CHILDREN'S OMISSION OF PREPOSITIONS IN ENGLISH AND ICELANDIC

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It is also dedicated to children's spirit of inquiry, whose critical thinking comes from a place of genuine curiosity.

DEDICATION – *Continued*

The Naughty Preposition

I lately lost a preposition
It hid, I thought, beneath my chair
And angrily I cried, "Perdition!
Up from out of in under there."
Correctness is my vade mecum,
And straggling phrases I abhor,
And yet I wondered, "What should he come
Up from out of in under for?"

— Morris Bishop
in *The New Yorker*, 27th September, 1947, p.30

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ABSTRACT

The purpose of this dissertation is to empirically test the hypothesis that children's omission of functional elements reflects performance factors (McKee, 1994; McKee & Iwasaki, 2001), rather than lack of knowledge (Felix, 1987; Radford, 1990, 1995; Tomasello, 2000). The multi-level production system treats content and function morphemes differently (Garrett, 1982). Further, a function morpheme's free or bound status and the independence of the content stem affect the likelihood that a function morpheme will be omitted. Four experiments each employed production and comprehension tasks testing English- and Icelandic-speaking children's and adults' production and comprehension of different prepositional phrases. The English experiments tested prepositional phrases with content prepositions and content/function preposition combinations. The Icelandic experiments tested prepositional phrases with prepositions and their associated case markings. Function prepositions in English and case markings in Icelandic both convey information about case, with the former being a free function morpheme, and the latter a bound function morpheme. Both English- and Icelandic-speaking children showed comprehension of prepositions that they do not produce. Further, Icelandic-speaking children produced case markings but English-speaking children did not produce function prepositions. These findings support a performance-based hypothesis with omission attributable to coordination issues among elements in the multi-level production system. These findings also show the importance of cross-modality and cross-linguistic research in studying the competence of children before, during, and after the telegraphic speech stage.

CHAPTER 1:
INTRODUCTION

1.0 Overview

This dissertation compares comprehension and production of prepositional phrases of English- and Icelandic-speaking children transitioning out of the telegraphic speech stage. Specifically, the experiments contrasted prepositional phrases expressing no change in location (i.e., no physical movement), such as *on the rug*, with prepositional phrases that are used to express change in location (i.e., physical movement), such as *onto the rug*. In Icelandic, accusative and dative can be assigned by the same prepositions (Einarsson, 1949). Dative case is most often assigned by prepositions that denote no change in location, such as *á mottunni* ("on the rug"), and accusative case is most often assigned by prepositions that denote change in location, such as *á mottuna* ("onto the rug") (Árnason, 1980). Icelandic was of interest because it is a case-marking language that is quite closely related to English. Although Middle English and Modern English do not overtly mark case except on pronouns and function prepositions, Old English had an extensive case-marking system. Modern Icelandic is a direct descendent of Old Icelandic, which comes from Old Norse, the language spoken by the first settlers of Iceland during the Viking Age in the late ninth century (Thráinsson, 1994), and shares Proto-Germanic as a close ancestor with Old English (Robinson, 1992).[1]

The two languages are compared because, although case information for prepositional phrases is realized as bound function morphemes in Icelandic (e.g., both the noun itself and the definite article inflect for case, number, and gender), in some instances it is realized as free function morphemes (e.g, function prepositions such as *to* and *of*) in

1 It should be noted that Old Icelandic is from North-Germanic and Old English is from West-Germanic. During the Viking Age, Old Norse also influenced Old English (Robinson, 1992).

English (Rauh, 1993; Rooryck, 1996).[2] This bound versus free distinction has interesting consequences for the onset of the two types of case-marking function morphemes in children's early speech patterns, with bound function morphemes generally appearing earlier than free function morphemes do. The goal of this dissertation is to provide a performance-based account for why differential recruitment of free versus bound function morphemes during production affects their susceptibility to omission. So, first, what are the typical properties generally observed in telegraphic speech?

1.1 Telegraphic speech

Somewhere between the ages of 1;0 and 2;6, when most typically-developing children have between 50 and 100 words in their expressive vocabulary, they enter a stage in language development in which they begin to say two words together (Nelson, 1973). This phenomenon is commonly referred to as TELEGRAPHIC SPEECH because it is structured similarly to telegrams. Like telegrams, these utterances emphasize words that are essential to the meaning of the message. For example, if the target utterance is *Go to the store*, a child at this stage may only utter *Go store*. Thus, CONTENT ELEMENTS, such as nouns and verbs, are more likely to appear in these utterances, while FUNCTION ELEMENTS, such as articles and prepositions, are less likely to appear. Further, there is a robust tendency in young children's speech across languages towards omission of function morphemes that are morphologically independent (i.e., free morphemes) when compared with function morphemes that are supported by a host word (i.e., bound morphemes). Why might this developmental pattern exist?

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2 There are instances in which the free form of the definite article can also stand at the beginning of the noun phrase. An example is when there is an adjective in the noun phrase *Fallega húsið brann* (*Beautiful house-the burned*) or *Hið fallega hús brann* (*The beautiful house burned*). However, this free form is formal and archaic and not used much anymore (Thráinsson, 1994).

1.2 Competence- and performance-based accounts

At least two options might explain this aspect of telegraphic speech. One explanation attributes the tendency to omit function elements to limitations in the child's grammatical knowledge of the language being learned (e.g., Felix, 1987; Radford, 1990, 1995; Tomasello, 2000). The other attributes the phenomenon to limitations in the processing of already intact grammatical knowledge (e.g., Gerken, Landau, & Remez, 1990; Gerken & McIntosh, 1993; Demuth, 1996; McKee, 1994; Shady & Gerken, 1999; McKee & Iwasaki, 2001). This former type of explanation will be referred to a competence-based claim and the latter as a performance-based claim from here on. How might one decide between the two options?

One way to distinguish a competence-based claim from a performance-based claim is to examine the child's ability in more than one modality. Across developmental stages, production abilities generally lag behind comprehension abilities (Shipley, Smith, & Gleitman, 1969; Sachs & Truswell, 1978; Gerken, Landau, & Remez, 1990; and Shady & Gerken, 1999). Thus, comparison of production and comprehension of a child at the telegraphic stage offers potential resolution. A competence-based claim suggests that both production and comprehension of function morphemes would be affected by the relevant linguistic limitation. A performance-based claim, however, emphasizes for the possibility of a dissociation. The existing evidence for a relevant dissociation between production and comprehension is strong and will be reviewed in Chapter 2.

1.3 Content versus function prepositions and case inflections

This dissertation compares production and comprehension of prepositions. Although prepositions are a closed-class and hence highly frequent, with one in every eight to 10 words being a preposition (Svartvik, 1988; Fang, 2000), they can exhibit properties of

both content and function morphemes (Rauh, 1993; Rooryck, 1996). This dissertation uses the term CONTENT PREPOSITION to describe prepositions that more readily convey a clear encyclopedic meaning, such as *on*, whereas FUNCTION PREPOSITION is used to describe prepositions that primarily express grammatical relationships, such as *of*. Reviewed in detail in Chapter 3, the diversity of properties among prepositions, which are nonetheless within the same syntactic category, supports fine-grained experimental contrast.[3] The emergence of CONTENT PREPOSITIONS in children's speech is earlier than that of grammatical or FUNCTION PREPOSITIONS (Grimm, 1975; Vorster, 1984; Tomasello, 1987; Littlefield, 2005). Why might function morphemes be treated differently from content morphemes by the production system?

Further, different languages vary with respect to the independence of content words and inflections, and thus, telegraphic speech manifests differently across typologies (McKee & Emiliani, 1992). This dissertation exploits this difference. Some languages, like English, can have well-formed, uninflected content forms. In other languages like Italian, content stems are generally not uttered by themselves. Icelandic sometimes allows content stems to exist by themselves but mostly forbids it. For example, some nouns take a null case marker, such as *hest* (*horse*) where the null marker denotes accusative case. Other nouns require overt inflections such as *mottu* (*rug*), where *mott-* is the stem and *u* denotes accusative case. In prepositional phrases, as elsewhere, noun phrases are inflected. Interestingly, Icelandic-speaking children's early speech includes inflected nouns in prepositional phrases where the inflection persists even when case-assigning prepositions are missing (Thordardottir & Weismer, 1998; Sigurjónsdóttir, 2005). For example, an Icelandic-speaking child may first say *húsinu* (*house-the* including the

3 More canonical function categories (such as tense, aspect, and determiners) are not compared experimentally with lexical categories because of confounding variables, such as significant differences in frequency of use and differences in the syntactic frames one would have to elicit.

definite article suffix inflected for dative case) to mean "in the house" instead of *í húsinu* (*in house-the* including the preposition and the definite article suffix inflected for dative case).

Interestingly, the inflections of prepositional phrases in Icelandic and the function prepositions in English may be different manifestations of similar information regarding case (Rauh, 1993; Rooryck, 1996). For Icelandic, accusative case is most often assigned to prepositions that denote change in physical location, and dative case is most often assigned to prepositions that express non-movement. Thus, this difference in the appearance of case inflections and omission of function prepositions comports with a bound versus free distinction among function morphemes in a processing account of telegraphic speech. In addition to the content versus function distinction, how can the bound versus free morpheme distinction be handled by the production system? Specific details of this are pursued in Chapter 4.

1.4 Multi-stage production framework

The performance-based claim assumes that the child's production system is organized similarly to the adult system, but that there is a difference in its usability during its development (McDaniel, McKee, & Garrett, 2010). This dissertation specifically relies on a framework that posits separate processing of lexical retrieval and grammatical encoding (Garrett, 1975, 1982; Levelt, 1989). Content morphemes are directly recruited under conceptual control during lexical retrieval, while function morphemes are largely generated during the integration of sentence structure. Thus, this framework within which content and function morphemes play distinct roles at different times supports a partial account of the pattern of telegraphic speech. In line with McDaniel, McKee, and Garrett (2010), even though adults and children both draw upon the same production system, the authors emphasized that children, who have less practice and fewer resources

to draw upon in coordinating the information in the system than do adults, may have difficulties with function morphemes that depend on detailed construction mechanisms and are recruited at late stages of online processing. For example, if the specific phonetic instantiation of a function morpheme is not available when the system is preparing pronunciation codes, the production system must continue by outputting an utterance that either has an omitted word or, for heavily inflected languages, the default inflection (McKee & Iwasaki, 2001).

1.5 Experimental strategy

Testing a performance-based account of telegraphic speech as compared with a competence-based account relies on finding evidence for different performance in comprehension and production tasks. That evidence must link to relevant changes in telegraphic patterns of speech for the prepositions that are the targets for this research. For reasons detailed in Chapter 5, this study tested prepositional phrase usage in English and Icelandic as it emerges in early development using elicited production and comprehension tasks. Although many experiments have examined English-language sentence production and comprehension with adults, and some with children, little has been done on sentence production and comprehension in rich case-marking languages with either adults or children (Melinger, Pechmann, & Pappert, 2009; Bader & Lamers, 2009).

