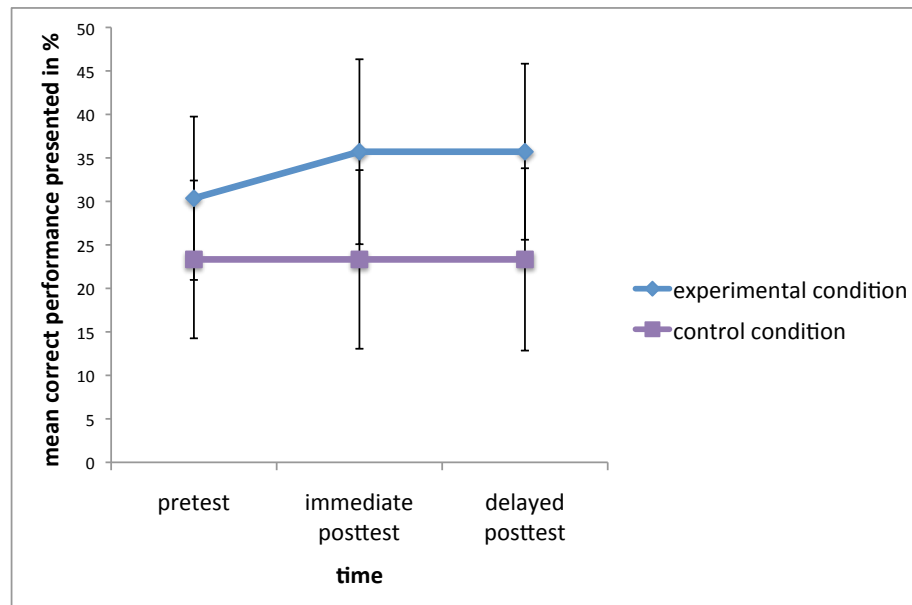


Figure 4: Mean correct performance presented in percentage of children in both conditions when tested with familiar item sets in the acting-out task at all testing times (task transfer)

Condition	Testing time		
	Pretest $M (SD)$	Immediate posttest $M (SD)$	Delayed posttest $M (SD)$
EC	30.36 (39.44)	35.71 (45.69)	35.71 (41.27)
CC	23.33 (30.57)	23.33 (33.36)	23.33 (37.16)

Table 9: Mean percentage (M) and standard deviations (SD) of correct performance when tested with familiar item sets in the acting-out task at all testing times (task transfer)

To conclude, when tested with familiar item sets, children, who learned the spatial prepositions embedded into a narrative input structure, retained these words better at posttests than children who were exposed to an unrelated control input. This was true particularly for the picture-selection task, which asked children to demonstrate comprehension of the target words by recognizing the right pictures from the training. When asked to generalize the newly acquired word knowledge to a sparsely familiar task, i.e. to act-out the target relations with real objects, children in the narrative training condition did not show improved comprehension compared to controls, although their performance averaged higher.

4.2.4. Generalization to unfamiliar item sets

Another interesting question for the study was whether children in both conditions were able to generalize their newly acquired preposition knowledge to unfamiliar item sets when tested with the familiar task. It was assumed that children who were exposed to the target prepositions embedded into a narrative input structure are better able to generalize their newly acquired word knowledge to unfamiliar exemplars than children exposed to the control input. The unfamiliar item sets comprised functionally related as well as abstract item sets, which were considered together for the analysis. Children's performance with unfamiliar item sets in the familiar picture-selection task served as dependent variable for this analysis. A (3) time x (2) condition ANOVA with repeated measures on time was conducted to analyze children's performance in both conditions at all three testing times. The pretest was included in these analyses, too, because when children came into the study, pretest items were still unfamiliar to them. This approach allowed for a comparison between children's generalization at posttests and their performance at pretest and, thus, for a conclusion if generalization can be traced back to the training. Results revealed neither a main effect of condition ($F(1,27) = .20, p = .66$) nor a main effect of time ($F(2,26) = .35, p = .71$) nor an interaction effect between condition and time ($F(2,26) = .94, p = .40$). See Figure 5 and Table 10 for mean percentage and standard deviations.

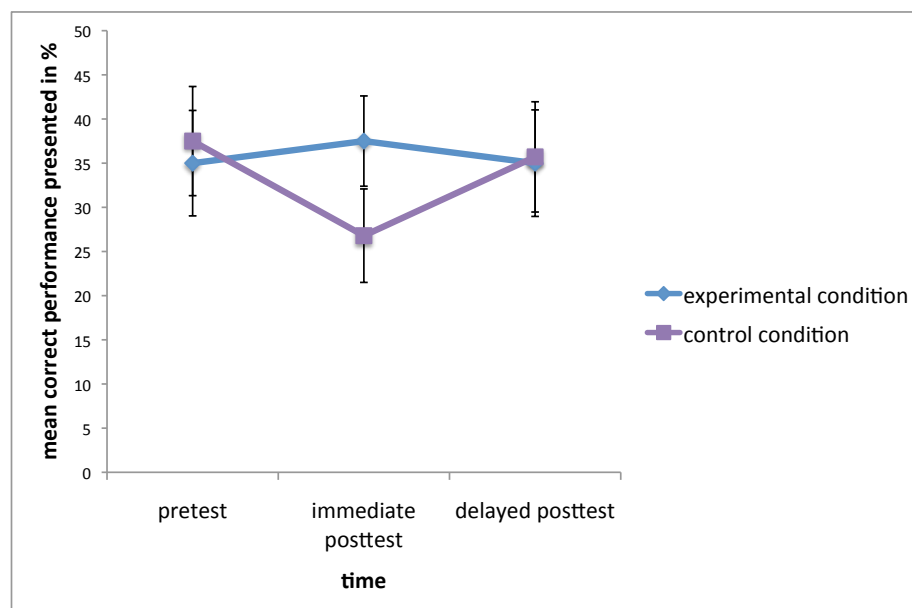


Figure 5: Mean correct performance presented in percentage of children in both conditions when tested with unfamiliar item sets in the picture-selection task at all testing times (item transfer)

Condition	Testing time		
	Pretest <i>M</i> (<i>SD</i>)	Immediate posttest <i>M</i> (<i>SD</i>)	Delayed posttest <i>M</i> (<i>SD</i>)
EC	35.00 (18.42)	37.50 (20.59)	35.00 (19.59)
CC	37.50 (27.30)	26.79 (18.90)	35.71 (26.79)

Table 10: Mean percentage (*M*) and standard deviations (*SD*) of correct performance when tested with unfamiliar item sets in the picture-selection task at all testing times (item transfer)

To conclude, the present hypothesis was not confirmed as children of the narrative training condition did not show improved generalization performance compared to controls. Furthermore, generalization performance of both conditions did not improve over time.

4.2.5. Generalization to unfamiliar item sets and across tasks

The most complex generalization situation was assumed when children were confronted with unfamiliar item sets in the sparsely familiar acting-out task, because neither the task nor the stimuli provided contextual scaffolds helping children to recall the preposition knowledge. As in the other generalization analyses, it was assumed that children who were exposed to the target prepositions embedded into a narrative input structure are better able to generalize their newly acquired word knowledge to unfamiliar exemplars when tested in a sparsely familiar task than children exposed to the control input. This time again, the analysis took children's performance at pretest into account in order to find a difference in performance due to training. The following analyses focused on children's generalization performance with unfamiliar item sets at pretest, immediate and delayed posttest. Again, functionally related as well as abstract items (designed not to afford a particular relation) were considered together. Children's performance with unfamiliar item sets in the less familiar acting-out task served as dependent variable. A (3) time x (2) condition ANOVA with repeated measures on time was conducted to analyze children's performance in both conditions at all three testing times. Results revealed neither a main effect of condition ($F(1,27) = 2.42, p = .13$) nor a main effect of time ($F(2,26) = .73, p = .49$), but revealed a marginal interaction effect between time and condition ($F(2,26) = 2.85, p = .08, \eta^2 = .18$). To analyze the marginal interaction effect in more detail, a subsequent split sample analysis revealed a

marginal main effect of time, $F(2,13) = 3.49$, $p = .06$, $\eta^2 = .35$, for children in the narrative condition, which refers back to a significant difference between pretest and delayed posttest ($p = .02$). However, performance neither differed from pretest to immediate posttest ($p = .18$) nor from immediate to delayed posttest ($p = .47$). For children in the control condition, a significant main effect of time could not be observed, $F(2,12) = .32$, $p = .73$. The results of the post-hoc analysis suggest that children who were taught the target prepositions embedded into the narrative input structure were marginally better able to generalize their newly acquired word knowledge to unfamiliar exemplars when tested in a sparsely familiar task at delayed posttest. In contrast to the EC, the learning curve of the CC remained on baseline level as demonstrated at pretest, indicating that children did not benefit from the control input for generalization of the target prepositions to unfamiliar exemplars as tested in a sparsely familiar task. See Figure 6 and Table 11 for mean percentage and standard deviations.

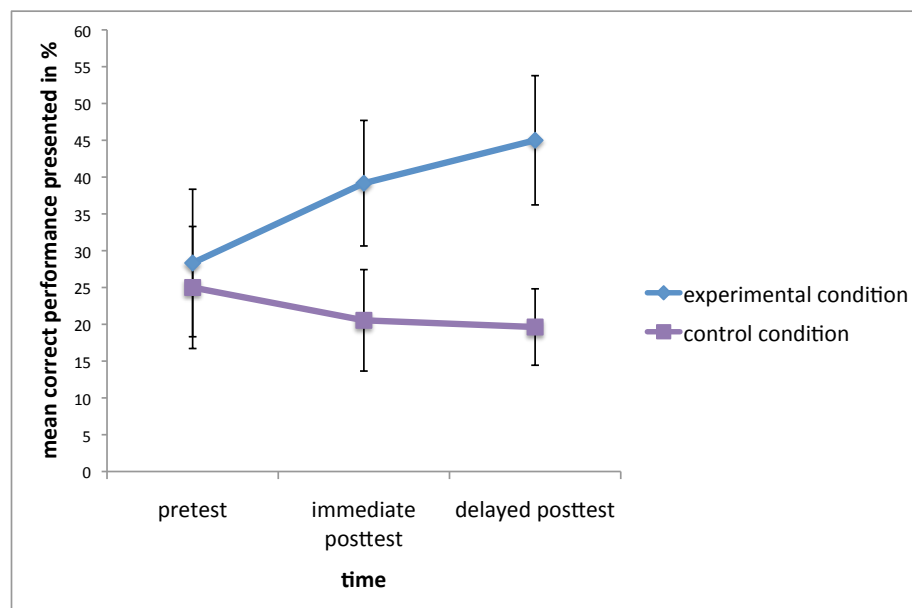


Figure 6: Mean correct performance presented in percentage of children in both conditions when tested with unfamiliar items in the less familiar acting-out task at all testing times (item and task transfer)

To sum up the analyses of children's generalization skills when tested in a complex situation including unfamiliar exemplars as well as a condition-specific sparsely familiar task (item + task transfer), the hypothesis could not be confirmed, although for those children who learned the target prepositions embedded into the narrative input (EC) a marginal effect was found. The children demonstrated a significant ability to

generalize their newly acquired word knowledge to unfamiliar items in the sparsely familiar acting-out task at delayed posttest. This effect could not be observed for children in the object condition.

Condition	Testing time		
	Pretest <i>M</i> (<i>SD</i>)	Immediate posttest <i>M</i> (<i>SD</i>)	Delayed posttest <i>M</i> (<i>SD</i>)
EC	28.33 (38.81)	39.17 (33.03)	45.00 (34.00)
CC	25.00 (31.00)	20.54 (25.76)	19.64 (19.44)

Table 11: Mean percentage (*M*) and standard deviations (*SD*) of correct performance when tested with unfamiliar item sets in the acting-out task at all testing times (item and task transfer)

4.2.6. Relationship between retention and generalization competencies

An intriguing question of the slow mapping processes investigated in the present study is whether there is a common base for the competence to retain word knowledge in semantic memory and to generalize this word knowledge to new situations. Both competencies are assumed to be aspects of slow, extended word mapping and indicate profound and strongly represented word knowledge (Vlach & Sandhofer, 2012). Rohlfing (2006) assumes a hierarchical structure underlying these processes and showed that the extension of a newly learned preposition is based on the former successful mapping of the preposition. With the exception of one child, all children in her study that successfully generalized their word knowledge to an unfamiliar transfer situation had performed correctly in a familiar situation before. The ensuing analysis is motivated by these findings, also assuming a relationship between children's performance in familiar item sets (retention) and in unfamiliar item sets (generalization) at posttests. Thereby, the analysis of children's performance was conducted for each posttest independently, because the time in between was assumed to be relevant for consolidation processes.

At immediate posttest, children's retention performance in both conditions was positively correlated to their ability to generalize the acquired word knowledge to unfamiliar items assessed in a sparsely familiar task. This indicates that independent of the training condition, the better children retained their newly acquired word knowledge at immediate posttest, the better they also generalized this word knowledge to a new

situation comprising unfamiliar exemplars and an unfamiliar pragmatic testing context. Results did not reveal a relationship between children’s retention performance and their ability to generalize their word knowledge to unfamiliar items, when considering children’s transfer to unfamiliar item sets in the familiar task at immediate posttest. See Table 12 for correlations and the corresponding level of significance.

		generalization (item transfer)	generalization (item + task transfer)
retention (familiar items and familiar task)	EC	$r = .31, p = .25$	$r = .68, p = .00$
	CC	$r = .38, p = .24$	$r = .79, p = .00$

Table 12: Correlations (Pearson’s coefficient of correlations r) and the corresponding level of significance (p) between children’s retention and generalization at immediate posttest

At delayed posttest, a different pattern appeared. For those children, who learned the new words embedded into a narrative input structure, results revealed a positive relationship between the ability to retain the newly acquired preposition knowledge and the ability to generalize this word knowledge to unfamiliar item sets in the familiar as well as in the less familiar task. In contrast, the results did not reveal any relationship between different types of performances in the control condition. See Table 13 for correlations and the corresponding level of significance.

		generalization (item transfer)	generalization (item + task transfer)
retention (familiar items and familiar task)	EC	$r = .70, p = .00$	$r = .79, p = .00$
	CC	$r = .45, p = .10$	$r = .38, p = .18$

Table 13: Correlations (Pearson’s coefficient of correlations r) and the corresponding level of significance (p) between children’s retention and generalization at delayed posttest

The overall picture of this analysis indicates that, while at immediate posttest, retention performance of all children was positively correlated to their ability to generalize their word knowledge to an unfamiliar context of unknown items and a new task, children’s retention performance at delayed posttest was only positively correlated to their generalization performance when children were trained with the narrative input.

4.2.7. Relationship of word learning and further relevant variables: Language skills, shyness and experience with picture-book reading

In addition to the testing procedure, further important variables assumed to have a potential influence on the word learning process and / or on children's performance during the study were considered: children's language skills, children's level of shyness and children's individual experience with picture book reading. These variables are considered in the following.

4.2.7.1. Children's language skills

It was assumed that in order to understand and execute the testing instructions, children needed sufficient language competencies. In addition, vocabulary size in general has been found to be positively correlated with the amount of new word learning (Robbins & Ehri, 1994) and with children's reading ability (Stanovich, 1986). More recently, Nachtigäller and colleagues (2013) found advanced expressive language skills in 2-year-old children to be particularly helpful for children to benefit from enriched word knowledge provided in a narrative context to generalize the meaning to unfamiliar items. Thus, for the present study, children's language skills were assessed with the *SETK-2* (Grimm, 2000), with a particular focus on the subtest of 'reception of sentences'. For this analysis, correlations between children's sentence reception and their retention and generalization performance at posttests were calculated. See Table 14 for correlations at immediate and Table 15 for correlations at delayed posttest.

For children in the experimental condition, at immediate posttest, the sentence reception was significantly positively correlated to their generalization performance with unfamiliar exemplars and across tasks. At delayed posttest, children's retention performance and their generalization performance to unfamiliar exemplars in the familiar and less familiar tasks was significantly positively correlated to their sentence reception. These findings indicate that the higher children's level of sentence comprehension was, the more they could profit from the narrative input as demonstrated in high retention and generalization performances, particularly at delayed posttest.

In the control condition, the relationship between children's language skills and their performance was different. While at immediate posttest, children's sentence reception was neither correlated to their retention performance nor to their generalization

performance, the relationship differed at delayed posttest. Children’s sentence reception was significantly correlated to their retention performance as well as to their generalization performance with unfamiliar exemplars in the less familiar acting-out task indicating that those children in the control condition with advanced sentence comprehension also performed better at delayed posttest.

	Retention with familiar items	Generalization to unfamiliar items	Generalization to unfamiliar items and across tasks
EC: sentence reception	$r = .46, p = .09$	$r = .44, p = .10$	$r = .62, p = .01$
CC: sentence reception	$r = .39, p = .15$	$r = .19, p = .50$	$r = -.46, p = .09$

Table 14: Correlations (Pearson’s coefficient of correlations r) and the corresponding level of significance (p) between children’s sentence reception and their performance at immediate posttest

	Retention with familiar items	Generalization to unfamiliar items	Generalization to unfamiliar items and across tasks
EC: sentence reception	$r = .85, p = .00$	$r = .68, p = .01$	$r = .71, p = .00$
CC: sentence reception	$r = .66, p = .01$	$r = .25, p = .38$	$r = -.54, p = .04$

Table 15: Correlations (Pearson’s coefficient of correlations r) and the corresponding level of significance (p) between children’s sentence reception and their performance at delayed posttest

4.2.7.2. Children’s temperament: Shyness

In order to control for a possible influence of shyness on children’s performance during the testing procedure, the ECBQ (Putnam et al., 2006) subtest for shyness was assessed. The raw scores of the ECBQ range from one to seven, with one indicating a low and seven indicating a high level of shyness. In the present sample the minimal raw score was two and the maximal raw score was six. Children in the experimental condition ($M = 3.13, SD = 1.20$) were on average more shy than children in the control condition ($M = 2.47, SD = .52$), but this difference was statistically not significant ($t(29) = -1.95, p = .06$). The marginal difference hints at a lower level of shyness in the control condition than in the experimental condition, which could not account for inhibited behavior in the testing procedure.

Taken children of both conditions together, their performance in the testing procedure at posttests was not affected by their level of shyness: There was neither a significant correlation between shyness and retention performance ($r = .07, p = .72$) nor between shyness and generalization performance with unfamiliar items in the familiar picture-selection task ($r = .08, p = .69$) nor between shyness and generalization performance with unfamiliar items in the less familiar acting-out task ($r = .22, p = .26$). Thus, for the present sample, an influence of shyness on the testing procedure was not assumed.

4.2.7.3. Children's experience with picture-book reading

Another potential factor of influence on children's word learning process and on their performance during the study was their individual experience with picture books. As according to Fletcher and Reese (2005), the age of onset of picture book reading predicts children's language development in a way that children beginning early to read have higher scores on language measures, parents of the present sample of children were asked to report about the age in months of children's first book contact to operationalize children's experience with picture book reading.

The first book contact of children in the experimental condition was on average at $M = 7.64$ ($SD = .256$) and of children in the control condition at $M = 8.71$ ($SD = 3.07$). Both conditions did not differ ($t(26) = 1.00, p = .33$) in their experience with picture books. Furthermore, a correlation analysis revealed that, when considering both conditions together, children's experience with picture-book reading was not related to children's performance in the testing procedure at posttests. Children's first book contact was neither correlated to their retention performance ($r = -.30, p = .12$) nor correlated to their generalization performance with unfamiliar item sets in the familiar picture-selection task ($r = -.03, p = .87$) nor correlated to their generalization performance with unfamiliar items sets in the less familiar acting-out task ($r = -.29, p = .15$). Taken together, for the current sample, a relation between children's experience with picture-book reading operationalized by age in months of first book contact and their performance in the testing procedure was not assumed.

4.2.8. Descriptive error analysis: Insights into the word learning process?

In the following descriptive error analysis, children's performance in the familiar picture-selection task with familiar item sets (retention) followed by the unfamiliar item

sets, i.e. functionally related and abstract items (generalization: item transfer) is analyzed qualitatively. Thereafter, children's performance in the less familiar acting-out task is considered. Due to their complexity, the results of this descriptive analysis are presented in tables. The main question that guided the descriptive analysis concerned whether there were differences in children's errors according to their training condition: Did children in one condition make errors of a particular category more frequently than children in the other condition?

4.2.8.1. Picture-selection task

4.2.8.1.1. *Familiar item sets*

The distribution of errors made with familiar item sets is presented in Table 16. When focussing on the familiar item sets, children in the experimental condition - with the exception of some single cases - did not make errors of the category 'no picture selected'. When children of this group did not point to the right picture, they pointed to another one depicting another relation or the other, not instructed trained target relation. This pattern could be found for both relations as well as for both posttests and indicates that children in this group did not refuse to answer when asked to depict one of the target relations. For children in the control condition, there was no such distinct pattern observable. When performing incorrectly, children in the control condition made errors of all three types: Some children refused to answer or did something else instead of pointing to the pictures, some children pointed to another relation and some children pointed to the other, not instructed trained target relation. In both conditions, nothing indicated that children might have mixed up the trained target relations and pointed to the other trained relation instead.

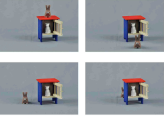
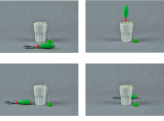
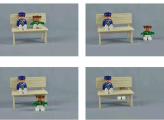
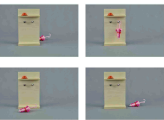
Item	Testing time	Category	Preposition <i>behind</i>		Preposition <i>next to</i>	
			EC (N = 16)	CC (N = 15)	EC (N = 16)	CC (N = 15)
rabbit / cat / barn 	Immediate posttest	no pict. selected other relation trained relation	0% (0) 56% (9) 6% (1)	20% (3) 13% (2) 33% (5)	6% (1) 31% (5) 19% (3)	20% (3) 33% (5) 27% (4)
	Delayed posttest	no pict. selected other relation trained relation	0% (0) 31% (5) 12% (2)	20% (3) 33% (5) 13% (2)	0% (0) 50% (8) 12% (2)	13% (2) 33% (5) 13% (2)
spoon / tea bag / cup 	Immediate posttest	no pict. selected other relation trained relation	6% (1) 19% (3) 25% (4)	13% (2) 20% (3) 13% (2)	6% (1) 25% (4) 38% (6)	20% (3) 20% (3) 33% (5)
	Delayed posttest	no pict. selected other relation trained relation	0% (0) 12% (2) 25% (4)	7% (1) 33% (5) 40% (6)	0% (0) 31% (5) 19% (3)	13% (2) 40% (6) 27% (4)
girl / boy / bench 	Delayed posttest	no pict. selected other relation trained relation	0% (0) 13% (2) 6% (1)	20% (3) 20% (3) 13% (2)	0% (0) 19% (3) 38% (6)	7% (1) 33% (5) 27% (4)
umbrella / hat / wardrobe 	Delayed posttest	no pict. selected other relation trained relation	0% (0) 13% (2) 6% (1)	7% (1) 20% (3) 20% (3)	0% (0) 31% (5) 31% (5)	7% (1) 54% (8) 7% (1)

Table 16: Percent (and frequency) of error types observed with familiar item sets; percent missing to 100% were due to correct answers or to experimentally caused missing values

4.2.8.1.2. Unfamiliar item sets: Functionally related items

Items of this category were randomized for use at either immediate or delayed posttest, and are accordingly considered for both posttests. For the functionally related, unfamiliar item sets, no clear distinction between both conditions could be found. The error-category ‘no picture selected’ appeared very seldom in the EC: With the exception of the item ‘horse / dog / fence’, where 3 children did not point to a picture, there were only a few single cases of this category. This category appeared at bit more often in children of the CC. Apart from that, the category ‘other relation’ was in most cases of both conditions the most frequently used error-category. Altogether, the total amount of errors was slightly higher than for the familiar items.

See Table 17 for the distribution of all error types made with functionally related unfamiliar items.



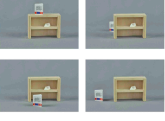
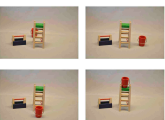
Item	Category	Preposition <i>behind</i>		Preposition <i>next to</i>	
		EC (N = 16)	CC (N = 15)	EC (N = 16)	CC (N = 15)
child / bird / boat 	no pict. selected	0% (0)	7% (1)	0% (0)	7% (1)
	other relation	25% (4)	31% (6)	32% (5)	33% (5)
	trained relation	6% (1)	13% (2)	13% (2)	13% (2)
horse / dog / fence 	no pict. selected	6% (1)	13% (2)	19% (3)	7% (1)
	other relation	50% (8)	27% (4)	25% (4)	24% (5)
	trained relation	6% (1)	27% (4)	38% (6)	13% (2)
book / iron / shelf 	no pict. selected	0% (0)	20% (3)	6% (1)	13% (2)
	other relation	31% (5)	40% (6)	13% (2)	27% (4)
	trained relation	25% (4)	20% (3)	25% (4)	27% (4)
bucket / toolbox / ladder 	no pict. selected	0% (0)	7% (1)	0% (0)	0% (0)
	other relation	51% (8)	47% (7)	56% (9)	53% (8)
	trained relation	13% (2)	27% (4)	13% (2)	7% (1)

Table 17: Percent (and frequency) of error types observed with functionally related unfamiliar item sets; percent missing to 100% were due to correct answers or to experimentally caused missing values

4.2.8.1.3. Unfamiliar item sets: Abstract items

Again, like in the descriptive error analysis of the functionally related item sets, items were considered for both posttests together. The qualitative analysis revealed no clear pattern between conditions. Altogether, in both conditions, only a few children did not select a picture. The most often observed category was ‘other relation’. Accordingly, children in both conditions pointed very often to another relation and only some children selected the other, not instructed trained target relation. Overall, for this item group again, the total amount of children who made errors was higher than for the familiar item sets. See Table 18 for the distribution of all error types made with abstract unfamiliar items.

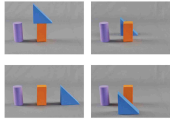
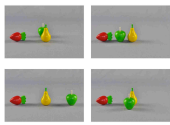
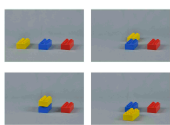

Item	Category	Preposition <i>behind</i>		Preposition <i>next to</i>	
		EC (N = 16)	CC (N = 15)	EC (N = 16)	CC (N = 15)
triangle / square / circle 	no pict. selected other relation trained relation	0% (0) 38% (6) 25% (4)	0% (0) 33% (5) 13% (2)	7% (1) 44% (7) 19% (3)	0% (0) 53% (8) 7% (1)
apple / pear / strawberry 	no pict. selected other relation trained relation	0% (0) 44% (7) 13% (2)	13% (2) 67% (10) 0% (0)	0% (0) 69% (11) 7% (1)	7% (1) 53% (8) 0% (0)
yellow / red / blue Lego bricks 	no pict. selected other relation trained relation	0% (0) 63% (10) 7% (1)	7% (1) 53% (8) 7% (1)	13% (2) 38% (6) 19% (3)	0% (0) 60% (9) 27% (4)
sun shade / fir tree / table 	no pict. selected other relation trained relation	0% (0) 44% (7) 19% (3)	7% (1) 40% (6) 27% (4)	7% (1) 38% (6) 13% (2)	13% (2) 13% (2) 47% (7)

Table 18: Percent (and frequency) of error types observed with abstract unfamiliar item sets; percent missing to 100% were due to correct answers or to experimentally caused missing values

4.2.8.2. Acting-out task with real objects

The descriptive error analysis of this task confirmed the observations of the picture-selection task with unfamiliar items and also added on them. Over both conditions, the most frequently observed category was ‘other relation with right TR + LM’. This means that when children did not perform correctly, in most cases, they created another relation with the instructed objects. But for some children the selection of the appropriate objects was not trivial, as can be seen in the second most frequently observed category ‘other relation with wrong TR + LM’ with slightly more cases in the CC, particularly when faced with the abstract items and the preposition *next to*. Overall, there were only a few children creating the other, not instructed trained target relation, with right or with wrong TR + LM. The same was true for the category ‘no relation created’: Only in some few cases, children refused to perform or did something else

with the objects than relating them in some way. See Table 19 for the distribution of all error types made in the acting-out task.

Item	Testing time	Category	Preposition <i>behind</i>		Preposition <i>next to</i>	
			EC (N=16)	CC (N=15)	EC (N=16)	CC (N=15)
rabbit / cat / barn	Imm. posttest	no rel. created	0% (0)	0% (0)	6% (1)	7% (1)
		other rel. with right TR + LM	38% (6)	60% (9)	44% (7)	54% (8)
		other rel. with wrong TR and/or LM	3% (19)	7% (1)	13% (2)	13% (2)
		trained rel. with right TR + LM	0% (0)	0% (0)	6% (1)	20% (3)
rabbit / cat / barn	Del. posttest	trained rel. with wrong TR and/or LM	0% (0)	0% (0)	0% (0)	0% (0)
		no rel. created	13% (2)	0% (0)	6% (1)	20% (3)
		other rel. with right TR + LM	31% (5)	74% (11)	51% (8)	33% (5)
		other rel. with wrong TR and/or LM	13% (2)	7% (1)	13% (2)	13% (2)
funct. rel. item	Imm. posttest	trained rel. with right TR + LM	0% (0)	0% (0)	6% (1)	7% (1)
		trained rel. with wrong TR and/or LM	0% (0)	0% (0)	0% (0)	0% (0)
		no rel. created	13% (2)	13% (2)	13% (2)	13% (2)
		other rel. with right TR + LM	38% (6)	27% (4)	25% (4)	33% (5)
funct. rel. item	Del. posttest	other rel. with wrong TR and/or LM	0% (0)	20% (3)	19% (3)	13% (2)
		trained rel. with right TR + LM	0% (0)	7% (1)	6% (1)	20% (3)
		trained rel. with wrong TR and/or LM	0% (0)	0% (0)	0% (0)	0% (0)
		no rel. created	0% (0)	27% (4)	6% (1)	13% (2)
funct. rel. item	Del. posttest	other rel. with right TR + LM	19% (3)	40% (6)	44% (7)	54% (8)
		other rel. with wrong TR and/or LM	6% (1)	0% (0)	0% (0)	13% (2)
		trained rel. with right TR + LM	0% (0)	0% (0)	19% (3)	7% (1)
		trained rel. with wrong TR and/or LM	0% (0)	0% (0)	6% (1)	0% (0)
abstr. item	Imm. posttest	no rel. created	19% (3)	27% (4)	13% (2)	13% (2)
		other rel. with right TR + LM	19% (3)	33% (5)	25% (4)	13% (2)
		other rel. with wrong TR and/or LM	25% (4)	20% (3)	25% (4)	47% (7)
		trained rel. with right TR + LM	0% (0)	7% (1)	6% (1)	0% (0)
abstr. item	Del. posttest	trained rel. with wrong TR and/or LM	6% (1)	7% (1)	0% (0)	7% (1)
		no rel. created	0% (0)	13% (2)	0% (0)	13% (2)
		other rel. with right TR + LM	19% (3)	20% (3)	31% (5)	27% (4)
		other rel. with wrong TR and/or LM	13% (2)	20% (3)	25% (4)	33% (5)
abstr. item	Del. posttest	trained rel. with right TR + LM	13% (2)	20% (3)	0% (0)	7% (1)
		trained rel. with wrong TR and/or LM	6% (1)	13% (2)	6% (1)	7% (1)

Table 19: Percent (and frequency) of error types observed with each item category in the acting-out task; percent missing to 100% were due to correct answers or to experimentally caused missing values

4.3. Discussion

The current study was conducted with the aim of examining whether a narrative input structure presented in a picture book reading context provides 27- to 29-month-old

children a useful context for embedding weakly represented words. Thereby, a narrative context was assumed to scaffold children in the development of a robust semantic representation, because the meaning of a new word should be more easily conveyed and understood by being embedded into a narrative input structure containing temporally and causally related sentences. The robust semantic representation should become apparent in children's behavior by an enhanced long-term retention as well as generalization of the newly acquired words to new contexts of those children who learned the prepositions *behind* and *next to* within a narrative input structure compared to children, who were exposed to an unrelated, semantically unsubstantial input.