The strategy adopted for the dissertation used vocabulary size as a diagnostic and grouped children aged 2;0 to 3;11 on that basis for testing. Vocabulary size indicates function word repertoire across languages more reliably than either age or Mean Length of Utterance (MLU) does (Devescovi et al., 2005). By the time a child is able to produce 100 - 200 different words, they are solidly using two-word combinations (Nelson, 1993). An expressive vocabulary of 400 words is the threshold for emergence of productive

use of function words, and at 600 words, emergence of function word use plateaus (Marchman & Bates, 1994). Thus, children participating in the study were placed into one of three groups: those having 200 to 399 words and telegraphic sentences, 400 – 599 words and transitional use between telegraphic and complete sentences, and more than 600 words and complete sentences. English- and Icelandic-speaking adults were also tested to serve as a baseline.

Recall the main hypothesis of this dissertation: Children's omissions are due to limitations in processing grammatical information, specifically with coordinating free function morphemes with other elements in a sentence. If the patterns found in telegraphic speech do reflect problems with coordinating information in the production system, the following is predicted: English-speaking adults (who have a fully developed production system and thus, serve as a baseline) will both comprehend and produce content and function prepositions. Although there are no particular predictions per se, it would be natural to expect ceiling effects. English-speaking children with the lowest vocabulary and telegraphic speech will comprehend but not produce content and function prepositions; those with vocabularies at the 400 word mark or higher and with transitional speech will comprehend and produce content prepositions and comprehend and sometimes produce function prepositions; and those with vocabularies over 600 with complete speech will both comprehend and produce content and function prepositions.

Since the manifestation of similar information is different between the two languages –free function prepositions in English and bound case marking in Icelandic – analogous experiments in Icelandic investigated the production of bound morphemes. Again, the hypothesis is that children omit certain elements not because of limitations in their grammatical knowledge, but rather because of limitations in their processing of certain kinds of grammatical information, particularly free function morphemes. Thus, despite conveying similar case information to that of English free function prepositions,

Icelandic case inflections should be less vulnerable to omission because they are bound morphemes and processed differently from free morphemes. On these assumptions, the following is predicted: Icelandic-speaking adults should both comprehend and produce prepositions and their case inflections at high, perhaps ceiling, levels. Icelandic-speaking children with the lowest vocabulary and telegraphic speech should comprehend prepositions and their case inflections but only produce (sometimes erroneous) inflections, those with vocabularies at the 400 word mark or higher and with transitional speech should comprehend prepositions and their case inflections and produce inflections but only sometimes produce prepositions; and those with vocabularies over 600 with complete speech should both comprehend and produce prepositions and their case inflections, just like the adults. The evaluation of these several predictions is reported in Chapters 6 and 7.

Results to be reported support the performance-based hypothesis that attributes telegraphic speech to issues with coordination of function elements in the production system. They further indicate that certain types of function elements, like free function prepositions, are more vulnerable to omission than bound case markings. This dissertation concludes with emphasis on the merits of testing for cross-modality and cross-linguistic differences among telegraphic children. It also addresses potential limitations with the study and provides suggested areas for future investigation.

CHAPTER 2:
DEVELOPMENTAL PATTERNS OF PREPOSITION USE

2.0 Introduction

Issues of competence and performance affect most theoretical and empirical investigations of language. How is the knowledge of language (competence) related to the system that puts the knowledge to use (performance)? As indicated in Chapter 1, comparison of production and comprehension performance can play a significant role in grappling with those issues. How are the processes involved in understanding language (comprehension) related to the processes involved in outputting it (production)? It is helpful to consider different accounts of telegraphic speech from the perspective of performance-based claims. This provides a theoretical context for omission of prepositions in children's early utterances. Specifically, this chapter discusses possible explanations for why prepositions and other function elements are susceptible to omission in telegraphic speech. It concludes with an overview of specific developmental patterns of preposition use.

2.1 Competence versus performance and comprehension versus production

Chomsky's distinction between competence and performance spawned a novel way of viewing the psychological reality of language (1964). His analysis encouraged focus on competence, as he argued that performance is too variable and susceptible to too many grammatically irrelevant factors to reveal a speaker's true knowledge of language. These factors include errors of omission and commission and disfluencies due to memory limitations and attentional shifts. It is important to note that Chomsky's goal was the study of a relatively static form of linguistic knowledge. The more dynamic patterns in language processing and language learning were not his focus. With respect

to language processing, Fodor and Garrett (1966) pointed out that "…[I]n the sense in which distinguishing between performance and competence is distinguishing between behavior and the mechanisms underlying it, both linguistic and psychological models are models of competence" (p. 138). In other words, there must be some possession of some linguistic knowledge to be able to apply that knowledge in language comprehension or language production.[4] This is true whether it is in the task of judging grammaticality of a sentence or comprehending or producing a sentence. Thus, in the subsequent sections, I adopt Fodor and Garrett's assumption in evaluating evidence from comprehension and production in children.

A central question regarding language development data then might be: How do we distinguish data that support linguistic competence claims from data that support performance claims when trying to build a model of the child's current linguistic status? As McKee (1994) pointed out, the developing language of a child can be thought of as incomplete in representation (competence), realization (performance), or both when compared to that of an adult. Thus, there are different ways to characterize the status of a child's competence and performance as compared to an adult's. Explanation of any developmental datum appeals to a combination of competence and performance but the practice of the field does not always reflect that very clearly, as discussed in subsequent sections.

2.1.1 Theories that emphasize competence

The dominant tradition has been to interpret the child's production output as direct reflection of competence. For example, work by deVilliers and deVilliers (1973) and Tomasello and colleagues (see Tomasello, 2000, for some review) best represent the

4 Note however, that this is a dynamic and interactive relationship between knowledge and processing. See J. D. Fodor (1998a, 1998b) for more.

perspective that, despite some superficial similarity of the child's utterances to the adult's, the underlying competence is different. Specifically, Tomasello claimed that a child's utterance is an imitation of an adult's utterance and that the child does not yet break it down into analyzable units, such as morphemes. So, he claimed that just because children say certain words or structures, does not mean that they have an adult-like representation of them.

Felix (1987) and Radford (1990, 1995) also represent the perspective that the competence of the child differs from that of the adult. Felix (1987), for instance, assumed that a child develops grammatical rules that go through a series of restructuring stages to eventually match the grammatical rules of the adult. He attributes this sequence of child structures to a difference in competence, stating, "…[T]he principles of Universal Grammar, though being innately specified and thus characterizing the child's initial mental state, are not fully available from the very beginning, but rather emerge in a specific temporal order which is specified by a genetically determined maturational schedule" (pp. 5). Radford (1990) also attributed this discrepancy of competence between children and adults to an initial lack of grammatical information. He assumed this was due to a difference in competence, stating that "…[G]iven the absence of any morphosyntactic properties for lexical items at this stage, the child's early lexicon is clearly defective in character in comparison with its adult counterpart. It seems likely that other modules of grammar are inoperative (or vacuously operative) at this stage" (pp. 243). Thus, both Felix and Radford assume that a child does not say certain grammatical morphemes because he does not yet know those certain grammatical structures. However, a child's ability in the production modality should not necessarily be the only basis for drawing conclusions about the child's competence. The most compelling evidence of that is the widely known developmental dissociation of comprehension and production, as reviewed in the next section.

2.1.2 Dissociation of comprehension and production bearing on competence theories

The stages that a child goes through in the development of production do not necessarily have a one-to-one correspondence with the stages that a child goes through in the development of comprehension. In general, production lags behind comprehension. Evidence for this misalignment can be found at various windows of time. Around the ages of 10 –12 months, the child normally produces her first word but already comprehends around 50 words (Nelson, 1973). Around 18 – 24 months, a child may only say 50 words and have an MLU of 1.8 but already comprehends about 300 words, around 24 – 30 months, a child may only say 200 words and have an MLU of 3.1 but already comprehends 500 words, and at 30 – 36 months, a child may only say 500 and have an MLU of 3.4 but comprehends 900 words (Gard, Gillman, & Gorman, 1993). There is corroborating experimental evidence that shows that children comprehend more than they can produce.

Shipley, Smith, and Gleitman (1969) tested comprehension of commands in holophrastic children (MLUs of 1.06 to 1.16) by observing action and verbal responses. The commands varied along the dimensions of syntactic structure and English/nonsense. Shipley et. al. (1969) found that children at the holophrastic stage responded significantly more to commands with isolated nouns and commands with verb and noun (telegraphic) combinations, suggesting that their comprehension ability was at a slightly higher level than their production level. Sachs and Truswell (1978) replicated this finding with children between the ages of 1;4 and 2;0 who were confirmed to only produce only one-word utterances.[5] Despite that production limitation, and like the holophrastic children in Shipley et al. (1969) the children in Sachs and Truswell (1978) showed comprehension of the meaning of two-word verb and bare-noun combinations (e.g., *kiss dolly*). Additionally, there is evidence of maintenance of this lag of production ability relative to

5 Even when the children were urged to imitate two-word utterances, they only said one of the two words.

comprehension ability when telegraphic speech normally starts at roughly 18 – 30 months of age (Shipley, et. al, 1969). Children who produce telegraphic speech are able to comprehend fully well-formed adult utterances, and in fact respond better to them than to sentences that mimic their own utterances. In the same study, Shipley, et. al. (1969) tested the comprehension of telegraphic children (MLUs of 1.4 to 1.85) of the same commands. They found that children at the two-word level responded significantly more to the well-formed commands than to the child-forms of utterances that used isolated nouns or verb plus noun combinations, indicating that their comprehension ability was at a higher level than their production level.

Gerken, Landau, and Remez, (1990) also concluded that complete sentences with correct function elements are represented in 2-year-olds' knowledge of language. When asked to imitate sentences with English function morphemes (e.g., *Pete pushes the dog*) and non-English function morphemes (e.g., *Pete pusho na dog*), children omitted the English function morphemes (e.g., *Pete push dog*) significantly more often than the non-English ones. This consistent difference was interpreted as showing perceptual sensitivity to familiar items. Gerken and colleagues thus claimed that children do analyze and encode function morphemes in comprehension and that the omission could be attributed to other processing factors in the production domain. Speculation on which factors could contribute to omission include difficulty with weakly stressed syllables and MLU length (e.g., *pushes the dog* has four morphemes whereas according to the authors *pushona dog* is interpreted as having two morphemes with the novel non-English morphemes treated as syllables of a single novel word).