Retention

With respect to the first hypothesis, assuming that children, who were exposed to weakly represented words embedded into a narrative context, demonstrate an improved retention of the trained words over time, the results confirmed the hypothesis. They revealed that children, who were exposed to the narrative input, learned and retained the target spatial prepositions *behind* and *next to* better than children in the control condition: While both groups of children started from a comparable level at pretest, children in the experimental condition improved their performance significantly to delayed posttest, whereas children in the control condition remained on the same performance level as demonstrated at pretest. The narrative training thus turned out to be beneficial for children's long-term retention. This is remarkable as Horst and Samuelson (2008) observed that retention after fast mapping does not occur naturally. But this finding is in line with other research demonstrating the existence of factors contributing to successful long-term retention: Causal descriptions of new labels (Booth, 2009) and children's individual learning history (Rohlfing, 2006; Thom & Sandhofer, 2009) were reported to effect children's word learning. Also, a beneficial effect of narration during encoding on later memory retrieval compared to empty narration (Hayne & Herbert, 2004; Nachtigäller et al., 2013) was already reported for younger children. In contrast to these previous findings with younger children, where the learning gain was best at immediate posttest and decayed over time, although still on improved level compared to pretest (Nachtigäller et al., 2013), a different word learning curve was observed: Children in the narrative training condition improved their performance from pretest to delayed posttest, but did not show improved retention at immediate posttest. This finding is in line with and replicates other research reporting

that an enhancement of newly learned words becomes prominent after days or weeks rather than immediately after training (Booth, 2009; McGregor et al., 2009). This effect is likely to be due to multiple repetitions of the narratives in three training sessions on three different days. Multiple training sessions with exposure to new words embedded into a narrative context seemed to strengthen the learning effect, as group differences became most prominent at delayed posttest in the present study. Horst (2011) demonstrated the importance of reading the same stories repeatedly on learning new words and retaining them. According to Horst (2013), repeated exposure to storybook texts and illustrations led to a robust representation of a new word, because „such contextual repetition helps lower the attentional demands of word learning“ (p. 2). But the described finding can also be attributed to consolidation processes, which pass in the absence of exposure to a training (Munro et al., 2012). In the current study, there was always a minimum of one day, in most cases several days, between the last training session and the delayed posttest. It might thus be that children’s memory for the newly learned words improved in this period of recovery from training, an effect also known from other language learning studies (Booth, 2009; Rost, 2011).

An additional look at children’s errors made in both conditions revealed particularly one interesting pattern: With only a few exceptions, children, who learned the new words embedded into the narrative context did not refuse to answer when instructed by the experimenter. In case they did not perform correctly, they depicted another relation instead. This error pattern was not found in the control condition. According to Bjorklund (1987) „slow mapping is the extended period of learning, in which – depending on the individual experience – an item in the semantic memory may get more features associated with them, have more readily activated connection with other items in semantic memory, and have lower thresholds for their activation, all relative to less elaboratively represented items.“ (p. 122). If - as assumed in the present study - children, who were taught new words in a narrative context, have a richer semantic knowledge associated with the new target prepositions, they might have more free capacity to answer the tasks as opposed to children in the control condition who might be at the limit to perform and thus refuse to do so sometimes. Thus, the error analysis supports the idea proposed by Bjorklund (1987) according to which elaborately encoded words need less mental effort to be activated. The kind of elaboration the narrative training provided thereby seemed to result in a more elaborative encoding of the words

and to be a scaffold for later retaining them from memory. It seems likely that the narrative context facilitated learning of the newly acquired prepositions by connecting them to already existing structures.

Generalization

In addition to children's retention ability, their ability to generalize the newly acquired preposition knowledge was examined with different approaches. To recall, the second hypothesis was that children who were taught new words embedded into a narrative input structure show an enhanced ability to transfer their strengthened word knowledge to unfamiliar situations compared to control children. Therefore, unfamiliar situations were designed that differed in terms of task requirements (a familiar and a sparsely familiar task) and in degree of familiarity of the applied item sets. In order to test different task requirements, two tasks common in assessing children's language comprehension were applied: a picture-selection and an acting-out task. The idea behind this operationalization was to broaden the scope of decontextualization of word knowledge. It was hypothesized that children would draw from their experience during training and that children trained with the narrative input are better able to abstract the acquired word knowledge over their learning experiences during training in order to generalize the word knowledge to new situations.

With respect to task transfer, the results did not confirm the hypothesis: When tested with familiar item sets, the narrative training did not influence children's ability to recall the newly acquired word knowledge in the acting-out task with real objects. The performance of children in both conditions did not differ significantly from pretest. When considering the strong impact of the narrative training on children's retention, this finding is surprising. But the results can be interpreted in terms of Madole and Oakes (1999), reporting that performance in one task does not necessarily reflect a stable representation. It might thus be that the semantic representation children developed during training was not stable enough to persist in the context of a new material, i.e. real objects, and of new task demands, i.e. free recall, with items that were experienced and stored in form of a still picture. However, it might also be that children experienced this task as complex, because they did not only have to abstract their acquired word knowledge over the training experiences, but also to inhibit their item based knowledge (experienced during training) in order to recall it in another form. Considering the methodological approach chosen, two important issues should be noted.

First, the order of presentation of the two task was not counterbalanced across children which might have caused order effects in favor of the firstly presented picture-selection task. Second, the picture-selection task comprised more items than the acting-out task, which might have influenced the task sensitivity again in favor of the picture-selection task. Both issues should be taken into account in further studies comparing both tasks. However, the present findings underline the need to assess children's preposition understanding in different tasks in order to get insights into the semantic representations children developed during the course of the study. For the investigation of the development of robust semantic representations, further research is needed to better understand the role of different task demands on the recall of word knowledge.

Concerning children's generalization to unfamiliar exemplars examined in the familiar picture-selection task (item transfer) as well as in the less familiar acting-out task (item + task transfer), the results did not confirm the hypothesis, but hint into the right direction. Children who learned the new prepositions embedded into the narrative input structure performed marginally better with unfamiliar items in the acting-out task than control children. The observed marginal interaction effect refers back to a marginal main effect of time in the experimental condition indicating a difference between performance at pretest and at delayed posttest. It seems likely that due to a more enriched encoding of the target words in the experimental condition, children were better able to cope with completely new situations, where the context did not provide scaffolds for recall and recognition of the stored word meanings. This finding indicates that the assessment of children's performance in different tasks is useful to get insights into different aspects of a developed semantic representation. As Madole and Oakes (1999) state, infant's performance during an experiment depends on the task demands, because the performance in one task does not necessarily reflect a stable representation, but reflects the child's ability given the task demands. According to the authors, it might be that similar fundamental cognitive processes operate in different tasks on the same topic, but that nonetheless tasks imply different cognitive demands. The fact that children in the narrative condition performed marginally better than children in the control condition when confronted with unfamiliar exemplars in a free recall acting-out task suggests that the narrative training might have facilitated the development of a stable semantic representation, which is accessible across different tasks and allows a generalization to unfamiliar exemplars. As the result is not significant, it may only be

considered as a hint into the expected direction, but further research is needed to better understand the processes at work during generalization of newly learned prepositions and to follow up on this finding. Yet, the results indicate that a narrative training does not substantially influence children's generalization abilities to unfamiliar exemplars as assessed with different tasks.

Some considerations of slow mapping in general

An intriguing question concerns slow mapping in general and the involved processes of retention and generalization: Both skills are assumed to be essential in the slow mapping of new words (Vlach & Sandhofer, 2012), but little is known about their relationship. It might be that these processes work independently or that they are interrelated. The results of the present study give first insights into this topic. They revealed that while at immediate posttest, the retention and generalization performance of all children was positively correlated, children's retention and generalization performance at delayed posttest was only positively correlated for children being exposed to the narrative training. The better children of this condition retained a new word, the better they also generalized this word to new situations. Rohlfing (2006) described a similar pattern in her training study and assumed a hierarchical structure of the processes underlying word learning. She observed that the extension of a newly learned preposition seemed to be based on the former successful mapping of the preposition. Considering these findings together, they provide preliminary indications that successful mapping, retaining and generalizing - abilities underlying the slow mapping of new words - seem to be somehow interrelated. This is an intriguing aspect of the extended word learning, which needs to be further specified and considered in detail in future research.

One notion of the slow mapping process is that, after a word is fast mapped, children need to be exposed to this word in multiple contexts over a period of time (Carey, 2010; Carey & Bartlett, 1978; McGregor, 2004). According to Capone Singletons (2012) definition of semantic enrichment, exposure to referents provides a quantitative source of semantic enrichment of an existing semantic representation, which was given in the present study by repetition of the target prepositions during training. The narrative input provided in the experimental conditional can be considered as a qualitative source of semantic enrichment according to Capone Singleton (2012). The present findings suggest that pure exposure to newly fast mapped words, and thus a quantitative source

of semantic enrichment, is not sufficient for retention and generalization. Context variables present at exposure seem to play a role for the ensuing word learning. Children in both conditions were taught each new preposition four times per training session, i.e. a total of 12 times over the course of the study. Nevertheless, children in the control condition failed to retain the new prepositions over a period of several days and performed poorer than children trained with a narrative input when asked to generalize the acquired word knowledge to new situations. These findings indicate that a qualitative source of semantic enrichment, like the narrative input encasing the target words in the present study, seems to be a more powerful source of semantic enrichment and to provide a more scaffolding learning context than a quantitative source of semantic enrichment, like pure repetition of the target words embedded in unrelated sentences in the present control condition. However, it might also be that a quantitative source of semantic enrichment is powerful, but that the amount of exposure to the target words in the control condition was simply not enough for enhancing retention and generalization of the newly learned target prepositions.

Relationship to children's language skills

According to several findings in literature (Boland et al., 2003; Nachtigäller et al., 2013; Stanovich, 1986), there is convincing evidence suggesting that children's individual language skills play an important role in word learning. The present findings add to this body of research. While at immediate posttest, the performance of children in both conditions did not relate to their language skills (with the exception of the most complex generalization task to unfamiliar exemplars in the less familiar acting-out task for children in the EC), children's language skills turned out to be particularly relevant for long-term word learning as observed at delayed posttest. With one exception again (performance of children in the CC was not related to their generalization to unfamiliar exemplars in the familiar task), the retention and generalization performance of children in both conditions was positively correlated to their language skills at delayed posttest, i.e. children with more advanced language skills learned, retained and generalized words better. This finding indicates that learning new words is highly dependent on the word knowledge that a child already has, a finding which is in line with Thom and Sandhofer (2009) postulating that a child's learning history predicts the ability to learn new words. Thus, it can be stated on the one hand that although children who were trained with the narrative based training, retained the newly acquired words better than

children trained with unrelated speech, all children in both conditions seemed to perform better at delayed posttest when they had good language skills at their disposal. On the other hand, these findings taken together with findings described above that children in the experimental condition retained the newly acquired prepositions better than children of the control condition suggest that an advanced linguistic foundation is particularly helpful to benefit from the narrative training. If elaborated narrative structures enrich new word meanings during encoding and consolidation in children with advanced language skills, children can make use of these skills for an enduring and sustainable word storage. The results can also be interpreted in terms of the Matthew effect found for reading abilities (Stanovich, 1986) emphasizing „the importance of the current knowledge base in acquiring new information“ (p. 381). Apart from children’s language skills as influencing factor on word learning, children’s shyness and their experience with picture-book reading were not related to children’s retention and generalization of the newly acquired prepositions.

Comparison to the former study of Nachtigäller et al. (2013): A story about a word

One aim of the present study was to build on former findings about the influence of narratives on preposition learning in 20- to 24-month-old children (Nachtigäller et al., 2013) and to deepen the understanding of how a robust semantic representation can be developed with support of a narrative input (see 2.3.2.1. for a detailed description of the study). As demonstrated in the present study, a narrative training accompanied by pictures showing the content of the narrative enhanced the acquisition of the spatial prepositions *behind* and *next to* in a way that children retained the newly learned words better over time and generalized them marginally better across different tasks to unfamiliar items.

The present study extends the former findings in several regards. First, as participants of the present study were on average 6 months older than those of the former study, it can be concluded that the idea of embedding unfamiliar words into a narratively structured input is supportive for long-term word learning of children at different ages. As scaffolds for learning work best, when they are tailored to the child’s zone of proximal development (Vygotsky, 1986), the methods applied for testing the 27- to 29-month-old children were adopted to children’s development. The narrative training was for example created longer in the amount of words and sentences and, thus, more complex. Also, following children’s development, two more complex target prepositions were

learned indicating that findings can be generalized to the whole group of spatial relations rather than being stick to the spatial relation trained. Second, the present study extends the former findings with respect to an important methodological difference: While the narrative input including the target spatial preposition *under* was demonstrated with real objects dynamically in the former study, the present study replicated the positive influence of narratives on word learning with narratives accompanied by static pictures showing the target spatial prepositions *behind* and *next to*. This experimental setting resembled a picture book reading situation. It can thus be preliminarily concluded that pictures as well as objects are suitable for depicting the content of a narrative and are thereby also suitable for supporting children's lexical development. However, an explicit comparison of both materials was conducted in the second study (see chapter 5 below). The present study did not replicate findings concerning generalization of the newly learned prepositions. While in the former study, only those 20- to 24-month-old children with high language competencies could benefit from the narrative training for generalizing the acquired word knowledge to unfamiliar exemplars, children at the age of 27- to 29-months did not benefit significantly from the narrative training for generalization to unfamiliar items. Nevertheless, a marginal learning effect was found for performing with unfamiliar items in a sparsely familiar task, which needs to be further investigated in future research. As correlation analyses in the present study revealed, children of both groups with high language competencies retained and generalized the newly learned prepositions better. This finding is plausible as it corresponds to the typical language milestones of normally developed children at that age (Grimm, 2003; Szagun, 2008): Sufficient language skills in terms of vocabulary size and increasing sentence understanding help children to understand the narrative input and to place new words into the relevant semantic network they already have established.

Conclusion

The present study replicated findings from Nachtigäller and colleagues (2013) by demonstrating a facilitative effect of a narrative based training on children's retention of newly learned words with older children. Thereby, a particular narrative discourse strategy including temporally and causally related sentences and elements of what typically constitutes a full narrative, like a situation introduction and an action sequence resulting in a consequence, seems to be a useful means in a picture-book reading

context to enhance 27- to 29-month-olds development of a robust semantic representation, which is retained in long-term memory.