This mismatch between production and comprehension abilities at the telegraphic speech level is further demonstrated by several picture selection studies by Gerken and McIntosh (1993), Shady and Gerken (1999) and Golinkoff, Hirsh-Pasek, and Scheweisguth (2001). Gerken and McIntosh (1993) tested children's comprehension of

free standing function morphemes in the sentence frames such as *Find ___ dog*. With no insertions and with grammatical insertions (*the*), children (aged 21 to 28 months) performed better (i.e., pointed to the dog) than they did with ungrammatical insertions (*was*) or nonsense insertions (*gub*). This suggested that children were sensitive to these grammatical cues, indicating the ability to comprehend cues they did not reliably produce.

Shady and Gerken (1999) examined this further by looking at whether grammatical cues, such as the distributional properties of frequent grammatical morphemes and prosodic structure played a role in parsing speech for telegraphic two-year-olds. Frequent grammatical morphemes are usually positioned at phrase boundaries (*the* only occurs at the beginning of noun phrases and *was* only occurs at the beginning of verb phrases). The authors wanted to see if children used these constants even though their own speech lacked them. Likewise, prosodic structure includes pausing, syllable lengthening and pitch resetting occurring at phrase boundaries. They wanted to see if children also used these features as a cue, despite not producing long enough sentences to utilize it in their own speech. Shady and Gerken found that 2-year-old children (with a MLU around two words) showed a higher proportion of selecting the correct picture for grammatical than non-grammatical sentences and for prosodically natural than unnatural sentences. (See also Gerken and McIntosh, 1993.)

Golinkoff, Hirsh-Pasek, and Scheweisguth (2001) also studied children's comprehension of grammatical morphemes, this time testing bound morphemes added to verbs such as *dance*. They found that with grammatical suffixes (*dancing*), children aged 18 to 21 months performed significantly better (i.e., correctly pointed to the picture of dancing) than with the ungrammatical suffixes (*dancely*) and nonsense suffixes (*dancelu*). These results corroborated the work by Gerken and colleagues that children understand grammatical morphemes despite not being to say them. In particular, the

combined findings of Golinkoff et al. (2001) and Gerken and McIntosh (1993) indicated that comprehension of bound morphemes seems to appear before (at 18 to 21 months) comprehension of free morphemes (21 to 28 months).

As noted earlier, function words seldom and inconsistently appear in a child's early expressive vocabulary. Between the ages of 1;6 to 2;6, Bates et al. (1994) found that a proportional growth of function words was not present until a child reached the 400-word mark with his or her expressive vocabulary development. Caselli, Cassidio, and Bates (1999) found this same pattern with Italian-speaking children. When grammatical complexity scores are plotted against vocabulary level, there is a similar nonlinear relationship until an inflection point at 400 words for both English- and Italian-speaking children. This is despite the morphological complexity and more flexible word order of Italian. Combining these findings with Gerken and Golinkoff and colleagues' findings again suggests that young children's comprehension ability is at a higher level than their production level. Relationships between comprehension and production of the kind reviewed offer a potential avenue for deciding between competence- and performance-based accounts of a given feature of child speech. Considering the evidence provided above, a competence story for failure to display a certain element type (e.g., prepositions) in production cannot easily grapple with contemporaneous demonstrations of a child's detailed appreciation of that same element (e.g., prepositions) in comprehension. Thus, interpretations of children's production data must take into account performance factors.

2.1.3 Theories that appeal to performance factors interacting with competence

Work by L. Bloom, P. Bloom, and Valian represents perspectives that appeal to performance factors interacting with competence. In addition to Shipley et al. (1969), Lois Bloom (1970) provided one of the earlier observations of performance-based limitations. In essence, she assumed that at the telegraphic stage, children know more

than they are actually able to say. She analyzed the spontaneous speech of three children, attributing the cause of omissions to an increase in structural complexity. On those grounds, she asserted that function elements are more susceptible to omission at this stage than content elements because "something [in the utterance] had to give in its production" (1970, p. 165). This suggested that the function elements are in the child's knowledge base in the first place, but are somehow vulnerable to being left out during the process of production. However, she did not propose any specific mechanisms by which they may be omitted.

Studying children's omission of subjects, Paul Bloom (1990) also claimed that the child masters aspects of the target grammar but may omit elements because of performance factors. He built on Lois Bloom's account, also attributing the omissions to increased structural complexity and length. Analyzing corpus data from CHILDES that were originally collected by Brown (1973), he specifically tested if verb phrase length influenced whether a child omitted a subject or not.[6] He found that subjects were more likely to be omitted when the verb phrase length was increased. Although his focus was on the omission of subjects, which are constituents containing both function and content elements (e.g., an article and a noun), this omission pattern can still be explained by a production account. In his 1993 paper P. Bloom (referring to a personal communication with Merrill Garrett) suggested that subjects may be susceptible to omission because they are at the beginning of a structural unit, and at that point an increase in processing load is found. This may manifest itself as hesitations in adults, but as omissions in children's speech. This interpretation is fortified by Bloom's (1990) findings that subjects are both more frequently omitted and reduced (e.g., as pronouns) than objects are by children. Also examining subjectless sentences, Valian puts forth a similar performance-based

6 The three children were Adam (samples taken from ages 2;3 to 2;7), Eve (1;6 to 1;10), and Sarah (2;3 to 2;7).

hypothesis to explain young children's absent elements. In her 1991 paper, she took a similar stance to that of L. Bloom and P. Bloom, providing additional evidence from analyses of collected samples of spontaneous speech from 21 English-speaking children (ages 1;10 to 2;8 and MLU of 1.53 to 4.38) and five Italian-speaking children (monthly recordings over roughly a year starting between ages 1;6 and 1;7)[7]. Like P. Bloom, she found that shorter verb phrases were used with full lexical subjects than with pronouns, and shorter verb phrases were used with pronouns than with null subjects. Considering tasks involved in sentence production such as "[t]he combination of planning the content of what we have to say, finding and organizing the syntactic structures to express the content, [and] finding the words, ..." she asserted that "[c]hildren have the same tasks [as adults] and much less practice integrating them, so they will have at least as many constraints as adults do. Thus, it is highly likely that children's performance system is also a limitation on the length of their utterances, and the younger the child the greater the limitation." (p. 31). Thus, although she did not use the exact terms, she referred to important components of sentence production models (which will be discussed in great detail in Chapter 4) such as message planning, lexical retrieval, and syntactic planning. Valian's view was that children's omissions are performance-based. (See McDaniel, McKee, & Garrett, 2010, for a recent discussion of planning domains in children's speech that fits this general perspective.)

Adult-like competence is also illustrated in Valian's (1986) study of young children's knowledge of syntactic categories, including prepositions. In an analysis of spontaneous speech of six 2-year-olds (2;0 to 2;5) with MLUs between 2.93 and 4.14, Valian (1986) found that children showed evidence of six syntactic categories:

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7 It should be noted that Valian (1991) was motivated in part as a response to Hyams (1986), which argued that all linguistic principles were innate, but that a child started out with a certain parameter setting, which could be changed later based on the linguistic input a child received.

Determiner, Adjective, Noun, Noun Phrase, Preposition, and Prepositional Phrase. She took this as an early indication of syntactic knowledge similar to that of adults.[8] The next section reviews how prepositions come about in children's language.

2.2 Developmental patterns of preposition use

Prepositions are the cornerstone of the empirical investigation pursued in this dissertation. This section reviews some relevant aspects of their general developmental patterns. In particular, I note some contrasts of prepositional use associated with semantic and grammatical factors.[9] Slobin (1973) proposed that prepositions are mapped directly to a set of universal spatial conceptualizations with the order of emergence of spatial terms in speech reflecting the order of mastery of these spatial conceptualizations (see also E. Clark, 1973). For different languages, prepositions for even spatial concepts like containment and support can either collapse across the two categories or further divide them into finer categories (Landau, 1996). For example, Spanish *en* describes both containment and support, whereas Korean *ahn* and *sok* describe containment as either loose or tight, respectively, and German *auf* and *an* describe support by either vertical or horizontal attachment, respectively. The concepts of location and direction can also be described by separate terms or collapsed into one. For example, even within the inventory of prepositions of the same language, as with English for example, location and direction

8 Although Valian carefully considered the possible impact of memory limitations on her data, she concluded that memory did not explain the length or omission patterns. She argued that the upperbound of utterance length is fairly high with MLUs of 3 – 4 morphemes (Braine, 1974). She did point out, however, that there is some selectivity in what children omit from their utterances. For example, children leave out determiners even where they are required, but rarely leave out prepositions. Thus, although she ruled out memory limitations as a contributing factor, she did suggest that there are also other factors that can contribute to processing difficulties, such as complex syntax.

9 Note that the term "semantic" is used throughout this dissertation to refer to "encyclopedic content."

can be expressed independently by different prepositions, such as *in* and *into* or be covered by a single preposition, such as *over* (e.g. *Flying over the river* can either mean hovering in one location above the water or clearing the water in a direction from one bank to the other.)[10]

Results from several studies suggested that infants possess fairly well-developed conceptual representations of spatial relationships before they utter their first words (Baillargeon, 1995; Gibson & Spelke, 1983; Levine & Carey, 1982; Needham & Baillargeon, 1993; Piaget & Inhelder, 1956; Mandler, 1996). Nelson (1973) found *up* and *down* among the first words children say. For most languages, spatial expressions for containment and support also emerge quite early (Sinha, Thorseng, Hayashi, & Plunkett, 1994). For example, *in* and *on* are found in the expressive vocabulary for most English–speaking 2-year-olds (Bloom, 1973; Bloom, Lightbown, & Hood, 1975; Brown, 1973; Gopnik, 1982).

Cross-linguistic investigation reveals the emergence of locative terms in a consistent order, both within and across languages (Johnston & Slobin, 1979). Caselli, Casadio, and Bates (1999) also found this pattern of emergence of prepositions for English and Italian. The prepositions that denoted a simple location (e.g., *down*, *up*, *here*) seemed to come in first, then prepositions that denoted a more complex location (e.g., *on*, *inside*, *under*), and then prepositions that denoted a more complex spatial relationship (e.g., *next to*, *behind*) appeared. Grimm (1975) analyzed spontaneous production data from 137 German-speaking preschoolers to first-graders and found spatial prepositions were said earlier than grammatical prepositions (e.g., *zu* which marks dative case). Vorster (1984) also did a spontaneous production analysis of six Afrikaans-speaking 2- to 3-year-olds and found spatial prepositions were said earlier, followed by temporal

10 It is not certain whether language specifically influences early spatial conceptualizations (Gentner, 1982) or whether early spatial conceptualizations reflect an original set of options (Slobin, 1985).

prepositions, then those conveying more grammatical relations such as instrumentals and datives. Tomasello (1987) did a diary study of one English-speaking child from age 1;0 to 2;0. He found that spatial prepositions, such as *up*, *down*, *on*, *off*, *in*, *out*, *over*, and *under* were said much earlier than the prepositions *with*, *by*, *to, for*, *at*, and *of* that are used to express case relationships. He also found that when the child did first start saying grammatical prepositions from the latter list, however, those prepositions were more often omitted in utterances than spatial prepositions from the former list. Littlefield (2005) did a corpus analysis using the CHILDES database (MacWhinney, 1993; MacWhinney and Snow, 1985, 1990) looking at the onset of prepositions for two children. The first child was studied from the ages of 1;2 to 4;9 and the second one from 2;3 to 5;1. Littlefield found that not only do prepositions differ in when children first produce them and how often children omit them, but also that prepositions with more content such as *in* or *on* are produced earlier and associated with fewer errors than prepositions with less content such as *of*. Specifically, content prepositions were first uttered when the children had MLUs of between 1.5 and 1.99. However, function prepositions with little or no content, such as *of*, were not uttered until the children had MLUs between 2.0 to 2.49. Once they were produced, content prepositions were used increasingly steadily and rapidly as the children developed, but function prepositions were used minimally and at a lower rate.

Other elements of prepositional phrases, such as case inflections, can also have differential emergence patterns. Recall that Icelandic marks the object for case associated with the preposition. Thordardottir and Weismer (1998) found that Icelandic-speaking children with MLUs ranging between 2.39 – 4.31 consistently omitted the preposition but marked the object with the correct case inflection to distinguish the meaning with (i.e., generally dative) or without movement (i.e., generally accusative). Even the youngest children with MLUs just over 1.0 used a large array of bound morphemes. This included dative and accusative case, although with some form errors, mainly for accusatives.

Sigurjónsdóttir (2005) also found that an Icelandic-speaking child aged 1;2 to 1;3 produced verb phrases in which a verb should take a prepositional phrase but only an inflected noun phrase appears.

In summary, collapsing across English and Icelandic and using MLU as a point of comparison, it seems that bound morphemes such as inflections appear first (MLU of 1.0), then content prepositions (1.55 to 1.99) and then function prepositions (2.0 to 2.49).[11] This variation in the onset of these different types of elements suggests systematicity of the child's developing production apparatus. Chapter 4 proposes in detail how such a system may handle these differences, but first the subsequent chapter discusses the differential properties of content and function prepositions and bound and free morphemes with which the system must contend.

11 Note that even though vocabulary level works better across languages than MLU does, MLU is used as a point of comparison because Thordardottir and Weismer only looked at MLU.

CHAPTER 3:
ANALYZING PREPOSITIONS

3.0 Introduction

This chapter discusses issues that arise in classifying prepositions, emphasizing distributional and statistical facts. It also provides further rationale for distinguishing FUNCTION and CONTENT PREPOSITIONS, as first mentioned in section 1.3. It motivates the structural analysis according to which function prepositions of English are case markers. Properties of Icelandic, an overt case-marking language related to English, are also described, and the same structure for function prepositions in English is shown for prepositional phrases in Icelandic.

3.1 Properties of lexical classes

The lexicon includes a broad spectrum of item types, ranging from highly-specified, richly evocative items like *dame* or *assassinate* to encyclopedically spartan but grammatically essential elements such as *whether* or *a*. Each lexical item is a member of a syntactic category, and these categories differ in important ways.

There are several ways to carve up our lexicon. However, different descriptions do not always neatly demarcate our lexical inventory. Some descriptions, for instance, focus on the division between semantic (or encyclopedic) and syntactic (or grammatical) information, such as CONTENT word and FUNCTION element (Klammer, Schulz, & Della Volpe, 2009). The meanings of content words are easy to provide rich encyclopedic descriptions for, whether they are concrete (*book, jump, red*) or abstract (*idea, governed, proud*). In other words, they are the elements that convey the essential concepts in communicating a message (Bowerman, 1973). This is in contrast to function elements whose meanings are harder to describe and are highly constrained highly constrained

(Landau & Jackendoff, 1993). Function elements often express a grammatical relationship among other content elements and often cannot occur independently of other elements. Determiners, auxiliaries, inflections, and prepositions are generally thought of as function elements. They are thus good candidates for omission when compared to content words, if there are constraints on how many words may be used and if a word's encyclopedic contributions to the message matter, as in composing a telegraph or text message.

The category of prepositions spans a broad semantic range. For instance, the meanings of some prepositions, such as *on*, are intuitively easier to pantomime or visualize independently of grammatical structure. Other prepositions, such as *of*, are not as easily explained without mentioning grammatical relationships, suggesting that the function/content division is relevant within this syntactic category. The bulk of this chapter will be devoted to motivating the content/function distinction within the category of prepositions, and to considering its implications.

Note that the content/function distinction is orthogonal to the free/bound distinction. The latter focuses on morphophonological rules specific to a language. A FREE MORPHEME can either be a content element (*book, idea*) or a function element (*the, by*). Likewise, a BOUND MORPHEME can either be a content element (*electr-, feroc-*) or a function element (*-ment, -s).* This will be important in discussion of Icelandic, in particular in contrasting certain prepositional phrases in English with those in Icelandic.

While the function/content division is largely semantic in nature, a related distinction which has also been discussed in connection with it is more syntactic in character.[12] The term OPEN-CLASS describes the syntactic categories that accept new lexical items, while the term CLOSED-CLASS describes ones that do not. Examples of open-class

12 Computational work by Thorne, Bratley, and Dewar (1968) is one of the earliest citations of the distinction between open- and closed-classes.

syntactic categories are nouns (e.g., *Skittlebrau*), verbs (e.g., *googled*), and adjectives (e.g., *grody*).[13] Examples of closed-class categories are conjunctions, determiners, pronouns, and prepositions. Open-class mostly overlaps with content elements, and closed-class with function elements, although there are some subtle yet important distinctions between the sets picked out by these different characterizations. Prepositions are generally considered closed-class words, just as they have traditionally been considered function words. But as noted above, they can uncharacteristically contain rich encyclopedic information, which is more typical of the open-class category. This chapter shows that prepositions can interact with other aspects of the system of language in more than one way.

3.1.1 Characteristics of content versus function categories and prepositions

In addition to conveying encyclopedic meaning or not, there are other important ways in which content and function words differ. They participate in distinct way in derivational morphological processes, for example. One such process is compounding, a morphosyntactic process that tends to apply productively to content words (Plag, 2003). For example, in English, nouns can compound with other nouns (e.g., *bedroom*), verbs (e.g., *haircut*, *browbeat*, *washing machine*, or *finger-pointing*), or adjectives (e.g., *bluebird* or *house poor*); verbs can compound with other verbs (e.g., *start walking*) and adjectives (e.g., *blacklist*); and adjectives can compound with adjectives (e.g., *Asian-*

13 The common mechanisms for introducing neologisms include coining (inventing a novel word such as *robotics*), acronyms (using the first initials of a description of something such as *scuba* or *laser*), borrowing (using a word that already exists in another language such as *taco*), compounding (adding words together that already exist in the language such as *black hole*), blending (merging parts of words together that already exist in the language such as *blog*) and derivation (adding affixes to change the part of speech of an already existing word such as *Californication*).

American).[14]

For most function words, however, compounding is not an option. For example, combinations of function words like the following are not imaginable or acceptable words: **the-an*, **the-or*, and **was-an*. Also, combinations of content and function words are not acceptable words either, such as **book-was.* This restriction also includes certain prepositions such as **do-of*, and **the-to*.[15] Yet, some prepositions are an exception. Interestingly, certain ones can participate in compounding with content words that belong to noun (e.g., *hoedown*, *passer-by*, *onlooker*) and verb (e.g., *outrun*, *overrate, throughput*) categories. They can also be combined with nouns to result as verbs (e.g., *out-fox*) and verbs to produce nouns (e.g., *lookout*). They can even combine with nouns (e.g., *side*) to form prepositions (e.g., *outside*) and they can combine with other prepositions, as will be shown in the following examples. Note that the prepositions involved tend to be content prepositions, (e.g. *out, down*). Content prepositions may even combine with other content prepositions (e.g., *through*) to form new prepositions (e.g., *throughout*). Also, although they are not necessarily compounds per se, when function prepositions are contained in a sequence of prepositions, it seems that only one function preposition, (e.g., *of*) may be included (e.g., *outside of*). Other examples exhibiting this constraint include: *through to*, *down to*, *on top of,* and *in front of*. Morris Bishop (1947) exploited the sequencing property of this word class in his poem *The Naughty Preposition,* quoted at the beginning of this document.

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14 Note that noun-verb compounds and verb-verb compounds are rare in English and have some constraints. For example, in verb-verb compounds, the first verb is usually considered a light verb and can change tense but the second verb is a gerund and is fixed (E.g., *She starts walking* versus *They start walking*.) Also, some verb-verb compounds require a conjunction such as *I'll go and see* or *He up and left.*

15 Although, it may be pointed out that are archaic exceptions such as *thereto.*

In poking fun at stranded prepositions, he used seven prepositions in grammatical constructions in lines 4 and 8:

> I lately lost a preposition
> It hid, I thought, beneath my chair
> And angrily I cried, "Perdition!
> Up from out of in under there."
> Correctness is my vade mecum,
> And straggling phrases I abhor,
> And yet I wondered, "What should he come
> Up from out of in under for?

Note that only one function preposition, *of*, exists in each of the sequences. Thus, some prepositions are not only clearly different from others in terms of their capacity to convey encyclopedic meaning, but this ability also affects their participation in combining with other prepositions.

3.1.2 Open- versus closed-class categories and prepositions

One additional distinction between closed- and open-class words, besides their potential for new members is that they vary in frequency of occurrence. Closed- and open-class words differ greatly with respect to frequency. Closed-class words overall have a much higher average frequency and much less variability, whereas open-class words vary greatly in frequency, with some appearing with high frequency and some with very low frequency. According to Kucera and Francis (1967) and Francis and Kucera (1984), the majority of the 50 most frequent words in English are closed-class.[16] (Please see APPENDIX A for specific list.) They constitute 40.6% of all of the word tokens, yet are only 0.1% of the word types. Furthermore, three quarters of the tokens – all open-class

16 Articles, prepositions, conjunctions, pronouns, auxiliaries, and quantifiers appear.

words – appear less than 0.01% as often as the most frequent closed-class word.[17]

Yet another distinction between open- and closed-class words involves prosody. The two word classes differ systematically in their phonological stress pattern, number and complexity of phonemes, and vowel duration. Closed-class words are often unstressed (*the, of, but*), in contrast to open-class words, which often have stressed syllables (Collins & Mees, 2003). Additionally, among open-class words, some even exhibit salient prosodic typicality, in which the majority of words within a syntactic category exhibit a canonical stress pattern (Farmer, Christiansen, & Monaghan, 2006). Such prosodic indicators of syntactic category include those of nouns (e.g., stress is on the first syllable of a two syllable word such as *CONtract*) and verbs (e.g., stress is on the second syllable of a two syllable word such as *conTRACT*). Closed-class words also tend to have fewer (Demuth, 1996) and simpler syllables (Morgan, Shi, & Allopena, 1996). The vowels in open-class words are also longer than in closed-class words (Cutler, 1993; Cutler & Carter, 1987), and this difference is particularly exaggerated in child-directed speech (Swanson, Leonard, & Gandour, 1992). Thus, closed-class words overall seem to be minimal on an acoustic-phonological basis, in comparison to open-class words (Morgan et al., 1996).