Thus, the present findings add on the one hand on previous findings with younger children demonstrating an influence of narratives on word learning and on the other hand on research investigating factors contributing to the development of a robust semantic representation. Furthermore, the fact that children's generalization performance in the present study differed depending on the task applied illustrated the importance of assessing children's semantic representations with different tasks, implying different materials and different task demands, in order to draw inferences from concrete findings about underlying stable representations. While this study focused on child-directed input during picture book reading, other aspects of the book reading context might also be important. The following study attends to one of these aspects, namely the material accompanying a narrative input structure, and pursues the question whether different materials depicting the content of a narrative input structure have an impact on children's extended word learning.

5. Study II: The Influence of Different Materials Depicting a Narration on Extended Preposition Learning

The results of Study I revealed that weakly represented words can be better retained if they are embedded into a narrative input structure during encoding than into unrelated sentences. Pictures are a typical material supporting the content of a narrative, because narratives are mostly told in joint book reading situations. Another material, which most children are also familiar with from free play situations, are real objects. The ensuing study focused on both materials with respect to their supporting influence on children's extended word learning and compared the effects of pictures and objects coming along with a narrative input structure on retention and generalization of newly learned prepositions. In the following, the methodological approach for the experiment (5.1.) and the results obtained (5.2.) are described. At the end of this chapter, findings are discussed (5.3.) in terms of the characteristics of the applied materials and of the particular methodological approach.

5.1. Methodological approach: A training study

The study was guided by focussing on whether a narrative input is particularly suitable for the enrichment of a semantic representation in the context of a specific material. Accordingly, it was questioned whether children who are taught new spatial prepositions embedded into a narrative input accompanied either by pictures or by real objects can retain the newly acquired word knowledge over several days and generalize it to new situations. It was hypothesized that both pictures and objects are effective means for supporting the content of a narrative as children trained with either material were assumed to show long-term retention and generalization of the newly acquired prepositions to unfamiliar situations. See also chapter 3 for a description of the research questions. In the following, the methodological approach for testing the assumptions is outlined. After a description of the participating children (5.1.1.), the design and procedure of the current training study (5.1.2.) as well as the training- and testing stimuli deployed in the study (5.1.3.) are depicted. While the coding scheme (5.1.4.) equals the one applied in Study I, the statistical analyses (5.1.5.) differ due to different scales underlying the dependent variables of the conditions and are briefly considered.

5.1.1. Participants

Children between 27 and 29 months of age were recruited from Bielefeld, Germany, and its surroundings. Their recruiting as well as the inclusionary criteria for participation were the same as in study I. Parents remained uninformed about the real purpose of the study until the end of the testing procedure, but were informed at their last visit. All included children were native learners of German.

As the target words taught during training were *behind* and *next to*, the age of the participants was the same as in study I. Participants would only - if at all - have a nascent knowledge of these spatial prepositions so that they could still learn more about their meaning. In order to control children's knowledge of these prepositions upon enrollment in the study, parents were asked to report about their children's comprehension and production of *behind* and *next to*. Accordingly, children in the picture and the object condition did neither differ in their comprehension of the spatial preposition *behind* ($\chi^2(1, N = 29) = .00, p = 1.0$) nor in their production of this preposition ($\chi^2(1, N = 29) = .39, p = .54$). The same was true for comprehension of the preposition *next to* ($\chi^2(1, N = 29) = .31, p = .58$) as well as for production of *next to* ($\chi^2(1, N = 29) = .95, p = .33$).

Altogether, 41 children participated in the study, $N = 15$ in the picture condition (PC) and $N = 15$ in the object condition (OC). Children of the picture condition were the same as in the experimental condition of study I, i.e. only children of the object condition were additionally recruited for study II. Eleven children were excluded from participation due to fussiness or experimental dropout (e.g. illness, time shifting during the 14 day span). The mean age of the PC was $M = 27.93$ ($SD = .80$) and of the OC was $M = 27.93$ ($SD = .70$). Both groups did not differ with respect to age ($T(28) = .00, p = 1.0$), gender ($\chi^2(1, N = 30) = .14, p = .71$), maternal status of education ($U = 96.50, p = .51$), maternal time spent with child per day ($U = 78.50, p = .16$) and older brothers and/or sisters ($\chi^2(1, N = 30) = 1.21, p = .27$).

5.1.2. Design and procedure

5.1.2.1. Design

The present training study was conducted in a pretest-posttest-design with 2 posttests to investigate the research questions. In total, the training phase comprised 3 sessions on 3

different days. Children's comprehension of the target prepositions was operationalized by two dependent variables: children's performance of spatial relations in an acting-out task with real objects and children's performance in a forced-choice picture-selection task. Like in study I, the study design comprised 2 independent variables: time (a 3-level repeated measure: pretest, immediate posttest, delayed posttest) was a within-subject variable repeatedly measured; the experimental condition was a between-subject variable and had 2 levels: training based on pictures and training based on objects. Altogether, a 3 (time) x 2 (condition) design was tested and all possible factor combinations were assessed by the items. Children's sentence understanding played a crucial role for the testing as well as the training procedures and children's sentence reception (assessed with the SETK-2, Grimm, 2000) was additionally analyzed as an indicator of children's language competencies. All participants were matched according to their age and gender before the beginning of the first visit to participate in either the picture or the object condition.

5.1.2.2. Procedure

The applied procedure equals study I (see chapter 4). Main deviations are described in the following.

5.1.2.2.1. *Testing procedure for pretest, immediate and delayed posttests*

After a short warm-up phase, the testing procedure started according to the condition children were randomly assigned to. The picture-selection task as well as the acting-out task were used for testing children's comprehension of the target spatial prepositions. While both conditions did not differ in pretest, they differed in posttests and in training with respect to the key aspect of material (picture vs. object). Both conditions performed in both tasks and at both testing times with the same amount and kind of items, but according to the condition-specific material under investigation.

Pretest: The pretest paralleled exactly study I.

Immediate posttest: As conditions differed according to the material they were trained and tested with, one task at posttest was deemed to be familiar (the picture-selection task in the picture condition and the acting-out task with real objects in the object condition) and the other task was deemed to be a less familiar transfer task only known from pretest (the acting-out task with real objects in the picture condition and the

picture-selection task in the object condition). The idea behind was that testing children with the material familiar from training should aid them in recognizing and recalling the word knowledge, while the less familiar task was thought to put different demands on children's comprehension of the spatial prepositions.

In the picture condition, the immediate posttest followed the first training session and started with the picture-selection task. It included six items, two of these items were familiar, i.e. they were already known from pretest and training. Four items were unfamiliar and served as transfer items that were completely new for children. Two of these transfer items were functionally related whereas the other two were abstract item sets. The order of presentation was randomized and within one item, the order of instructing the spatial prepositions *on*, *behind* and *next to* was also randomized. The ensuing acting-out task captured a smaller amount of items: There was one familiar and two transfer items (one of which was functionally related and one abstract). The familiar item was chosen to be the an animate one, whereas the functionally related transfer item was an inanimate one. For one familiar and one transfer item in each task the preposition *on* and for all items the prepositions *behind* and *next to* were instructed, leading to a total of 14 instructions in the picture-selection and 8 in the acting-out task.

The object condition was similar to the picture condition in the amount and kind of items as well as in the preposition instructions of *on*, *behind* and *next to* for the purpose of comparability between conditions. However, in this condition, the testing procedure focused on the acting-out task as being the familiar task, followed by the less familiar picture-selection task.

Delayed posttest: Testing children's word learning trajectory over the course of several days enabled to get insights into their slow mapping processes (i.e. retention and generalization performances of the target prepositions). This delayed posttest paralleled the immediate posttest in both conditions. In the PC, the picture-selection task was tested first and in the OC, the acting-out task with real objects was tested first. Nonetheless, in order to optimally differentiate children's learning gain and their task performance at the end of the study, two more items were applied. The first task in each condition (PC: picture-selection and OC: acting-out) included eight items, four of them were familiar and four were unfamiliar transfer items. Again, half of the unfamiliar items were functionally related and the other half were abstract items. There were again

3 items comprising the second task in each condition (PC: acting-out and PC: picture-selection): one animate familiar item, one inanimate functionally related transfer item and one abstract transfer item. This time, one item of each category (familiar, functionally related and abstract) in both tasks was instructed to create the relation *on*, for all other items *behind* and *next to* were instructed, leading to a total of 19 instructions in the first task and 9 instructions in the second task. As in the immediate posttest, the presentation order for items as well as for relations was randomized.

5.1.2.2.2. *Training procedure for each training phase*

As the guiding question of this study was whether a narrative input is particularly suitable for specific materials (pictures or objects) and thus differentially influences children's extended word mapping, the training conditions in this study were designed to differ in the material children were exposed to while listening to a lexically scaffolding narrative input. While children in both conditions listened to the same narratives (see Tables 5 and 6: narrative input for the experimental condition in study I), children in one condition saw pictures describing the content of the input (picture condition, PC) and children in the other condition were exposed to real objects in a static arrangement supporting the input (object condition, OC). It is important to state that, contrary to the typical dynamical use of objects, objects were not moved while the narratives were told in order to realize best comparability to the picture condition. This way, the risk of a possible confounding variable of static versus dynamic demonstration of the spatial relations was reduced. See Figure 7 for a picture of each condition.

In both conditions, the experimenter opened the training by instructing the child:

„So, und jetzt machen wir etwas anderes: Ich zeige dir viele interessante Bilder / Spielsachen und erzähle dir kurze Geschichten dazu. Und du hörst mir ganz genau zu, okay?“

[„Now, we are going to do something else: I'll show you lots of interesting pictures / objects and I'll tell you stories about them. And you, you listen very carefully, okay?“]

Picture condition: The way the training was designed equalled the experimental condition in study I: The experimenter placed a book containing pictures of all training items in randomized order on the table and started the training at once. The child was involved if he/she wanted to for turning pages in order to enhance engagement. Apart

from that, the child just listened to the input and watched the depicted scenes. After finishing one story, the child was free to comment on the items shortly, but was not asked to do so. Also, the experimenter tried to reduce talking about the items apart from the training input during this phase to a minimum. While the narrative input was directed to the child, the experimenter pointed to the objects on the pictures and named them. The training procedure was the same at each of the three training sessions with the items being in randomized order.

Object condition: For this training procedure, the experimenter placed the objects corresponding to each item set on the table in a static arrangement which paralleled the arrangement of the pictures in the picture condition. Thereby, the objects were not handled or moved while the input was spoken and the trained spatial relations were not acted-out during training, which would have probably been the more common and canonical use of objects. But it was aimed at distinguishing between a 2D and 3D context without confounding a static versus dynamic realization of the narrative content. Possible differences between conditions were thus reduced to a minimum due to properties of the deployed materials. Items were finally placed at center of the table, where the child could see everything clearly, but could not reach the objects. While the experimenter told the narrative input, she depicted each object while naming it. Like in the picture condition, other input apart from the training was reduced to a minimum, but after each narrative, the child was allowed to touch the items or play with them shortly. Item sets were presented in randomized order at each training session.



Figure 7: Pictures of children participating in the object condition (left picture) and in the picture condition (right picture). Both children learned the preposition *next to* with the item set girl / boy / bench.



5.1.3. Stimuli: Testing- and training material

The testing- and training material as well as the additionally collected data from parent ratings and questionnaires used for this study were the same as in study I (see chapter 4.1.3.). The *SETK-2* was conducted for an assessment of children's language

competencies (Grimm, 2000). Both conditions were tested with the same testing material, being composed of either pictures (picture condition) or real objects (object condition). The pictures and the object arrangements depicted the target spatial relations, introduced at the end of each story. The photographs used in the picture condition were self-made and were based on the objects used in the object condition, e.g. the horse on the picture had the same appearance as the object horse. This was important, because the items should have been as similar as possible in order to reduce the risk of confounding variables. Accordingly, the same tablecloth for covering the table in the object condition also served as the photograph background.

5.1.4. Coding scheme

Like in study I, the coding of children's performance with the target relations *behind* and *next to* in both tasks as well as the statistical analysis of this performance coding were of primary interest for the word learning process. The coding scheme of study I was applied for the data coding (see chapter 4.1.5.).

5.1.4.1. Inter-rater reliability

A second rater coded 4 randomly selected participants of each condition (corresponding approx. 25 % of the data). Cohen's Kappa for inter-rater reliability was .89 indicating a high inter-rater agreement for the whole testing. In detail Cohen's Kappa was .84 for pretest, .89 for immediate and .91 for delayed posttest.

5.1.5. Statistical analysis

All statistical analyses were conducted with IBM® SPSS® Statistics Version 21. Given normality ($\alpha = 0.05$) in the sample for pretest (Kolmogorov-Smirnov- $Z = 1.13, p = .15$), immediate posttest (Kolmogorov-Smirnov- $Z = .74, p = .64$) and delayed posttest (Kolmogorov-Smirnov- $Z = .61, p = .85$), the following statistical analyses were conducted with one-way ANOVAs with repeated measures on the variable time for each condition due to different scales underlying the dependent variables of the conditions. In case of significant results, ensuing post-hoc analyses were conducted (LSD). Correlations were calculated with Pearson's coefficient of correlations r . According to convention, results were interpreted as being significant on an α -level of .05. According to Cohen (1988), the effect sizes were assumed to be small (.01), moderate (.06) and

large (.14). For the statistical analysis of the data, means of the raw data taken together for the trained target prepositions *behind* and *next to* were calculated. For the items in the picture-selection task, the score ranged from 0 points (wrong picture) to 1 point (right picture). For the items in the acting-out task, the score ranged from 0 to 2 points. The preposition *on* served as a control relation and was not considered in the analyses.

5.2. Results

As described above, both conditions under investigation did not only differ with respect to the material they were trained with (i.e. pictures or objects), but also with respect to the testing procedure which was designed in accordance to the material of the training procedure. Accordingly, children trained with pictures were tested for retention with a task based on pictures (picture-selection) and for generalization with a task based on an unfamiliar material (acting-out with real objects). For children trained with objects, testing for retention was based on objects (acting-out with real objects) and testing for generalization was based on pictures this time (picture-selection). The following statistical analyses were conducted separately for both conditions, because a direct comparison of children's performance in both conditions was not possible due to different scales underlying the dependent variables. In the following, after a description of children's pretest performance (5.2.1.), children's retention performance (5.2.2.) is considered. Afterwards, children's generalization across tasks (5.2.3.) as well as their generalization to unfamiliar item sets (5.2.4.) and their generalization to unfamiliar item sets and across tasks (5.2.5.) are described. Towards the end of this chapter, the relationship between children's word learning and other variables is considered (5.2.6.).

5.2.1. Pretest

Children in both conditions did not differ upon enrollment in the study concerning comprehension and production of the target prepositions examined via parent report (see 5.1.1.). Performance at pretest was considered as a baseline measure of children's performance before the beginning of the training. Children in both groups did not differ with respect to their performance in the picture-selection task ($t(28) = .75, p = .46$). Thereby, performance of children in the PC ($M = 33.33, SD = 20.41$) was on a comparable level as performance of children in the OC ($M = 26.67, SD = 27.49$). The same was true for the acting-out task: The PC performed on average $M = 23.21$ ($SD =$

34.62) and the OC $M = 10.83$ ($SD = 15.57$). They did not differ significantly ($t(27) = 1.23, p = .24$). See also Figure 8. This is important, because it indicates on the one hand that all children came into the study with a comparable level of comprehension of the target prepositions and on the other hand that all children performed similarly in both tasks.