When considering these characteristics, prepositions are clearly a closed class. They are a category that very rarely, if at all, accepts additions.[18] And, although there are some exceptions of archaic forms, they also fulfill the closed-class criterion of occurring

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17 Note that the Brown Corpus (Kucera & Francis, 1967) shows frequency distributions in accord with Zipf's Law, which states that the frequency of a word is inversely proportional to its frequency rank. (Zipf, 1949). Following Zipf's law, the first ranked word, *the*, occurs 7% of the time in text, and the second ranked word, *of*, occurs 3.5% of the time in text and so on.

18 Kortmann and Konig (1992) argue that participles and gerunds can be categorically reanalyzed as prepositions and Vincent (1999) argues that articles can be categorically reanalyzed as prepositions.

with high frequency in a language.[19] As mentioned in Chapter 1, Svartvik (1988) reports that one in eight words in English is a preposition; Fang (2000) claims that one in every 10 is. Even the frequencies of function and content prepositions are closer to each other than other comparison pairs, such as the category of articles and the category of nouns. According to Mindt and Weber (1989), the Brown corpus (Kucera & Francis, 1982) shows the function preposition *to* as having a frequency of 1.1% and the content preposition, *in*, 2.0%. This is a stark contrast to the discrepancy between the first closed-class word on the list, *the*, and the first open-class word, *man.* The word *the*, which is the very first word on the list, appears 6.9%. The word *man,* however, is the 81st word and appears only 0.12% (Kucera & Francis, 1982). Prepositions also mostly fit with the closed-class prosodic criteria of phonemic minimality. They are often unstressed, have fewer and simpler syllables, and shorter vowel duration.[20] (See APPENDIX B for a list of English prepositions.)

Given these facts, prepositions are more similar to other categories of closed-class elements. When compared to open-class words, closed class words tend to impose more structural constraints. I now turn to discussion of analyses where prepositions align more with categories that offer relatively more content.

3.2 Phrasal categories and prepositions

Syntactic analyses are yet another type of diagnostic that further illuminates differing content and function roles, supporting the notion that prepositions are not a homogenous group. Lexical categories, like content elements, generally have encyclopedic content whereas functional categories, like function elements, do not (Haegeman & Guéron,

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19 Among some of the archaic exceptions are *nevertheless* and *heretofor*.

20 Note that there is even a degree to this, as illustrated by the *of* in *outta*, the *to* in *intuh* in which the last preposition of the combination is less stressed.

1999). Lexical categories generally include prepositions, nouns, verbs, and adjectives, and functional categories generally include case, inflections, and determiners. Although, there are different explanations given, the general consensus is that certain prepositions, such as *of* and *to,* sometimes appear in certain syntactic structures where they are considered functional categories and assign case. Thus, content prepositions fall under lexical categories and function prepositions, which assign case, fall under functional categories just like case inflections for other languages.

According to Rauh (1993), whether a preposition is a content or function preposition is determined by whether it can assign theta-roles or not. Content prepositions, which Rauh termed "lexical prepositions", determine a two-place argument structure and corresponding theta-roles. Thus, from her viewpoint, in addition to expressing roles assigned by verbs, content prepositions also assign roles themselves. The external argument is assigned the theta-role, THEME, and the internal argument is assigned any of the theta-roles of LOCATION, GOAL, SOURCE, PATH or ACCOMPANIMENT. For example, in (1), *threw* assigns the prepositional phrase headed by *on* the theta role of GOAL, and *on* assigns *the roof* the theta-role of LOCATION. (Original example shown as (53b) in Rauh, 1993, on page 119.)

(1) Bill threw the ball on[to] the roof.

In (2), the prepositional phrase is considered an adjunct phrase, so the verb does not assign a theta role to *on*. Thus, only *on* assigns *the hill* the theta role of LOCATION.[21]

(2) Bill kissed Mary on a hill.

Note that in (1), the preposition *to* can be added to the preposition *on* to further clarify that the verb assigned the prepositional phrase the theta role of GOAL. The preposition

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21 This is consistent with Tungseth (2006) who has proposed that prepositions can be either directional or locative (e.g., *on)* that "[o]n their locative reading, they appear higher up in the structure as adjuncts to the verb phrase, where they specify location for the event." (p. 30).

to does not assign a theta role to *the roof*. Thus, because *on* assigns theta-roles, Rauh argues that it, and similar content prepositions, are autonomous entries in the lexicon. Rauh argues that entries are considered autonomous when they do not depend on other lexical entries, as function elements often do.[22] (Implications of this with respect to lemma-driven production models will be discussed in Chapter 4.) Prepositions that do not assign theta-roles, such as *to* if it were inserted after *on* in example (1), however, do not have autonomous entries. These function prepositions, which Rauh termed "non-lexical" prepositions, include ones in fixed phrases that are part of the entry of a noun or a verb and ones that only assign case. (I will only expand on the latter type.) Rauh argues that together with the NP that expresses the theta-role assigned by the verb (or noun or adjective), these function prepositions that mark case form an NP that dominates them. However, unlike other case markings, which are assigned case by the element that governs them, these variants maintain their inherent case assigning abilities and placement. Examples of such variants are *of*, *to*, *for*, and *by*. Note that this list is not limited, though; any basic spatial preposition, including some derived ones, are candidates for this role depending on the syntactic structure they enter. The most common structures in which function prepositions with inherent case occur are with nouns or adjectives that may assign theta-roles to their complements, but cannot assign case. Such examples are constructions using genitives (e.g., *the mother of the groom*), deverbal nouns (e.g., *the painting of the house*) or adjectival heads (e.g., *she is proud of her class*) (Haegeman & Guéron, 1999). Thus, in (1) *to* is marks case.

Rooryck (1996) also argued that prepositions like *of* and *to* in English (and other certain prepositions in other languages) mark case, albeit providing structural analyses

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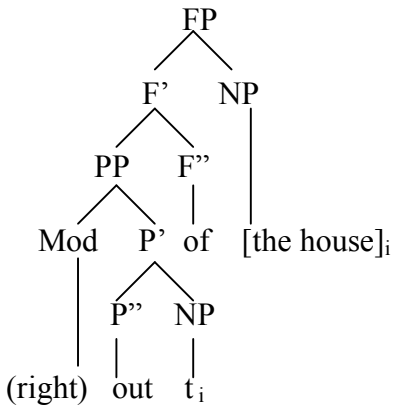
22 Rauh's assertion that content elements are listed as independent entries that drive theta-role structure is very similar to the function proposed of lemmas in production models, which will be discussed in Chapter 4.

with a different configuration of theta-role assignments than those proposed by Rauh. Specifically, he made a distinction between content and function prepositions in that content prepositions are heads of lexical categories, whereas function prepositions, such as *of* and *to*, are heads of functional categories. He used complex prepositions such as *out of*, *onto* and *into* to illustrate this.[23] Example (3) shows right branching of the case marker *of* when it occurs with a content preposition *out* (Original example shown as (19b) on page 234):

(3)



Importantly, the projection of the Function Phrase, F'' can select the lexical PP projection much like D selects an NP and I a VP. In this structure, Rooryck argued that *out* does not incorporate into *of* because if it did the usual rightward head adjunction would give **of out the country*, which is ungrammatical. Rooryck stated that non-incorporating case markers, such as *of* and *to* in these structures, can select both PP and NP in English. He claimed that the case markers *of* and *to* are simply spell-outs of directional meaning indicating the starting or ending LOCATION given by the 'true' heads of PPs *out*, *in,* or *on* and the SOURCE or GOAL given by the NP. Thus, although Rauh and Rooryck differ in what

23 Such complex prepositions are called "left-headed" because the first (left-most) P in the complex P is unambiguously the one that determines the selectional properties of the compound.

theta-roles are assigned to content prepositions and NPs, they converge on the conclusion that certain prepositions in certain syntactic structures, such as *of* and *to,* behave more like function elements. Specifically, Rauh's claim that function prepositions do not have autonomous lexical entries and Rooryck's claim that they are merely "spell-outs" of the structure has important implications for aspects of production models to be discussed in Chapter 4.

Several other linguists also argued for a similar distinction between content and function prepositions in languages besides English, albeit using different terminology. Demonte (1987) found in Spanish that the normally "semantically full" content preposition *a* serves merely as a case marker (function preposition) in certain structures. Tremblay (1996) maintained this distinction in her analysis of French prepositions, deeming content prepositions Dummy Case Assigners and function prepositions 'true empty' prepositions. Cadiot (1997) advanced this characterization of different French prepositions as well, but instead of treating them categorically, proposed a spectrum along which they can fall, with one end anchored by syntactic prepositions (function) and the other semantic (content) ones. Thus, from looking at cross-linguistic data there seems to be a general consensus that prepositions are not a homogenous category and can be like content or function elements. These alternative terms are summarized in Table 3.2.

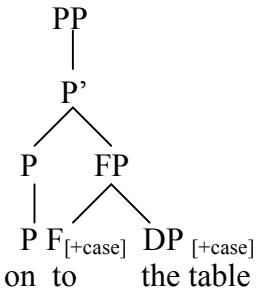
Table 3.2

List of terms that align with content and function descriptions

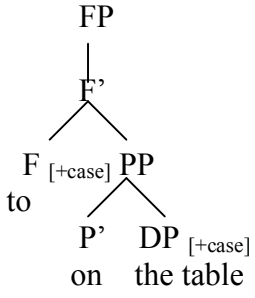
Author	Content Preposition	Function Preposition
Rauh (1993)	lexical preposition	non-lexical preposition
Rooryck (1996)	heads of lexical categories	heads of functional categories
Demonte (1987)	semantically full	case marker
Tremblay (1996)	Dummy Case Assigner	true empty preposition
Cadiot (1997)	syntactic preposition	semantic preposition

In choosing structures to best represent the underlying competence for speaking English with respect to prepositional phrases, there are at least two options. One option, (4), is a structure in which the prepositional phrase selects for a functional head that assigns case. The other option is a structure in which a case checking head is above the content preposition as proposed by Rooryck. In the second option, the content preposition can still determine case since it selects for the determiner phrase with an unchecked case feature, as in (5a). Then F' (e.g., *of* or *to*) checks it. The preposition then head-moves to F to generate the correct word order, resulting in (5b).[24] Because it is critical that there is separation of the content preposition and the functional case checker's F', the second option is preferred. It is more parsimonious in expressing the selection relation between the verb and GOAL theta-role of the functional head case checker.

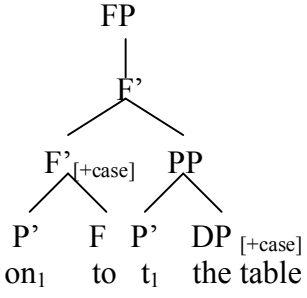
(4)



(5a)



(5b)



24 Note that the case checking relationship between F and D could be either *in situ* (i.e., undergoing covert movement) or a right spec configuration (i.e., overt movement) such as that specified by Rooryck (1996).

Before turning to Icelandic and the motivation for an analogous structure of prepositional phrases, I emphasize a point about the preceding section. Discussion of various diagnostics and processing vocabularies points to the conclusion that prepositions are not a homogenous category. Whether they are thought of as two separate groups or as two ends of a spectrum, much evidence supports the idea that CONTENT and FUNCTION PREPOSITIONS are different. This underscores the usefulness of prepositions as an experimental vehicle precisely because of their mixed status. This mixed status appeals to very different bases that are traceable to competence sources and processing sources. To further examine the difference between free function prepositions and bound case markings, this section now turns to the motivation behind examining children's use of prepositional phrases in Icelandic.

3.3 Case marking and prepositions: Motivation for Icelandic

As demonstrated by Rauh (1993) and Rooryck (1996) among others, some English prepositions in certain syntactic structures have assumed the role of case checkers. As mentioned in Chapter 1, Old English is thought to be the last version of English to have an overt case-marking system (Robinson, 1992).[25] Modern Icelandic is similar to Old English in important ways with respect to case marking[26]. Although the rich inflectional morphology of Icelandic is relevant to numerous syntactic phenomena, I focus only on those components relevant to prepositional phrases. Nominal inflection expresses the case

25 Note that Modern English still shows case in its morphology in some instances such as with pronouns such as *he* versus *him*.

26 With respect to morphology, Modern Icelandic has changed the least of all Germanic languages in the past thousand years (Thráinsson, 2007). In fact, speakers of Modern Icelandic can still mostly read and understand Old Norse writings, which differ mostly in pronunciations but have most of the same morphology and syntactic properties. Old Norse and Old English descend from the common ancestor Proto-German.

of the noun. If the noun is indefinite, it is inflected for case. If the noun is definite, it is inflected for case. Additionally, definite nouns expresses the definite article as a suffix, which is also inflected for case (Please see chart in APPENDIX C).[27] The definite article agrees in number and gender with the noun, and case is assigned by the preposition. Example (6a) shows nominative inflection of the definite noun *the rug*, (6b) shows accusative inflection, and (6c) shows dative inflection:

(6a) mottan
rug-the.FEM.SG.NOM

(6b) mottuna
rug-the.FEM.SG.ACC

(6c) mottunni
rug-the.FEM.SG.DAT

Most prepositions can assign either dative or accusative case, but some are restricted to assigning only certain cases.[28] (For specific examples, see APPENDIX D.) Often with rich case-marking languages there are associated meanings for use of the different inflections and prepositional phrases in Icelandic are no exception. Fillmore (1968) claimed that across languages there seems to be an organized universal set of semantic correlates with different cases: agent, experiencer, instrument, object, source, goal, place, time.[29] In general, for Icelandic prepositional phrases that denote a location

27 Indefinite articles are not expressed in Icelandic (Thráinsson, 2007).

28 Both dative and accusative cases can be considered lexically generated in some instances in Icelandic (Jónsson, 2003; see also Yip, Maling, & Jackendoff, 1987). (For a different view, however, see Svenonius (2002).)

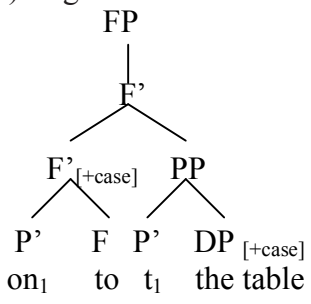
29 Note that later work by Grimshaw (1990) on the hierarchy of theta roles is similarly structured except for a few minor differences: Instead of Filmore's "object", Grimshaw uses "theme" and instead of her "place" he uses "location". Filmore also includes "time" and "instrument" which are mostly considered more adverbial.

without movement (i.e, place), the dative case is used. In general, to denote location with movement (i.e., source or goal), the accusative case is used.[30] For example, (7a) is used to describe an action in which the agent remained in the same location, whereas (7b) is used for an action in which the agent changed location:

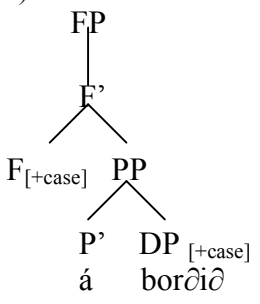
(7a)	Barnið	skreið	á	mottunni
	baby-the.NEU.SG.NOM	crawled	on	rug-the.FEM.SG.DAT
	"The baby crawled on the rug"			
(7b)	Barnið	skreið	á	mottuna
	baby-the.NEU.SG.NOM	crawled	on	rug-the.FEM.SG.ACC
	"The baby crawled on(to) the rug"			

Unlike function prepositions in English, case markings in Icelandic are bound morphemes. They agree in number and gender with the noun to which they are affixed and are dependent on the case of the preposition. Despite the differences in free and bound morphology, it is assumed that the underlying syntactic structures are remarkably similar, with the one for English shown in (8a) (same as (5b))and the one for Icelandic shown in (8b).[31]

(8a) English



(8b) Icelandic



30 Exceptions to this correlation include some prepositions such as *með,* translated as *with* in English, although this may still show affectedness (Einar Freyr Sigurðsson, personal communication, June 2010).

31 Note that there is leftward head to head movement for the content preposition in English, *on* in example (18a), for the correct word order.

The English-speaking child and the Icelandic-speaking child thus face a similar problem space in terms of mastering competence of the prepositional phrase. Recall that English-speaking children are more likely to omit a function preposition in an utterance, and Icelandic-speaking children are more likely to include case marking in an utterance. Because the relevant underlying competence is similar, this difference calls for an explanation elsewhere. As will be shown in Chapter 4, a better explanation of this cross-linguistic difference in omission patterns lies in the production system itself, as the production system handles free and bound function morphemes differently, making the former type more vulnerable to omission than the latter type.

CHAPTER 4:
CONCEPTUAL FRAMEWORK FOR A PRODUCTION ACCOUNT

4.0 Introduction

This chapter describes adult production models and extends them to account for child production performance. Models of adult language production draw upon rich observational and experimental foundations and there are general architectural features of those models that are widely accepted in the field. These will be sketched out with focus on particular features of certain models that are central to the investigation of telegraphic language. Specifically, the emphasis is on the distinction of the roles and timing of content and function elements in online processing and why differential recruitment of certain function elements may render them more vulnerable to omission in children's speech than in adults'.

4.1 General components of sentence production models

Although there is variation in proposals regarding implementation, four major components in sentence production are generally agreed upon: CONCEPTUALIZING, FORMULATING, ARTICULATING, and SELF-MONITORING (Levelt, 1989, p. 9 – 13). CONCEPTUALIZING involves developing the message we would like to communicate. FORMULATING requires turning the message into a linguistic plan. This involves accessing lexical content elements, and building the grammatical structures for the lexical elements as well as the phonological structures that can control motor systems that generate speech. ARTICULATING is the step in which the speech muscles (lips, tongue, jaw, and larynx) coordinate with each other to execute the phonetic instantiation of the linguistic plan. SELF-MONITORING involves assessment of our own speech regarding whether what

we said was exactly what and how we intended it to be.[32] Figure 4.1 (adapted from Bock and Levelt, 1994, and Bock, 1995) summarizes three major phases of sentence production, originating from Garrett's (1975) model. The figure specifically labels the conceptualizing component as the MESSAGE COMPONENT, the two important features of the formulating component as the FUNCTIONAL and POSITIONAL processing levels, followed by an articulating component the PHONOLOGICAL COMPONENT.

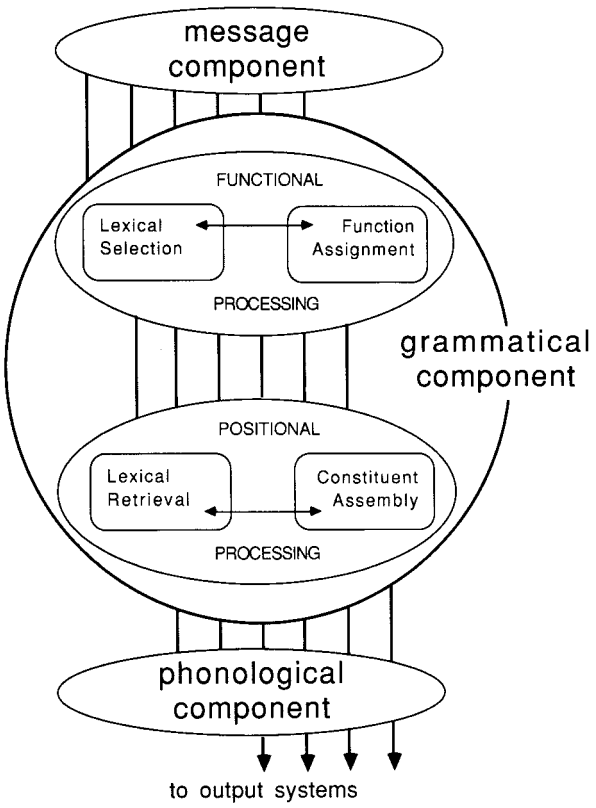


Figure 4.1. Multi-stage production model adapted from Bock and Levelt (1994) and Bock (1995)

Within the scope of this dissertation, the formulating component has the key features (within the FUNCTIONAL and POSITIONAL processing levels) essential to my experimental

32 Although articulation and self-monitoring are important aspects of sentence production, it will not be detailed in this dissertation.

approach. Thus, discussion in the remaining sections is narrowed down to this component and the motivations for its detailed elaboration.

4.1.1 Early evidence for two important features of sentence formulation

There are two core ideas in modeling sentence production. One is staged processing for building successive levels of sentence structures. The other is a corresponding staged lexical retrieval system. Broadly speaking, the distinction in both cases is between processing that represents logical and semantic properties of sentences and processing that represents the constraints of sequencing and pronouncing sentence components. Fromkin (1971) provided an early example of these processing contrasts.[33] Specifically, she provided a systematic account for a comprehensive set of speech error observations that showed the psychological relevance of linguistic theory of the time.