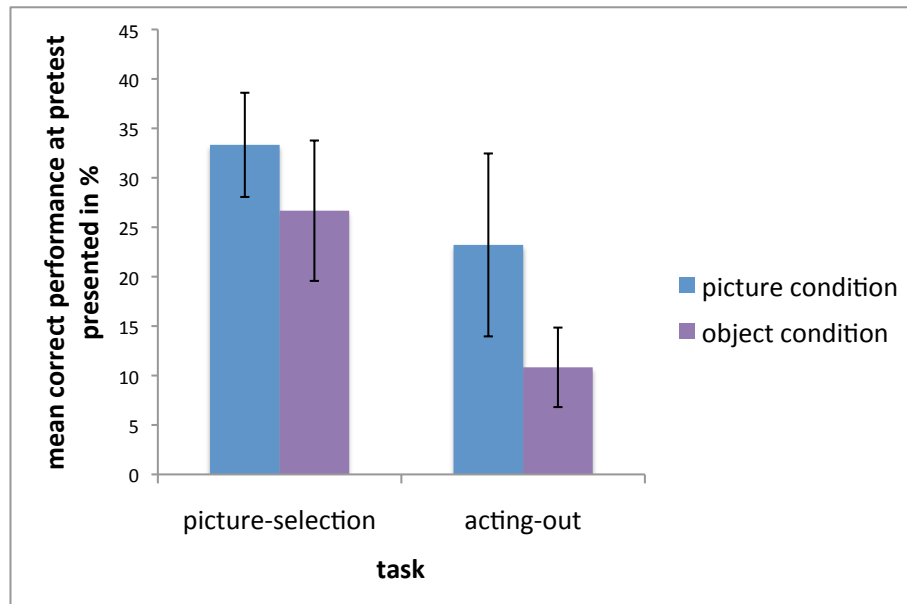


Figure 8: Performance presented in percentage of children in both conditions at pretest in both tasks (baseline measure)

5.2.2. Retention: Learning effect at posttests with familiar item sets

As demonstrated in study I, the narrative training with pictures was significantly more effective than a control input accompanied by pictures. The present study pursued the question whether children's retention was differentially influenced by a narrative training accompanied by pictures or objects. The first hypothesis concerned children's retention of the newly learned prepositions: It was assumed that children being trained with either pictures or real objects coming along with the content of a narrative input can retain their newly strengthened preposition knowledge at posttests. To investigate the learning effect of each training condition, two one-way ANOVAs with repeated measures on time (pretest, immediate and delayed posttest) were conducted: one for the picture condition and one for the object condition. As dependent variable, children's performance with familiar item sets at all three testing times (pretest, immediate and delayed posttest) in the familiar condition-specific task was analyzed. In the picture condition, the picture-selection task required a child to select one picture out of four

choices, on which the target relation was presented, while in the object condition, the acting-out task implied to act the relations out with real objects.

Picture condition (familiar items in the picture-selection task): Results revealed a marginal main effect of time, $F(2,13) = 3.37, p = .07, \eta^2 = .34$ with a large effect size indicating a remarkable effect. Ensuing post-hoc analyses (LSD) revealed a significant difference between pretest and delayed posttest ($p = .02$), but neither between pretest and immediate posttest ($p = .39$) nor between immediate and delayed posttest ($p = .19$). This finding indicates that pictures are an effective means for supporting the content of a narrative as children trained with the narrative picture training and tested with the picture-selection task learned the target prepositions at delayed posttest and retained them over a delay of several days. See Figure 9 and Table 20 for means and standard deviations of both conditions.

Object condition (familiar items in the acting-out task): Results revealed no significant main effect of time, $F(2,13) = 1.51, p = .26$. This finding indicates that children trained with objects and tested with the acting-out task did not show improved knowledge of the trained prepositions as children did not retain their knowledge over several days.

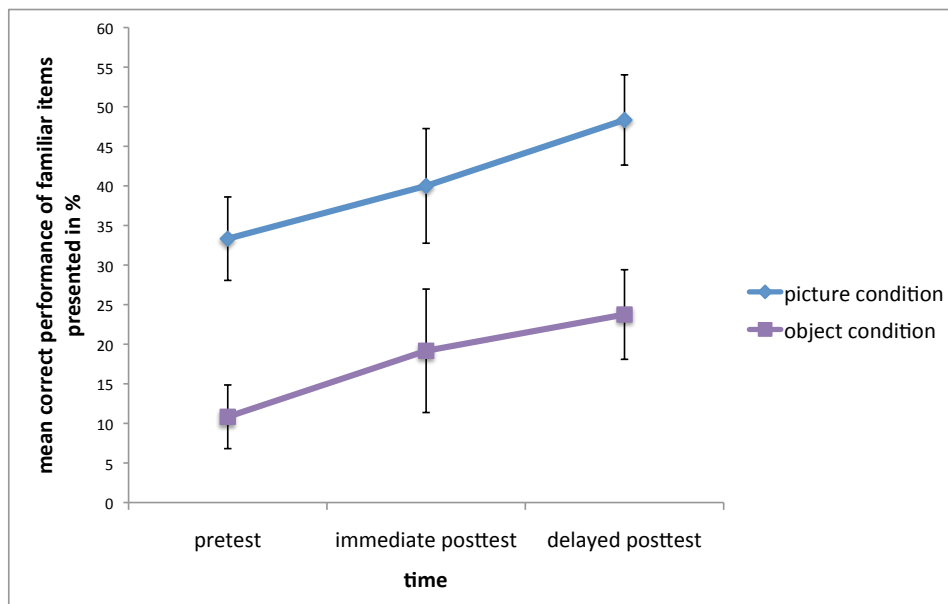


Figure 9: Mean correct performance presented in percentage of children in both conditions when tested with familiar item sets in the condition-specific familiar task at all testing times (picture condition: picture-selection and object condition: acting-out)

condition	testing time		
	pretest <i>M (SD)</i>	immediate posttest <i>M (SD)</i>	delayed posttest <i>M (SD)</i>
picture condition	33.33 (20.41)	40.00 (28.03)	48.33 (22.09)
object condition	10.83 (15.57)	19.17 (30.20)	23.75 (21.93)

Table 20: Mean percentage (*M*) and standard deviations (*SD*) of correct performance when tested with familiar item sets in the familiar task at all testing times

Thus, the results confirmed the first hypothesis for the picture condition as a narrative input structure turned out to be particularly suitable in the context of pictures, when focusing on children's long-term retention of the newly acquired spatial prepositions. The hypothesis was not confirmed for the object condition.

5.2.3. Generalization across tasks

An intriguing question for the study was whether there is an advantage in one of the two conditions to generalize the acquired word knowledge to another task. It was assumed that children trained with pictures as well as children trained with objects showing the content of a narrative generalize their newly acquired preposition knowledge to an unfamiliar task. The first operationalization of decontextualized word knowledge was based on the idea of testing children's ability to generalize the acquired new meanings to a task implying another material than the trained one (task transfer). Accordingly, children, who learned the new spatial prepositions in the picture condition were asked to act the relations out with real objects, while children who were trained with objects were asked to select a picture. Although all children experienced both types of tasks at pretest (baseline measure), the transfer task implied a new pragmatic situation for children in both conditions as they had to deal with a material they were not trained with. Even if the objects deployed were familiar to children (since they saw the objects on pictures already or they saw the depicted objects already as real), the task required to demonstrate preposition comprehension in another context.

The dependent measure of this statistical analysis was children's performance in the less familiar task (PC: acting-out and OC: picture-selection) at pretest, immediate and delayed posttest with familiar item sets known from pretest or training. Again, a one-way ANOVA with repeated measures on time (pretest, immediate and delayed posttest) was conducted for each of the two conditions.

Picture condition: Results revealed no significant main effect of time, $F(2,11) = .34$, $p = .72$, indicating that, compared to children's baseline performance at pretest, the narrative picture training did not influence children's performance in the less familiar acting-out task with familiar items, i.e. children's task transfer.

Object condition: As in the picture condition, results revealed no significant main effect of time, $F(2,13) = .51$, $p = .61$. The narrative object training did not influence children's performance in the less familiar picture-selection task with familiar items, i.e. children's task transfer, when compared to their baseline performance at pretest.

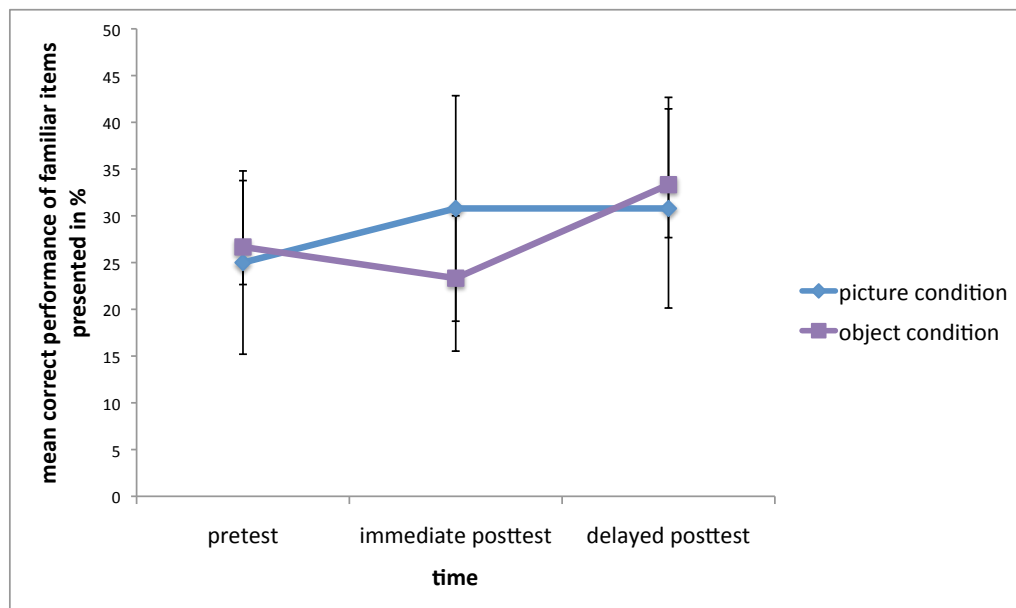


Figure 10: Mean correct performance presented in percentage of children in both conditions when tested with familiar item sets in the condition-specific less familiar task (picture condition: acting-out and object condition: picture-selection) at all testing times (task transfer)

condition	testing time		
	pretest $M (SD)$	immediate posttest $M (SD)$	delayed posttest $M (SD)$
picture condition	25.00 (35.36)	30.77 (43.49)	30.77 (38.40)
object condition	26.67 (27.49)	23.33 (25.82)	33.33 (36.19)

Table 21: Mean percentage (M) and standard deviations (SD) of correct performance when tested with familiar item sets in the less familiar task at all testing times (task transfer)

See Figure 10 and Table 21 for means and standard deviations of both conditions. To conclude, the hypothesis was not confirmed concerning a generalization across tasks at

posttests: Children in both conditions showed a comparable performance to pretest and did not improve their performance in generalizing their word knowledge to another task.

5.2.4. Generalization to unfamiliar item sets

Another interesting question for the study was whether children in both conditions were able to generalize their newly acquired preposition knowledge to unfamiliar item sets in the condition-specific familiar task. It was hypothesized that both children being trained with pictures and children being trained with objects depicting the content of a narrative are able to generalize their newly acquired word knowledge to unfamiliar exemplars. The unfamiliar item sets comprised functionally related as well as abstract item sets, which were considered together for the analysis. Children in the picture condition were tested with unfamiliar items in the picture-selection task and children in the object condition were tested in the acting-out task. Children's performance in the familiar task served as dependent variable for this analysis. Again, a one-way ANOVA with repeated measures on time (pretest, immediate and delayed posttest) was conducted for each condition. The pretest was included in these analyses, too, because when children came into the study, pretest items were still unfamiliar to them. This approach allowed for a comparison between children's generalization at posttests and their performance at pretest and, thus, for a conclusion if generalization can be traced back to the training.

Picture condition: Results revealed no significant main effect of time, $F(2,12) = .15$, $p = .86$, indicating that children in the picture condition showed no generalization of the newly acquired preposition knowledge to unfamiliar item sets, as their performance at posttests did not differ from their performance at pretest.

Object condition: The same pattern of results appeared in this condition: Results revealed no significant main effect of time, $F(2,13) = 1.85$, $p = .20$, indicating that children trained with the narrative object training did not generalize their acquired word knowledge to unfamiliar items, because their performance remained on baseline level.

To conclude, the present hypothesis was not confirmed as neither the narrative picture training nor the narrative object training enhanced children's ability to generalize their newly acquired preposition knowledge to unfamiliar items when tested in the context of a familiar task. See Figure 11 and Table 22 below for means and standard deviations.

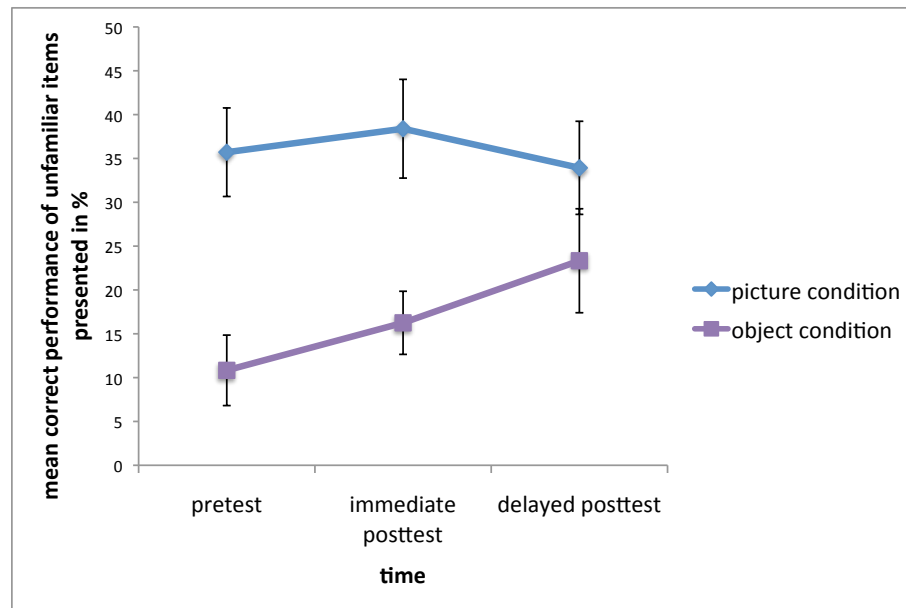


Figure 11: Mean correct performance presented in percentage of children in both conditions when tested with unfamiliar item sets in the condition-specific familiar task (picture condition: picture-selection and object condition: acting-out) at all testing times (item transfer)

condition	testing time		
	pretest <i>M (SD)</i>	immediate posttest <i>M (SD)</i>	delayed posttest <i>M (SD)</i>
picture condition	35.71 (18.90)	38.39 (21.07)	33.93 (19.87)
object condition	10.83 (15.57)	16.25 (13.94)	23.33 (22.96)

Table 22: Mean percentage (*M*) and standard deviations (*SD*) of correct performance when tested with unfamiliar item sets in the familiar task at all testing times (item transfer)

5.2.5. Generalization to unfamiliar item sets and across tasks

The most complex generalization situation was assumed when children were confronted with unfamiliar item sets in the less familiar task, because neither the task nor the stimuli provided contextual scaffolds helping children to recall the preposition knowledge. It was hypothesized that children trained with pictures as well as children trained with objects supporting the content of a narrative show the ability to generalize their newly acquired word knowledge to unfamiliar exemplars in a sparsely familiar task. This time again, the analysis took children's performance at pretest into account in order to find a difference in performance due to training. The following analyses focused on children's generalization performance with unfamiliar item sets at pretest, immediate and delayed posttest. Thereby, the unfamiliar but functionally related as well

as the abstract items (designed not to afford a particular relation) were considered together. Children's performance in the condition-specific less familiar task (PC: acting-out and OC: picture-selection) with unfamiliar item sets served as dependent variables.