The speech errors that she and other investigators observed and interpreted come in many different types (see Garrett, 2007, for a review). The errors of central interest, however, are those in which one or more target elements of speech are uttered in the wrong location. Example (9) illustrates an utterance in which the first phoneme, [h], of *history* has shifted, appearing before *ideology* (original example is listed as (23c) in Fromkin, 1971, on page 231):

(9) A *history* of an *ideology* → An *istory* of a *hideology*

Examination of the kinds of misplaced elements and their structural environments allows for many detailed inferences about processing events and their ordering. With respect to the development of sentence production theory, Fromkin's observations of *phonetic accommodation* and *stress stranding* illustrate one of the arguments for staged processing

33 Earlier analyses of speech errors include those of Freud (1901). However, they were under the theoretical framework of psychoanalysis and were not linguistics based.

in production. These complementary phenomena motivated the separate ordering of abstract syntactic representation and phonologically interpreted objects, later associated with a stratification of FUNCTIONAL and POSITIONAL LEVELS seen in multilevel models, such as that shown in Figure 4.1.

Phonetic accommodation occurs after the shifting or exchange of sound(s) or word(s) in which the contiguous function words or affixes have adjusted to the phonetic environment created by the error. Example (9) from Fromkin (1971) illustrates such accommodation for a sound shift. Note particularly that the article is *a* for *history* and *an* for *ideology* in the target sentence, however it is *an* for *istory* and *a* for *hideology* in the speech error. The error utterance thus has the correct morphophonemic alternations of the indefinite article, *an* when it appears before the word-initial vowel and *a* when it appears before the word-initial consonant. In other words, the forms of the articles accommodate to the forms of the nouns. Hence, the processing that provides morphophonemic information prior to phonological encoding seems to apply later than processes that order words in the sentence representation. (If this sequencing were not the case, the error would manifest as *a istory of an hidealogy*.)

Stress stranding refers to the preservation of phrasal stress in exchange errors, such as with word exchanges, as shown in example (10), (original example is listed as (24h) in Fromkin, 1971, on page 232):

(10)

	2	1		2	1
in the *theory* of *phonology*	→	in the *phonology* of *theory*			

Note that the intended stress contour is maintained and does not change with (i.e., tag along with) the exchanged words, *theory* and *phonology*. This shows that an abstract syntactic representation, reflected in the phrasal stress, is separate from morphophonemic form of the lexical content.

The separate processing of logical and semantic information from sequencing and pronunciation information, as exemplified by phonetic accommodation and stress stranding, specifically suggests that phonological specification of stranded and shifted function elements occurs after that of content elements. This kind of distinction, first motivated by Fromkin's work, lays the foundation for the hypothesis of this dissertation and is thus the focus of the balance of this chapter, with extension of her observations and interpretations present in various multi-stage sentence production models.

4.1.2 Current multi-stage sentence production models

As noted in the beginning of this chapter, the models to be mentioned here assume that we start sentence production with a message and end with a motor plan to articulate that message. The proposed details of this multi-step process between the starting point and ending point vary somewhat, but this general processing picture is a feature of several prominent current models. These incorporate and expand on Fromkin's original observations in multi-stage sentence production models, e.g. Garrett (1975, 1982), Dell (1986), Bock, (1987), Levelt (1989), and Bock and Levelt (1994).

Modern multi-stage models elaborate the detail of sentence formulation processes that Fromkin (1971) originally proposed. Separate FUNCTIONAL and POSITIONAL levels constitute the formulation component. Note that the FUNCTIONAL level connects to MESSAGE level representations and is thus under direct conceptual control. More recent models such as those proposed by Garrett (1975, 1982), Dell (1986), Bock, (1987), Levelt (1989), and Bock and Levelt (1994), represent further detail regarding lexical processing that is associated with FUNCTIONAL and POSITIONAL levels. MESSAGE-driven selection of content words is represented by retrieval of lexical entries labeled LEMMAS and these can link with abstract grammatical functions. Information in a LEMMA entry includes the abstract semantic features and the morphosyntactic category features of a word. At the

POSITIONAL level, LEMMAS are linked to phonologically represented word forms or LEXEMES, and grammatical operations that translate FUNCTIONAL structures into specific phrasal structures. Information included in a LEXEME entry determines the pronunciation of the word. Information to be associated with the phrasal structures is stress and intonation and pronunciation of other elements not included in the LEXEME list, such as function elements. The forms and phrasal structures can be then associated with a detailed phonetic level representation that can control instructions for articulation.

The specific nature of the staged lexical and sentence structure processes within the formulating component is central to the dissertation experimentation. Evidence for details of those processes of multi-stages comes from converging sources. The next section summarizes some relevant features of that evidence.

4.2 Evidence for multi-stage production models

The divide within each of the two levels of the formulating component of the multi-stage model (the Lemma/Lexeme distinction and the structural distinction between Functional and Positional levels) can be derived from spontaneous speech error patterns, from experimental studies, and from neuropsychological evidence. Section 4.2.1 reviews some evidence for the Functional/Positional structure contrast and section 4.2.2 some evidence for the Lemma/Lexeme contrast.

4.2.1 Functional and Positional Levels

Garrett (1975, 1982) argued extensively for speech error patterns as support for staged sentence structure building. To the Fromkin observations, he added evidence for a contrast between movement errors that involve lexical elements and those that involve sound elements. For these word exchanges and sound exchanges and other related observations, Garrett (1975) postulated a model with Functional and Positional

structures. The former assigns thematic roles (referred to as Function Assignment in Figure 4.1) to the various lemmas selected (Lexical Selection in Figure 4.1), whereas the latter assembles detailed surface constituents (Constituent Assembly in Figure 4.1) by incorporating retrieved forms of content words (Lexical Retrieval in Figure 4.1) with their inflections and closed-class words. Importantly, Garrett (1982) argued that the inflections and closed-class words such as "minor category free forms" (p. 50) are fixed by a different path than the process of lexical retrieval necessary for content words. Specifically, he argued that they are not represented until the positional level and are phonologically interpreted in a separate and later operation.

Two very important ranges of experimental investigation also support the separation of Functional and Positional levels. One of these comes from experimental studies demonstrating a level of syntactic organization in language production processes that is not semantically interpreted, but is strongly sensitive to syntactic configurational constraints. This is the work on syntactic persistence initiated by Bock (1986), and later pursued at length in many related experiments, such as in Bock (1989) and Bock and Loebell (1990)). Bock (1989) found that elicited utterances were influenced by a prime's construction type, suggesting priming at a separate positional level. Interestingly, she also found that differences between prepositions (e.g., *to* versus *for*) did not affect priming.[34] Bock and Loebell (1990) extended the findings of syntactic persistence to thematic role and grammatical role information associated with phrasal constituents. They found not only that locative and benefactive primes were equally effective in producing elevated prepositional datives, but so were passives, showing that sentences with very different event structures could still have similar priming effects on surface structure.

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34 Examples are the dative constructions below (Bock, 1989, p. 169):

(i) *The secretary is taking a cake to her boss.*

(ii) *The secretary is baking a cake for her boss.*

The second range of experiments that is set within the Functional/Positional framework revolves around the processing of number agreement mechanisms. These studies, initiated in work by Bock and Miller (1991), provided a rich array of detailed claims about the internal organization of syntactic processing levels. The key finding was that the semantic features of a subject have little bearing on the morphosyntactic processes that are required for agreement, again suggesting separation of somewhat autonomous Functional and Positional processing levels (see Bock et al., 2007, for extensive review and extended interpretations). Additional evidence supports separation specifically of the corresponding lexical selection and lexical retrieval mechanisms, also known as Lemma and Lexeme Levels, as detailed in next section.

4.2.2 Lemma and Lexeme Levels

Early work on speech errors by Fay and Cutler (1977) called particular attention to the lexical issues of formulating a sentence. Different properties of meaning- and form-based word substitution errors strongly suggested segregation of selection and retrieval operations. An additional phenomenon that relies on separate lemma and lexeme levels is when successful selection of a lemma is followed by an unsuccessful retrieval of the corresponding lexeme. Termed a "tip-of-the-tongue" state by Brown and McNeill (1966), this describes the state in which speakers know the detailed meaning of a word they want to say but are not able to remember how to fully pronounce it, despite some fragmentary awareness of the word's length in syllables, phonetic stress, initial phoneme as well as some lemma-specific information like mass/count distinction in English and gender in languages such as in Italian. (See Meyer & Bock, 1992, for experimental efforts to locate the locus of this phenomenon within multi-stage models.) For individuals with aphasia, this state is frequent and is clinically known as anomia. (See Vigliocco, Antonini, & Garrett, 1997, for details on Italian-speaking patients.)

A large set of experiments is also available that supports the lemma and lexeme distinction. For example, the work of Levelt et al. (1991a) with picture-word interference tasks show words that are semantic distractors to the target lemma slowed picture-naming times and that phonological distractors facilitated naming times. These effects showed a different time course, suggesting successive activation of lemmas and their lexemes (see also Dell & O'Sheaghdha, 1991, and Levelt et al., 1991b).

4.3 Open- and closed-class processing in multi-stage models

The general architecture of lexical processing levels sketched in 4.2 also incorporates aspects of open class and closed class vocabulary processing (some features of which were described in section 3.2). Several different sources of evidence motivate the open- and closed-class distinction: Speech errors, neuropsychological patterns, and experimental findings. Recall that the Fromkin examples in section 4.1.1 suggest that phonological specification of stranded and shifted function elements comes later than that of the content words. Another type of speech error to add to the evidence for this separation of open- and closed-class elements is stem exchanges. Example (11) illustrates such an error (original example is listed as (b) in Garrett, 1982, on page 49):

(11) She *slant*s her *writ*ing → She *write*s her *slant*ing

Note that the open-class words *slant* and *write* have switched places, yet the closed-class, function morphemes, -*s* intended for *slant* and -*ing* intended for *write,* remain at the positions *slant* and *write* should have been in. When *write* appears in the place of *slant*, it acquires the -*s* intended for *slant*, resulting in *slants*. And when *slant* appears in the place of *write*, it acquires the -*ing* intended for *write*, resulting in *writing*. In other words, only the stems have exchanged, with a sort of "inflectional stranding". If the open- and closed-

class morphemes of a word were represented together as a unit in the lexicon, we would predict the speech error to look like this: *She writing her slants*, in which the whole words, *writing* and *slants* (with their open- and closed-class morphemes), would have exchanged with each other. This is not the case, and thus suggests that open- and closed-class morphemes are represented separately.

Morpheme shifts are another type of error that reveals separate processing of open- and closed-class morphemes. An example is given in (12) (original example is listed as (e) in Garrett,1982, on page 51):

(12) I had forgott*en* about that → I had forgot about*en* that

In Example (12), the inflection morpheme, the past participle *–en*, was intended for *forgot* but ended up moving to *about*. Note that *about* is a preposition, not a verb, and does not take a past participle morpheme. Garrett (1982) linked this to post-lexical morphophonological operations at the positional level in which the attachment of an inflected morpheme is not restricted to the word form and syntactic category, as might be derived from the lexicon.