Picture condition: Results revealed a significant main effect of time, $F(2,12) = 3.86$, $p = .05$, $Eta^2 = .39$ with a large effect size indicating a remarkable effect. Ensuing post-hoc analyses (LSD) revealed a significant difference between pretest and delayed posttest ($p = .02$), but neither between pretest and immediate posttest ($p = .11$) nor between immediate and delayed posttest ($p = .60$). This finding indicates that children trained with the narrative picture training generalized their newly acquired preposition knowledge to a complex context of unfamiliar items and a new task at delayed posttest.

Object condition: The results found in the object condition were different. Results did not reveal a significant main effect of time, $F(2,13) = .81$, $p = .47$ indicating that children trained with the narrative object training performed on the same level as they did at pretest. These children were not able to generalize their acquired preposition knowledge to unfamiliar item sets in the picture-selection task at posttests.

See Figure 12 and Table 23 for means and standard deviations of both conditions.

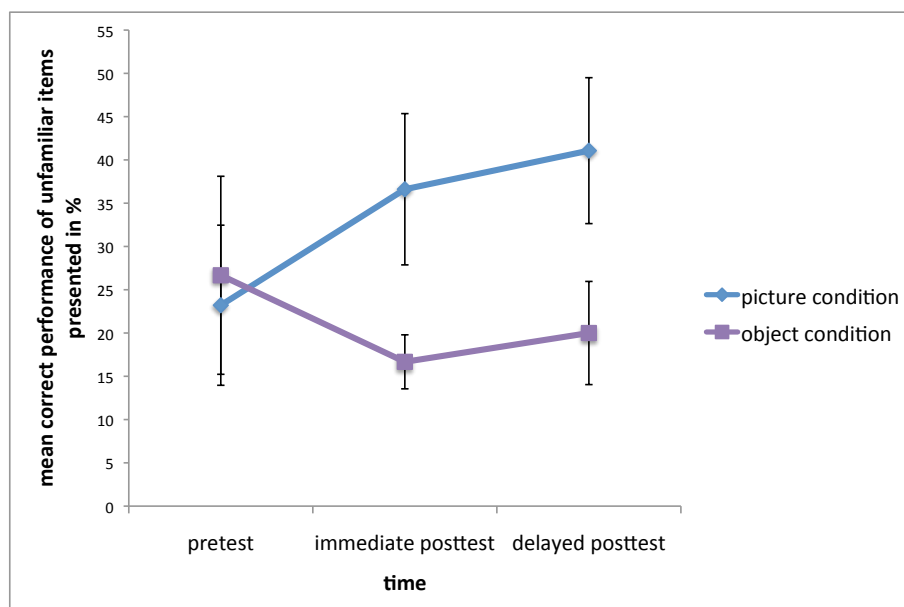


Figure 12: Mean correct performance presented in percentage of children in both conditions when tested with unfamiliar item sets in the condition-specific less familiar task (PC: acting-out and OC: picture-selection) at all testing times (item and task transfer)

condition	testing time		
	pretest <i>M (SD)</i>	immediate posttest <i>M (SD)</i>	delayed posttest <i>M (SD)</i>
picture condition	23.21 (34.62)	36.61 (32.70)	41.07 (31.56)
object condition	26.67 (27.49)	16.67 (24.40)	20.00 (25.35)

Table 23: Mean percentage (*M*) and standard deviations (*SD*) of correct performance when tested with unfamiliar item sets in the less familiar task at all testing times (item and task transfer)

To sum up the analyses of children's generalization skills when tested in a complex situation including unfamiliar exemplars as well as a condition-specific sparsely familiar task (item + task transfer), the hypothesis could be confirmed for those children who learned the target prepositions from pictures accompanied by a narrative input (picture condition). The children demonstrated a significant ability to generalize their newly acquired word knowledge to unfamiliar items in the acting-out task. However, the hypothesis was not confirmed for children in the object condition: The performance in the picture-selection task remained on baseline level and could not be influenced by the training.

5.2.6. Relationship of word learning and further relevant variables: Language skills, shyness and experience with picture-book reading

Like in study I, further potentially relevant variables for children's performance were assessed: children's language skills, their level of shyness and their individual experience with reading picture books. These variables are considered in the following.

5.2.6.1. Children's language skills

One can argue that in order to understand and execute the testing instructions, children needed sufficient language competencies. For the present study, children's language skills were assessed with the *SETK-2* (Grimm, 2000), with a particular focus on the subtest 'reception of sentences' in our analyses. Correlations between children's sentence reception and their retention performance with familiar item sets were calculated separately for each posttest. Furthermore, correlations between children's sentence reception and their generalization performance with unfamiliar items in the familiar task (generalization: item transfer) and in the less familiar task (generalization:

item and task transfer) were calculated for each posttest. See Table 24 for immediate and Table 25 for delayed posttest.

	Retention with familiar items	Generalization to unfamiliar items	Generalization to unfamiliar items and across tasks
PC: sentence reception	$r = .46, p = .10$	$r = .47, p = .09$	$r = .61, p = .02$
OC: sentence reception	$r = .13, p = .65$	$r = .23, p = .41$	$r = -.15, p = .61$

Table 24: Correlations (Pearson's coefficient of correlations r) and the corresponding level of significance (p) between children's sentence reception and their performance at immediate posttest

	Retention with familiar items	Generalization to unfamiliar items	Generalization to unfamiliar items and across tasks
PC: sentence reception	$r = .85, p = .00$	$r = .67, p = .01$	$r = .72, p = .00$
OC: sentence reception	$r = .38, p = .17$	$r = .72, p = .00$	$r = .28, p = .31$

Table 25: Correlations (Pearson's coefficient of correlations r) and the corresponding level of significance (p) between children's sentence reception and their performance at delayed posttest

For children in the picture condition at immediate posttest, results revealed that their sentence reception was marginally correlated to their retention performance as well as to their generalization performance with unfamiliar items. In addition, their sentence reception correlated significantly to their generalization performance with unfamiliar items in the less familiar task, indicating that the better children's sentence reception was, the better they performed. At delayed posttest, children's sentence reception correlated significantly with their retention performance and their generalization performance with unfamiliar items and across tasks. These correlations suggest that the higher children's level of sentence comprehension was, the better they performed at delayed posttest.

For children in the object condition, results revealed a different pattern: While at immediate posttest, children's sentence reception was not correlated to their retention and generalization performance, children's sentence reception at delayed posttest was significantly correlated with their generalization performance with unfamiliar items indicating that the better children's sentence reception was, the better they generalized their word knowledge to unfamiliar items in the familiar task. Children's sentence

reception did neither correlate to their retention performance nor to their generalization performance with unfamiliar items in the less familiar task at delayed posttest.

5.2.6.2. Children's temperament: Shyness

Children's performance during the testing procedure was controlled for shyness to ensure that there is no bias in children's behavior due to a shy temperament. The raw scores of the ECBQ shyness scale in the present sample ranged from one to six. Children in the picture condition scored on average $M = 3.07$ ($SD = 1.22$) and children in the object condition scored on average $M = 2.73$ ($SD = .96$). This difference was statistically not significant ($t(28) = .83, p = .41$). In order to test for a relationship between children's performance and their level of shyness, children of both conditions were considered together. Results revealed that children's performance during testing was not affected by their temperament taken both posttests together: There was neither a significant correlation between shyness and retention performance ($r = .04, p = .82$), nor between shyness and generalization performance with unfamiliar items in the familiar task ($r = .12, p = .54$), nor between shyness and generalization performance with unfamiliar items in the less familiar task ($r = .05, p = .79$). Thus, for the present sample, an influence of shyness on the testing procedure was not assumed.

5.2.6.3. Children's experience with picture-book reading

In everyday life, narratives are usually told while reading a picture book. For the current study, it was thus particularly important to control for children's individual experience with picture-book reading to ensure that participants were not biased towards this variable. That is why children's experience with picture-book reading operationalized by a parent report about the age of children's first book contact in months was controlled. The first book contact of children in the picture condition was on average at $M = 7.77$ ($SD = .262$) and of children in the object condition at $M = 10.43$ ($SD = 6.15$). Both conditions did not differ significantly ($t(25) = -1.44, p = .16$) in their experience with picture-book reading. Furthermore, a correlation analysis revealed that, when considering both conditions together, children's experience with picture-book reading was not related to children's performance in the testing procedure at posttests. Children's first book contact according to parent report was neither correlated to their retention performance ($r = -.26, p = .19$) nor correlated to their generalization performance with unfamiliar item sets in the familiar task ($r = -.10, p = .64$) nor

correlated to their generalization performance with unfamiliar item sets in the less familiar task ($r = -.05$, $p = .81$). Taken findings together, a relation between children's experience with picture-book reading operationalized by age in months of first book contact and their performance in the testing procedure could not be found.

5.3. Discussion

This study was conducted with the aim of investigating closely whether a narrative input is particularly suitable for word learning in the context of a specific material. In our Western culture, narratives are typically told in joint picture-book reading situations. As we have seen in study I (see chapter 4), a narratively structured input accompanied by a picture book can enhance retention of newly learned spatial prepositions, it was questioned whether children who learn new words embedded into a narrative input accompanied by pictures and by real objects differentially retain the newly acquired word knowledge over several days and generalize it to new situations.

The present study approached this aim with a training study with 27- to 29-month-old children, which systematically compared the influence of pictures and objects depicting the content of a narrative on children's enrichment of a nascent semantic representation. Children's comprehension of the spatial prepositions *behind* and *next to* was examined under material-specific conditions at pretest, immediate and delayed posttest. While children's ability to retain the newly acquired word knowledge was assessed by familiar item sets in a familiar task at posttests, children's ability to generalize this new word knowledge was operationalized by unfamiliar item sets, which children did not know from training or pretest. Additionally, the generalization performance was assessed in a familiar task and in a sparsely familiar task implying another material than the trained one, which constituted a new pragmatic situation for children. This way, the robustness of children's semantic representations of the newly learned prepositions was considered in different contexts which provided - if at all - only a few scaffolds for children.

Retention

With respect to the retention performance of children in the picture condition, the results did not confirm the hypothesis, but clearly hint into the assumed direction: Children being trained with pictures depicting the content of a narrative improve their performance from pretest to posttests marginally, and significantly from pretest to

delayed posttest. They benefitted from the training for retaining the acquired spatial prepositions over a delay of several days, whereas children trained with objects depicting the content of a narrative did not retain the acquired prepositions over time. The retention hypothesis is not confirmed with respect to children in the object condition. Thus, concerning long-term word learning, pictures seem to be an effective means for supporting the content of a narrative. This finding is in line with other research demonstrating the positive effects of reading stories from picture books to children on retention of newly learned words (Horst et al., 2011). When considering the learning curve from pretest to delayed posttest, the finding can be interpreted in terms of research reporting about consolidation effects on long-term learning compared to immediate learning gains (Booth, 2009). Children trained with pictures showed a significant learning of the newly acquired spatial prepositions at delayed posttest only, which might indicate that word knowledge was consolidated in the time between training and testing, an effect also reported in (Booth, 2009).

One explanation for the different results obtained for both conditions might come from the testing procedure. Children's condition-specific performances in the familiar task might have differed due to varying task demands apart from differences in material: In the picture condition, the picture-selection task required children to recognize one right picture out of four similar pictures (a recognition task), whereas in the object condition, the acting-out task required children to act-out the right prepositions from memory (a free recall task). According to Capone and McGregor (2005), richer semantic representations need less scaffolding for retrieval. For the tasks implemented in the present study, this might imply that in order to retrieve the semantic representation of the target prepositions in the forced-choice picture-selection task, a weaker semantic representation might have been sufficient, because more scaffolding cues (e.g. pictures of the trained relations, arranged by objects known from training) were present in this task (ibid). The acting-out task in turn might have been more complex, because the task provided the child with fewer cues for retrieval of the word meaning as children had to act-out the meaning by recalling it from memory instead of recognizing it. Furthermore, the match between the training situation and the test is greater in the picture condition than in the object condition, because the experimenter pointed to the pictures during training and this is what children had to do with the picture-selection task at test. The

experimenter did not manipulate the objects during training, which differs from what children had to do at test.

Generalization

An intriguing question of the present study was whether children who were either exposed to a picture showing the content of a narrative input or to an arrangement of real objects depicting the content of a narrative input were aided in generalizing the newly learned words to unfamiliar contexts. According to Carey and Bartlett (1978), one important component of extended mapping is the ability to generalize a word to a novel referent. In the present study, generalization was operationalized by testing children's performance with unfamiliar exemplars and across different tasks implying different pragmatic contexts. This way, detailed insights into what generalization might imply were approached.

As predicted, when trained with pictures showing the content of a narrative input structure, children generalized their newly acquired word knowledge to unfamiliar exemplars in the context of a sparsely familiar task. However, against the prediction, children trained with objects showing the content of a narrative input structure did not show generalization effects. Accordingly, pictures accompanied by a narrative input turned out to enrich children's existing semantic representation in a way that this strengthened word knowledge could be generalized to unfamiliar exemplars in a new pragmatic situation comprising a different material, namely real objects, as well as a more demanding task, i.e. an acting-out task. This finding is remarkable as this generalization context was assumed to be the most complex one, because the context did not provide scaffolds and because the new task constituted a new pragmatic situation for children to apply their knowledge. As according to Capone and McGregor (2005) „the graded nature of word learning can be tapped by tasks that vary in difficulty“ (p.1476), these findings indicate that children who were taught the new prepositions embedded in a narrative structure accompanied by pictures have developed a more robust semantic representation of the new words than children who were exposed to narratives based on objects. Furthermore, against prediction, children in both conditions neither showed generalization to unfamiliar exemplars in the context of the familiar task nor generalization to a sparsely known task applied with familiar referents. The narrative based training conducted in the context of pictures or objects thus did not seem to enhance children's generalization to either unfamiliar item sets or across tasks,

which is surprising compared to the above described finding, because these generalization settings were assumed to be less complex due to scaffolding cues coming from either items or task. Thus, a picture based narrative training turned out to enhance the development of a robust semantic representation in terms of generalization to unfamiliar exemplars consisting of real objects in an acting-out task.

Pictures as a scaffold for preposition learning

Considering the retention and the generalization performance together, the present findings indicate that learning new words embedded into a narrative input structure and demonstrated pictorially is a facilitative strategy for 27- to 29-month-old children: In addition to enhanced retention performance, children accomplish the generalization to unfamiliar exemplars in an acting-out task with real objects. Pictures supporting the content of a narrative thus seem to provide a child with a more appropriate learning context for the enrichment of existing semantic representations than observed by objects supporting a narrative content. This resulted in a more robust semantic representation, as demonstrated by successful long-term retention and generalization to unfamiliar exemplars in an acting-out task with real objects.

Pictures might be interpreted as easier for children, because seeing still pictures in the context of a narrative typically is a familiar situation for children (Simcock & DeLoache, 2006), which in turn makes the training setting easier as more expected. However, the fact that there was no relationship between children's performance and their experience with picture-book reading in the present data makes this possibility unlikely. Nevertheless, pictures might be interpreted as easier as they provide children with a more limited, because more structured (Nachtigäller & Rohlfing, 2011b), and thus scaffolding context for word learning by listening to a narrative than an arrangement of real objects does. The present findings are in line with research on children's pictorial understanding reporting that 2- to 2 ½-year-old children are able to make use of the information provided on a picture for the real world (DeLoache & Burns, 1994; Ganea et al., 2009). Results indicate that children can transfer information provided on pictures more easily to a task comprising real objects than the other way round, when asked to generalize to novel exemplars. The finding is also in line with other research reporting about a developmental shift in children's understanding of the symbolic nature of pictures between 24 and 30 months of age (DeLoache & Burns, 1994). Meanwhile, children develop an understanding of picture-referent relations

rather than only understanding the content of a picture. Children in the present study demonstrate that they understand the spatial relations depicted on the pictures accompanied by a narrative by demonstrating the ability to generalize their knowledge about the target prepositions to unfamiliar exemplars in a task requiring the arrangement of real objects. The results might be interpreted in terms of Haynes developmental cognitive flexibility account (2004) suggesting that the transfer between 2D and 3D depends on the cues available at encoding and at later retrieval. Thereby, children's age, the task demands as well as children's experience in the sense of cognitive flexibility to recognize relevant cues from encoding independent of the material are important for their performance. Accordingly, it might be that the information provided on pictures during the encoding of unfamiliar words can more easily be retrieved for retention and generalization performance than the information provided by objects during encoding of new words. Pictures seem to be advantageous particularly for the item and task transfer, which included a transfer from 2D to 3D and also to unfamiliar item sets.

In addition to the above mentioned explanation that pictures might be interpreted as easier, the opposite position is also plausible: It might be more complex to depict the dynamic nature of spatial prepositions with static pictures than with objects being manipulated. In this sense, the present generalization finding indicates that a more complex depiction of spatial prepositions is easier generalized to object manipulation than object manipulation is to static pictures. This finding adds to research suggesting a benefit in training something complex in order to generalize to something more simple (Kiran & Thompson, 2003; Rost, 2011). In their study, Kiran and Thompson (2003) investigated the influence of typical as well as atypical exemplars of one category and their semantic features on generalization to naming of further exemplars of the category in adult patients of fluent aphasia. They reported a „strong evidence that training atypical exemplars is superior to training typical ones for facilitating generalization to untrained items.“ (p. 9). Thus, an effective approach for enhancing generalization seems to be a training with more complex materials that encompass elements of more simple items. Findings from Rost (2011) with 3-year-old children hint to the same direction: While children trained on single exemplars only identified familiar exemplars 5 minutes after training, children trained with more complex materials, in this case multiple exemplars, identified both familiar and unfamiliar exemplars and thus showed category generalization.

Methodological concerns

In the following, some important methodological concerns of the present study will be further considered. In the present study, both conditions under investigation were not only characterized by different training procedures, but also by different tasks applied to assess children's language reception in the testing phases of the study. It is thus important to state that children's performance with pictures was always confound with the picture-selection task and the same was true for objects and the acting-out task. This approach, i.e. adopting the same material for testing and training, was implemented in order to consequently provide children in one condition with the same material. In consequence, findings can not be reverted back to either training or testing. As Madole and Oakes (1999) state, infants's categorical performance during an experiment depends on the task demands and on the stimuli used. A given performance does not necessarily reflect a stable representation, but reflects the child's ability given the task demands. According to the authors, it might be that similar fundamental cognitive processes operate in different tasks on the same topic, but that nonetheless tasks imply different cognitive demands. For example, a reduced number of items which children need to attend to in one task can facilitate children's categorical performance (ibid). In the present study, a pretest served as a baseline measure in order to control for different task demands of the picture-selection and the acting-out task: All children performed equally well in both tasks before the training, which indicated that task demands could not account for performance differences in the item and task transfer. Instead, children's former experiences during training and testing procedures seemed to influence their later generalization performance. Along the same line, Horst (2013) argues that children may have advantages in different language assessment tasks depending on how a particular word knowledge was learned. Accordingly, it is possible that what children learned from objects and what children learned from pictures was not the same word knowledge and that another task is needed in order to assess the acquired word knowledge of children in the object condition. Further studies will need to disentangle memory demands resulting from a task and those resulting from material by systematically varying types of tasks and types of material. The present interpretation that pictures provide a useful means for supporting the content of a narrative and for strengthening children's semantic representations is limited to the applied method.

Comparison to the former study of Nachtigäller et al. (2013): A story about a word

Interestingly, although children in both conditions of the present study listened to the new prepositions equally often, children trained with real objects depicting the content of the narrative were not able to retain and generalize the target words. This finding was surprising, because the results obtained in Nachtigäller et al. (2013) could not be replicated in the present study with older children (see 2.3.2.1. for a detailed description of the study). The present results might be attributed to differences in the methodological approach of both studies considered in the following. First, the training of the former study comprised the demonstration of the spatial preposition *under* while naming it. In the present study, the objects were arranged statically during training in order not to confound a dynamic arrangement with objects with a static arrangement depicted on the pictures in both conditions. In other words, the distinction between both conditions in the present study consisted more of a comparison between 2D and 3D depiction of the narrative content rather than of the typical use of pictures and objects. But this approach might have been confusing or irritating for children and they might have been distracted to handle objects for acting-out events or scenes and to play with them. While pictures are known to be static, objects are more commonly used dynamically, a characteristic which might be particularly useful in case of spatial relations. This possible explanation is underlined by the observation that the training procedure in the object condition worked less fluently and took in total longer than in the picture condition. Findings from McGregor and colleagues (2009) also indicate that movement has an advantage compared to a still photograph in demonstrating the meaning of a spatial term. The authors found a symbolic gestural movement in direct comparison to a symbolic photograph to be more effective for the enrichment of children's understanding of the spatial term *under*. It might thus be that the findings from Nachtigäller et al. (2013) could not be replicated in the present study due to this fundamental change in methodology. As described above, this approach was justified by methodological aspects, but will need to be considered in further studies in order to investigate whether a canonical use of a particular material can have an impact on word learning. Second, while the target words in both studies had the same word type, i.e. spatial preposition, the words themselves differed. In addition, children in the present study learned two spatial prepositions and results were considered taking the learning effect of both together. It might be that a training based on one or two real words is too

narrow to generalize the findings and that the study of more words from this word type as well as of different word types is necessary in order to replicate the present findings.

Relationship to children's language skills

Concerning children's language skills as operationalized by their sentence understanding, results revealed different relationships to children's performance in both conditions. For those children, who learned the new words from narratives accompanied by pictures, sentence understanding turned out to be related to their retention and generalization performance at delayed posttest in a way that the better children's sentence understanding was, the better they also performed. Additionally, their performance in the most complex task of transferring word knowledge to unfamiliar items and across tasks at immediate posttest was significantly better, the better their sentence understanding was. These findings are in line with other research reporting about the importance of existing language skills for future language learning (Edwards, Beckman & Munson, 2004; Robbins & Ehri, 1994; Stanovich, 1986). As reported in Nachtigäller et al. (2013), a narrative training based on real objects with 20- to 24-month-old children promotes generalization particularly for children with advanced language skills. This finding can be extended with slightly older children and in learning contexts with pictures. In order to benefit from the semantic grounding provided linguistically by narratives and visually by pictures, children needed the language to comprehend the narrative context surrounding them.

In contrast, the retention and generalization performance at immediate and delayed posttest of children, who were trained with narratives accompanied by real objects, was with one exception not related to children's sentence understanding: Children's performance was positively influenced by their language when tested for generalization to unfamiliar item sets at delayed posttest. As argued above, language learning depends on former experience with language as well as on already existing language skills. The finding, that children's performance in the object condition was not related to their sentence understanding was surprising and might be due to the fact that children did not learn the trained words from the object based narrative training significantly over the course of the study: As children showed little gains over the course of the study, there might have been a limited range of scores with which to obtain significant correlations. However, even if their generalization performance with unfamiliar items at delayed posttest was not significantly better than at pretest, the significant correlation mentioned

above indicates that the performance of children with advanced sentence understanding was better than the performance of children with low sentence understanding. This finding again is in line with Nachtigäller et al. (2013) reporting about the importance of language skills particularly for generalization.

Conclusion

A narrative input structure provided together with a visual depiction of the content by a picture created an efficient word learning context for 27- to 29-month-old children: They were able to develop a strengthened semantic representation of the unknown prepositions by the embedding into the narrative structure during encoding of the prepositions, which could be observed by a long-term retention after several days as well as by generalization to unfamiliar exemplars in the context of a new task. In contrast, a static arrangement of objects depicting the content of a narrative did not influence children's long-term word learning. The operationalization of generalized word knowledge by items of different degree of familiarity and by different tasks was insightful and should be considered further in the study of generalization processes.

Thus, the present study adds on findings about how a weak semantic representation might be strengthened in the context of joint interactions with children (Blewitt et al., 2009; Horst et al., 2011; McGregor et al., 2009; Nachtigäller et al., 2013; Rohlfing, 2006) by contributing first insights about the role of different materials deployed in word learning contexts and of different tasks assessing children's word comprehension. Furthermore, present results confirm the assumption that the extended mapping of words includes a successful retention as well as generalization to novel exemplars (Capone & McGregor, 2005; McGregor, 2004; Vlach & Sandhofer, 2012), because both aspects were observed in the presented study. This finding indicates in turn that successful extended mapping was tapped by the picture based narrative training.

6. General Discussion

The present work was concerned with the enrichment of nascent and weak semantic representations in 27- to 29-month-old children's preposition learning and pursued the question if, and how, the development from weak to strong semantic representations can be influenced. This concern is part of children's slow and extended word learning processes, including long-term retention of newly acquired words as well as the ability to generalize this word knowledge to new situations. As some of children's most common activities comprise joint picture-book reading and free play situations with adults, it was argued that these situations hold some distinct elements particularly scaffolding for children's word learning.

In study I, a narrative input containing temporally and causally related sentences and rudiments of a complete story structure turned out to be a useful frame for embedding weakly represented words, as children trained with these narratives demonstrated enhanced retention after several days. Furthermore, results indicated an enhanced ability to generalize their preposition knowledge to unfamiliar exemplars and a new task. These findings indicate that children were given a scaffolding structure for embedding the meaning of the trained new words during encoding. This support empowered them to transfer their word knowledge to unfamiliar situations, where the context did not provide scaffolds. On the one hand, with respect to retention, this study replicated findings from Nachtigäller et al. (2013) with 20- to 24-month-old children, who learned the unfamiliar spatial preposition *under* embedded into a narrative context. On the other hand, the present study extended the former findings with older participants and in a new learning context: The narrative input was provided together with pictures showing the content of the narrative. Study II then focused on the question whether a narrative input works best in the context of a particular material, e.g. pictures or objects. The finding was surprising: Only the picture based narrative training turned out to be an effective means for enhancing children's extended word learning. Thereby, pictures might either provide a more limited and structured context for word learning or even the contrary, a complex learning context, as children trained and tested with pictures demonstrated better retention and generalization performances in terms of unfamiliar exemplars and across different tasks. Taken together, the findings from the presented studies add on research indicating that processes at work during encoding of new words

as well as an ensuing consolidation phase can contribute to stabilize a formerly weakly represented word (Booth, 2009; Munro et al., 2012; Wojcik, 2013).

Based on these findings, some implications can be drawn for caregivers to implement in joint communicative interactions. During picture-book reading, a joint focus of attention (Tomasello & Farrar, 1986) between an adult and the child, repetition of the same stories over time (Horst et al., 2011) as well as using causal descriptions of labels during encoding (Booth, 2009) are already known to enhance children's word learning. The present studies now add on these findings by providing further factors found to strengthen a nascent semantic representation. A narrative discourse style turned out to enrich a weakly represented spatial preposition during encoding leading to a strengthened semantic representation which could more readily be recalled over time. According to this finding, the use of narratives - rather than of unconnected empty speech during picture-book reading - seems facilitative for children. Furthermore, the exposure of a narrative input together with pictures demonstrating the content of the narrative turned out to provide a scaffolding and limiting context particularly helpful for retaining newly learned words and for generalizing them to unfamiliar exemplars and across tasks. Although children's individual experience with picture-book reading was not related to their learning from pictures, a narrative input structure together with pictures showing the content provide a useful word learning frame for children. As could be seen in both studies presented above, this combination rather than a low elaborated, incoherent input provided with pictures and rather than a narrative structure coming along with static objects turned out to be the most effective means for extending the meaning of prepositions. It might be that a joint picture book context provides a scaffolding structure conveying generally applicable concepts, which can easily be repeated independent of the narrator (Nachtigäller & Rohlfing, 2011b). A visual depiction of a content combined with an elaboration on the content by a narrative structure, which facilitates the enrichment of new words with already existing structures, seems to provide a word learner with a clearly structured scaffolding learning context. This finding adds on reported findings about picture-book reading contexts, which are known to be a joint communicative situation between parents and their children providing an enormous range of exposing children to new vocabulary, particularly during the time of rapid vocabulary learning. Adults thereby talk in more

complex ways than in free play settings, label extensively what is depicted, and ask questions (Blewitt et al., 2009; Fletcher & Reese, 2005).

Generalization to other word types?

As the presented studies deal with the slow mapping of German spatial prepositions, an intriguing question remains: To what extent do the present findings allow conclusions about word learning in general? To put it in other words, does learning of words from different word classes follow the same rules or does it differ? An answer to this question is not trivial. On the one hand, Rohlfing (2005) assumes that preposition learning underlies similar processes as noun learning: A learned label needs to be mapped to a given referent and extended to new exemplars of the referent with the latter building upon the former. These processes are the same as assumed by Gupta (2005) for word learning in general. In this sense, it can be concluded that a semantically rich and coherent narrative input presented together with pictures showing the content of the narrative provide a useful learning context for toddlers for embedding new spatial prepositions as well as new words in general, as the linguistic structure in addition with the visual support scaffold the long-term learning of the unknown word. On the other hand, there is research reporting that some word classes are acquired easier than others. Horst (2013) summarizes important considerations for word learning and storybook research: She emphasizes that different word types are not created equal from storybooks by referring to research indicating that nouns are learned easier from storybooks than verbs and adjectives are (Ard & Beverly, 2004; Robbins & Ehri, 1994). Furthermore, prepositions in general are acquired relatively late in lexical development, compared to other word classes like nouns, verbs or adjectives (Grimm, 1975), because in order to infer their meaning 2-year-old children make use of lexical and syntactic knowledge they already have (Rohlfing, 2001; Tracy, 2008).

Thus, although the same mapping processes are assumed to guide the learning of prepositions that also guide learning of other word classes, the acquisition of spatial prepositions still holds characteristics that differ from the acquisition of other word classes due to their close relationship to the development of spatial understanding. What is particular about the spatial prepositions *behind* and *next to* trained in the present studies is that their meaning always depends on the composition of different reference objects that might vary in the notions of proximity, object-part or visibility (Johnston, 1984). A generalization of the present findings to word learning in general can thus only

be speculative and needs to be clarified in further studies with different word types. However, as the processes of fast and slow mapping seem to guide preposition learning as well as word learning in general, it seems likely that a rich semantic input like the one provided in a narrative in addition to the visual support coming from pictures enhances learning of other word types, too.

Future research questions

The presented studies focussed on narratives and different materials as influencing factors on the process of preposition learning. Further interesting questions remain open which were addressed only marginally in the present studies and which will deepen the understanding of the underlying mechanisms. For example, it might be insightful to investigate the role of consolidation processes in long-term word learning. As the results of study 1 revealed, children in the narrative condition showed enhanced knowledge about the trained spatial prepositions at delayed posttest, which might be due to a phase of consolidation between the last training session and the delayed test. Research by Booth (2009) and Munro et al. (2012) indicates that processes at work in the absence of a training (consolidation) play a crucial role for word learning. Nevertheless, it still remains vague how much time for consolidation is necessary or how much time would be optimal for consolidating newly learned words. Future research should focus these questions by systematically varying the time needed for consolidating words in long-term memory to better understand the involved memory processes.

Another interesting research question concerns a more detailed investigation of the presentation of different materials on word learning. In study 2, objects were used statically to depict a spatial relation while a narrative was told in order to be optimally comparable to static pictures. This approach might have been to the disadvantage of a natural and common contact with objects children have in everyday life. Also, a narrative training with static pictures did not enhance children's preposition learning in the present study, which differed from findings of Nachtigäller et al. (2011). The authors found enhanced retention of the preposition *under* in 20- to 24-month-old children when they were trained with a short narrative embedding the unknown word presented by objects that were moved while providing the input including the spatial preposition. Thus, future research should also focus on how a common usage of a particular material and its presentation might influence word learning.

Yet another interesting research question concerns narratives as a useful means to support word learning. In the present study, a narrative turned out to be an effective means for retention of newly learned words, when unknown words are embedded into a narrative structure. The way narratives were operationalized in the present studies included a temporal and causal structure and contained words that were appealing for 28-month-old children. A question that is currently under investigation (Rohlfing, Nachtigäller, Berner, Foltz, submitted) concerns the content of a narrative: Can children make use of emotional information in stories for long-term word learning? Is the degree of emotional content an important criterion for supporting word learning or is the structure of a narrative particularly important? It can be assumed that an emotionally involved child will be more interested in and will better understand complex sentences. It is thus possible that not only the causal and temporal structure, but also the emotional information in narratives let children get involved in the input, which might result in improvement of children's memory capabilities for tasks such as learning new words. The present studies could provide a limited operationalization of narratives but further aspects of this rich semantic input might play a beneficial role in word learning and their investigation would deepen our understanding of how narratives might influence word learning.

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8. Appendix

8.1. Flyer for recruiting children

Universität Bielefeld**CITEC**

... Spielsachen & Kinderbücher ...



Liebe Eltern,

Im Rahmen einer Studie zur Sprachentwicklung von Kleinkindern untersuchen wir Wortlernprozesse beim Spielen mit Spielsachen und Lesen von frühen Bilderbüchern.

Für diese Studie suchen wir Mütter oder Väter, die Deutsch als Muttersprache sprechen und gerne mit ihren **26 bis 28 Monate** alten Kindern an einer längsschnittlichen Untersuchung in der Universität Bielefeld teilnehmen möchten.

Sie kommen an 4 Terminen innerhalb von 2 Wochen für jeweils etwa 40 Min. zusammen mit Ihrem Kind zu uns ins Dialoglab. Hier zeigen wir Ihrem Kind eine Reihe von Spielsachen und Bildern und beobachten die Reaktionen Ihres Kindes mit einer Kamera.

Als Dankeschön für Ihre Teilnahme erhalten Sie 10 € und es wartet eine Überraschung auf Ihr Kind.

Wir freuen uns auf Ihren Besuch!

Bei Interesse melden Sie sich gerne bei:

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EMERGENTIST SEMANTICSwww.cit-ec.de/es/dialoglab

8.2. A copy of the questionnaire of demography

Demographische Daten

Diese Daten werden aus statistischen Gründen erhoben, ihre Angabe ist freiwillig. Die Speicherung Ihrer in der Studie erhobenen Daten erfolgt jedoch selbstverständlich anonym. Vielen Dank für Ihre Angaben!

Name des Kindes: _____

Geburtsdatum: _____

Geschlecht: männlich weiblich

Schulbildung der Mutter (Abschluss)

Hauptschulabschluss
 Realschulabschluss
 Abitur/Fachabitur
 Fachhochschulabschluss
 Hochschulabschluss
 Promotion

Wie viel Zeit verbringen Sie täglich ca. mit Ihrem Kind (bitte ankreuzen)?

Bis zu 1,5 Std. 3 Std. 4-7 Std. den ganzen Tag

Bitte beantworten Sie nun noch einige Fragen zu Ihrem Kind:

1. Ist Ihr Kind früher geboren? Ja Nein

Falls ja, würden Sie sein Geburtsgewicht (ca.) angeben und den eigentlichen
Geburtstermin?

Geburtsgewicht: _____

Geburtstermin: _____

2. Sind Seh- und Hörvermögen normal ausgeprägt?

Ja Nein Falls nein, welches? _____

Vielen Dank für das Ausfüllen des Fragebogens!

8.3. A copy of the 'Fragebogen zu Sprache' (Language survey)

Fragebogen zu Sprache

Studie: _____ Vpn: _____ (vom Versuchsleiter auszufüllen)

Bitte kreisen sie ein welche Wörter Ihr Kind versteht (☺) und welche es schon versteht und selbst spricht (☹):

Handlungen	passen (passt rein) ☺ ☹	Nomen
legen ☺ ☹	auf(drehen) ☺ ☹	Vorn ☺ ☹
geben ☺ ☹	zu(drehen) ☺ ☹	Hinten ☺ ☹
fallen ☺ ☹	weg ☺ ☹	Innen ☺ ☹
verstecken ☺ ☹	Relationen zwischen Objekten	Außen ☺ ☹
hängen ☺ ☹	Zu (auf etwas hin) ☺ ☹	Oben (drauf) ☺ ☹
drehen ☺ ☹	Hinter ☺ ☹	Unten ☺ ☹
umdrehen ☺ ☹	Vor ☺ ☹	(auf der) Kante ☺ ☹
hineintun (rein) ☺ ☹	Zwischen ☺ ☹	(in der) Mitte ☺ ☹
herausnehmen (raus) ☺ ☹	An (etwas dran) ☺ ☹	Seite ☺ ☹
öffnen (aufmachen) ☺ ☹	In ☺ ☹	Unterseite ☺ ☹
schließen, (zumachen) ☺ ☹	Auf ☺ ☹	Loch ☺ ☹
hoch ☺ ☹	Unter ☺ ☹	
runter ☺ ☹	Über ☺ ☹	Andere
zusammen ☺ ☹	Durch ☺ ☹	hier! ☺ ☹
auseinander ☺ ☹	Um ☺ ☹	wo? ☺ ☹
an(schalten) ☺ ☹	Bei ☺ ☹	da! ☺ ☹
aus(schalten) ☺ ☹	Neben ☺ ☹	dies / das ☺ ☹

Kombiniert Ihr Kind schon zwei Wörter miteinander? (z.B. *Papa Arbeit!*), wenn ja, fallen Ihnen Beispiele dazu ein?

Dankeschön!

8.4. A copy of the German version of the ECBQ

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Temperamentsfragebogen für Kleinkinder - deutsche Übersetzung der Schüchternheitsskala¹

Name des Kindes: _____

Geburtsdatum des Kindes: _____ Testdatum: _____

Alter des Kindes in Monaten: _____

Ausfüllende Person: _____ Geschlecht des Kindes: w m

Instruktionen: Bitte lesen Sie diese vor dem Ausfüllen des Fragebogens aufmerksam durch!

Untenstehend finden Sie einzelne Beschreibungen von kindlichen Verhaltensweisen. Beantworten Sie bitte, wie oft Ihr Kind das beschriebene Verhalten in den letzten 2 Wochen gezeigt hat, indem Sie eine der rechts neben der Frage stehenden Zahlen markieren. Die Zahlen beschreiben, wie oft Sie das beschriebene Verhalten in den letzten 2 Wochen an Ihrem Kind beobachtet haben.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Nie	Sehr selten	Weniger als die Hälfte der Zeit	Circa die Hälfte der Zeit	Mehr als die Hälfte der Zeit	Fast immer	Immer	Trifft nicht zu

Die Spalte "Trifft nicht zu" (X) kann benutzt werden, wenn Sie Ihr Kind in den letzten 2 Wochen nicht in der beschriebenen Situation beobachten konnten. Falls, beispielsweise, in der Situation das Verhalten des Kindes beim Arzt beschrieben wird, Sie und Ihr Kind in den letzten 2 Wochen jedoch gar nicht beim Arzt waren, markieren Sie bitte "trifft nicht zu" (X).

"Trifft nicht zu" (X) unterscheidet sich von "Nie" (1).

"Nie" (1) wird benutzt, wenn Sie Ihr Kind zwar in der beschriebenen Situation beobachtet haben, Ihr Kind jedoch das beschriebene Verhalten in den letzten 2 Wochen nicht gezeigt hat.

Bitte achten Sie darauf, dass Sie bei jedem Item entweder eine Zahl oder X angekreuzt haben.

¹Deutsche Übersetzung © 2010 Kerstin Nachtigäller, Iris Nomikou, Angela Grimmeringer
Cognitive Interaction Technology - Exzellenzcluster, Universität Bielefeld

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Nie	Sehr selten	Weniger als die Hälfte der Zeit	Circa die Hälfte der Zeit	Mehr als die Hälfte der Zeit	Fast immer	Immer	Trifft nicht zu

Wenn sich eine unbekannte Person an einem öffentlichen Ort (z.B. dem Supermarkt)

Ihrem Kind nähert, wie oft

1. ist Ihr Kind dann ruhig geblieben?	1	2	3	4	5	6	7	X
2. hat sich Ihr Kind zurückgezogen und die Person gemieden?	1	2	3	4	5	6	7	X
3. hat sich Ihr Kind an ein Elternteil geklammert?	1	2	3	4	5	6	7	X

Wenn sich Ihr Kind unbekanntem Kindern, die gerade spielen, nähert, wie oft

4. schaute Ihr Kind lieber zu als mitzuspielen?	1	2	3	4	5	6	7	X
5. näherte sich Ihr Kind langsam?	1	2	3	4	5	6	7	X
6. schien Ihr Kind sich unwohl zu fühlen?	1	2	3	4	5	6	7	X

In Situationen, in denen Ihr Kind neue Leute trifft, wie oft

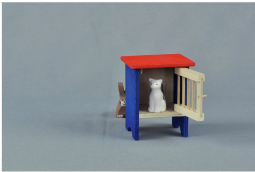

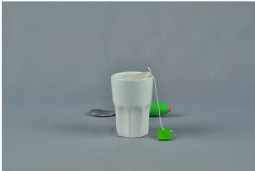
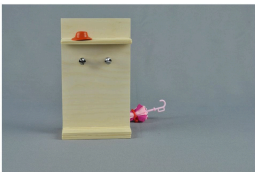
7. wendet sich Ihr Kind ab?	1	2	3	4	5	6	7	X
8. wird Ihr Kind still?	1	2	3	4	5	6	7	X
9. scheint sich Ihr Kind wohl zu fühlen?	1	2	3	4	5	6	7	X

Wenn Sie Verwandte oder erwachsene Freunde der Familie treffen, die Ihr Kind unregelmäßig sieht, wie oft



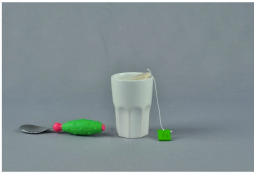
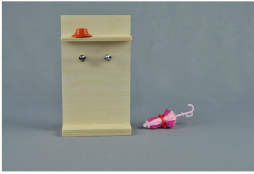
10. hält sich Ihr Kind im Hintergrund auf und vermeidet Augenkontakt?	1	2	3	4	5	6	7	X
11. versteckt Ihr Kind ihr/sein Gesicht?	1	2	3	4	5	6	7	X
12. wird Ihr Kind innerhalb weniger Minuten mit der Person warm?	1	2	3	4	5	6	7	X

Vielen Dank!

8.5. Original German narrative input for the spatial relation *behind* provided to children of both conditions of study I

Item set	Experimental condition	Control condition
rabbit / cat / barn 	<p>Es ist ein sonniger Tag. Der Hase möchte gerne seine Nachbarin besuchen. Darum hüpf er zu der Katze und dem Stall. Und wartet direkt <i>hinter</i> dem Stall, um sie zu überraschen.</p>	<p>Schauen wir uns das mal an! Hier ist ein brauner Hase. Und da ist noch eine graue Katze und das ist ein großer Stall. Und der braune Hase steht <i>hinter</i> dem Stall.</p>
girl / boy / bench 	<p>Es ist nachmittags. Das Mädchen und der Junge spielen verstecken. Sie laufen zur Bank und der Junge hält sich die Augen zu. Das Mädchen geht sofort <i>hinter</i> die Bank, damit er sie nicht finden kann.</p>	<p>Lass uns das mal kurz anschauen! Hier ist ein heiteres Mädchen. Und das ist ein netter Junge und da ist auch noch eine breite Bank. Und das heitere Mädchen steht <i>hinter</i> der Bank.</p>
tea bag / spoon / cup 	<p>Es ist früh morgens. Jemand hat schon das Frühstück vorbereitet. Der Löffel liegt weit weg von dem Teebeutel und dem Becher. Man findet ihn aber <i>hinter</i> dem Becher und das Frühstück kann beginnen.</p>	<p>Schauen wir uns dies mal an! Hier ist ein grüner Löffel. Und das ist ein leckerer Teebeutel und da ist auch noch ein runder Becher. Und der grüne Löffel ist <i>hinter</i> dem Becher.</p>
umbrella / hat / wardrobe 	<p>Es ist sehr windig. Der Schirm ist weg und wird als Schutz gesucht. Er liegt nicht bei dem Hut und der Garderobe wie sonst immer. Denn diesmal ist er <i>hinter</i> die Garderobe gefallen.</p>	<p>Schau mal das hier! Da ist ein rosa Schirm. Und da ist noch ein brauner Hut und das ist eine Garderobe aus Holz. Und der rosa Schirm ist <i>hinter</i> der Garderobe.</p>

8.6. Original German narrative input for the spatial relation *next to* provided to children of both conditions of study I

Item set	Experimental condition	Control condition
rabbit / cat / barn 	<p>Es ist ein warmer Tag. Der Hase hat Hunger und würde gerne etwas essen. Er sucht zuerst bei der Katze und dem Stall danach. Und findet dann schließlich <i>neben</i> dem Stall was Frisches zu essen.</p>	<p>Schau mal das hier! Da ist ein junger Hase. Und da ist auch noch eine alte Katze und das ist ein schöner Stall. Und der junge Hase steht <i>neben</i> dem Stall.</p>
girl / boy / bench 	<p>Es sind Ferien. Das Mädchen und der Junge wollen zusammen Eis essen gehen. Sie sucht den Jungen und die Bank, um ihn abzuholen. Schließlich steht sie <i>neben</i> der Bank und begrüßt ihn.</p>	<p>Jetzt schauen wir uns das mal an! Hier ist ein freundliches Mädchen und da ist ein fröhlicher Junge. Und da ist noch eine lange Bank. Und das freundliche Mädchen ist <i>neben</i> der Bank.</p>
tea bag / spoon / cup 	<p>Der Tee ist fast fertig. Man braucht jetzt nur noch umzurühren. Der Löffel liegt da, wo auch der Teebeutel und der Becher sind. Er ist direkt <i>neben</i> dem Becher und man kann den Tee damit umrühren.</p>	<p>Schauen wir uns das nächste mal kurz an! Das ist ein kleiner Löffel. Und hier ist ein loser Teebeutel und da ist ein weißer Becher. Und der kleine Löffel ist <i>neben</i> dem Becher.</p>
umbrella / hat / wardrobe 	<p>Es ist schlechtes Wetter. Der nasse Schirm ist aufgespannt und sehr groß. Er passt jetzt nicht dahin, wo auch der Hut und die Garderobe sind. Darum liegt er <i>neben</i> der Garderobe und kann dort gleich trocknen.</p>	<p>Und dann gucken wir uns noch ein Bild an. Hier ist ein bunter Schirm. Und da ist noch ein dunkler Hut und das ist eine hohe Garderobe. Und der bunte Schirm ist <i>neben</i> der Garderobe.</p>

8.7. Declaration

Erklärung

Hiermit erkläre ich, dass ich die vorliegende Arbeit selbstständig verfasst, keine anderen als die angegebenen Hilfsmittel verwendet und wörtlich oder inhaltlich übernommene Stellen als solche gekennzeichnet habe.

Die Dissertation ist auf alterungsbeständigem Papier nach DIN-ISO 9706 gedruckt.

Kerstin Nachtigäller

Bielefeld, Oktober 2015