Neuropsychological data augments the speech error data. It also indicates that open- and closed-class elements are differently accessed (Bradley, 1978; Bradley, Garrett, & Zurif, 1980). For many agrammatic Broca's aphasics, telegraphic speech is the hallmark of their pathology. Closed-class elements are quite difficult to retrieve during speaking, while open-class ones present less difficulty (Saffran, Schwartz, & Marin, 1980a; Saffran et al., 1980b).[35] For example, when read aloud, pairs of homophones, in which one is closed- and the other is open-class (e.g., *est* in French as the copular "to be" or the cardinal direction "east" or *would* versus *wood* in English) are pronounced

35 As mentioned before, anomia is common for most aphasics.

more often with the stress and intonation of the open-class version. They are also more correctly pronounced as open-class than closed-class when presented in their respective sentence frames (e.g., unstressed *will* as the auxiliary verb in English versus the stressed *will* as the legal document) (Andrewsky & Seron, 1975; Friederici & Schonle, 1980; Biassou et al., 1997). The aphasia data noted and related observations seem to best fit a staged model. (For a systematic discussion of these issues, see Schwartz et al., 2006)

Finally, experimental work cited earlier as relevant to the distinction between Functional and Positional processing also motivates the segregation of open- and closed-class morphemes in sentence production. Recall the Bock (1989) experiments in section 4.2.1, in which there was no differential priming effect for function prepositions like *to* and *for*. They primed each other with equal effectiveness. The failure to find priming effects specific to the identity of closed-class words contrasts sharply with findings of lexically specific priming effects for open-class words (e.g., see work by Pickering & Branigan,1998). This pattern fits Garrett's (1982) observation that free-standing closed-class morphemes – such as the function prepositions in Bock's experiments (1989) – are represented abstractly at the positional level. Thus, the conclusion that closed-class items are recruited in late structural processing is secure on multiple grounds.

4.3.1 Status of prepositional phrases in multi-stage sentence production models

This section now examines what the various lines of evidence suggest for the status of prepositional phrases in a multi-stage production model. The speech error distributions (stranding and shifts), aphasia patterns, and differences in priming effects described in previous sections are strong indicators that there is a level at which open- and closed-class elements are distinct. So where do prepositions fall? It depends on whether they are content prepositions or function prepositions, as discussed in Chapter 3. Indeed, some speech errors reveal a preposition's status as being a content preposition. Examples

such as (13) below illustrate that some prepositions can participate in word exchanges, a phenomenon typical of open-class words (original example is listed as (26) in Garrett,1975, on page 155).[36]

(13) Every time I put one of these buttons *on* [my shirt],
another one comes *off* [of my shirt]
→ Every time I put one of these buttons *off*,
another one comes *on*

Also regarding prepositions, Friederici (1982) showed that they, despite being closed-class, only exhibit the vulnerability found in Broca's aphasics in some situations. She tested German-speaking aphasics on prepositions that vary in their syntactic and semantic roles. Specifically, the same form of a preposition (e.g., *auf*) can either additionally provide semantic information (serving as a content preposition) or be obligatorily syntactic (serving as a function preposition). Prepositions that provide semantic information are freely substitutable. Example (14a) shows *auf* in this role as a lexical preposition. Obligatorily syntactic prepositions, on the other hand, provide no encyclopedic information but are selected by the preceding verb. Example (14b) shows *auf* in this role:

(14a) Peter steht *auf* dem Stuhl. (Peter stands on the chair.)

(14b) Peter hofft *auf* den Sommer. (Peter hopes for the summer.)

Freiderici (1982) found that in a production task, Broca's aphasics tended to omit obligatory prepositions such as the one in (14b) more than lexical prepositions such as the one in (14a). Wernicke's aphasics, however, were able to produce more obligatory prepositions than lexical prepositions. Furthermore, when patients substituted words

36 Although *on* and *off* may look like particles, they do not pass classic particle tests such as undergoing particle shifts. Instead, they are considered preposition with dropped objects (personal communication with Heidi Harley, February 8, 2011).

for the target prepositions, Broca's aphasics more often used words that were not prepositions whereas Wernicke's aphasics almost always used other prepositions. These replicate findings from Freiderici (1980, 1981) confirming that the early structural assignment necessary for recruiting closed-class items in sentence production is impaired in Broca's aphasics. Within the experimental realm of data, recall again that in the Bock (1989) experiments (introduced in section 4.2.1), the specific prepositions that were not affected by priming were *to* and *for*, which are function prepositions. Thus, from several angles, it is clear that the relevant contrast among prepositions is plausible: Content prepositions are more like open-class words and function prepositions are more like closed-class words. So then, what might be the respective pathways of content versus function prepositions in online sentence production that underlies this distinction? Further, what might be the pathway of a bound morpheme such as a case inflection suffix, in contrast to a function preposition?

Referring to Figure 4.1, a content preposition like *out* has an autonomous lexical entry, and hence will start out as a lemma in the lexical selection step. Lemmas are then mapped to the positional level through the functional structure. Each lemma representation is then coordinated with its lexeme. A free function preposition like *of*, on the other hand, does not have an autonomous lexical entry and thus does not start out as a lemma. Instead, such morphemes enter the structure when called indirectly by lemma-driven information during the construction of the positional level. Their abstract features are assigned at the constituent assembly step and their forms are retrieved only after the content lexemes in the sentence have been selected for at the lexical retrieval step. In Icelandic, both the noun and the definite article are inflected for case, number, and gender. Thus, the case-inflected definite article suffix–*inu* is a bound morpheme. Bound morphemes, like function prepositions, also do not have autonomous lexical entries and thus do not start out as lemmas. They go through the same process described above for

function prepositions: Their abstract features are assigned at the constituent assembly step and their forms are retrieved only after the content lexemes in the sentence have been selected for at the lexical retrieval step. An important difference between a free function morpheme in English and a bound function morpheme in Icelandic is that, in the last step, form retrieval is facilitated by the lexeme. This is because the content stem of the lexeme – the inflected noun to which it is attached – cannot stand alone. It is the content stem's support of the case-inflected definite article suffix that is hypothesized to make bound function morphemes less vulnerable to omission than free function morphemes in online production. Conversely, free function morphemes can be omitted. Because they are free, they are more readily omitted than bound function morphemes.

4.4 Production account of children's omission of prepositions

Section 4.3.1 argues that function prepositions and case inflections are realized at the positional level in a two-stage production model. Function prepositions are more vulnerable to omission than case inflections because of both their morphosyntactic and wordhood status. They thus do not have the advantages of indirect linking that case inflections do as bound morphemes. That working assumption can be used to explain the omission of free versus bound function elements in telegraphic speech of children. McKee (1994) argued that the two observations reviewed in previous sections matter to an account of children's telegraphic speech. First, these closed-class morphemes are selectively susceptible to errors in the spontaneous speech of normal, fully competent adults. Second, the selective impairments are seen in the patterns of error and omission in aphasias. This leads one to take seriously the proposal that the systematic features of telegraphic speech in children reflect performance issues, not competence issues. Children seem to omit function morphemes whose forms are not readily available. Although adults and children both draw upon the same production system, children have

fewer or limited resources for memory (cf. Valian, 1986), less practice with coordinating the information in the system and slower processing speed which could affect timing control of coordinating that information (McDaniel et al., 2010). Hence, they may have more difficulties with function morphemes because they are realized late in the encoding cycle during online processing (i.e., late in positional level processing). (The potential impact of these three factors – memory, practice, and coordination – will be discussed in further detail in Chapter 8.) Additionally, McKee and Emiliani (1992) have shown that in a heavily inflected language, children in the telegraphic stage rarely omit an inflection for words whose stems cannot stand alone (see also McKee & Iwasaki, 2001). This also seems to be true for Icelandic prepositional phrases as observed by Thordardottir and Weismer (1998) and Sigurjónsdóttir (2005). Since the stems support affixing of bound morphemes, inflections are less susceptible to omission than free function morphemes. If children omit function morphemes that are free but are less likely to omit function morphemes that are bound, then experimental investigation of child language performance across languages around the ages of telegraphic speech has the potential to reveal that. To pursue this question experimentally, comprehension and elicited production tasks are employed to test children's knowledge and processing of function elements in prepositional phrases in English and Icelandic. Extended discussion of methodological considerations for the experiments in this dissertation follows in Chapter 5.

CHAPTER 5:
METHODOLOGICAL CONSIDERATIONS

5.0 Introduction

It is clear that function morphemes are different from content morphemes. But, are bound and free function morphemes different? Before testing the hypothesis that the production system handles free and bound morphemes differently, there are several methodological issues to consider. A cross-linguistic comparison of performance for certain types of prepositional phrases in English and Icelandic is central to the study. The comparison will involve closely parallel production and comprehension tasks to test performance across modalities. The rationale for inclusion of adults and grouping children according to vocabulary size is also explained in further detail. Specific hypotheses and predictions follow.

5.1 Overview of materials and tasks

The experiments of this dissertation tested children's and adults' production and comprehension of prepositional phrases. The selected prepositional phrases each conveyed a spatial relation with a TRAJECTOR, or an object with the potential to move, and BOUNDED LANDMARK, or a stationary object (Johnson, 1987). Specifically, the prepositional phrases were chosen from each language because they conveyed either location with no change or location with a change (i.e., location plus a direction). For English, the former is a mono-morphemic content prepositions (e.g., *on*) and the latter is a multi-morphemic content and function preposition combination (e.g., *onto*). For Icelandic, prepositions for no change in location most often assign dative case to the object, such as *á mottunni* (*on the rug*), and prepositions for change in location assign accusative, such as *á mottuna* (*onto the rug*), although there can be exceptions (Árnason, 1980). Examples (15a) – (15d)

and (16a) – (16d) show the specific English prepositions that were tested. (The specific list of English materials (or target responses) can be found in APPENDIX E.) Different types of Icelandic prepositions were tested. One set alternates between accusative and dative case on its noun. Examples (17a) – (17c) show the specific Icelandic prepositions and their associated accusative and dative inflections tested. Another pair tested dative case for one form of the preposition and accusative case for another form of the preposition. Example (17d) shows the preposition and its associated dative case and (17e) a similar form and its associated accusative case. A first set required accusative case on the noun mandatorily, not allowing for alternation of accusative and dative case. Examples (18a) and (18b) show these prepositions and their associated dative case. (The specific list of Icelandic materials can be found in APPENDIX F.)

(15a) in
(15b) out
(15c) on
(15d) off
(16a) into
(16b) out of
(16c) onto
(16d) off of

(17a)	undir	-inum/inn, ið
	under	DAT/ACC
(17b)	yfir	-inu/ið, inn
	over	DAT/ACC
(17c)	á	-inni/ina
	on	DAT/ACC
(17d)	inn í	-inum
	inside	DAT
(17e)	inni í	-inn
	into	ACC
(18a)	út úr	-inum
	out of	DAT
(18b)	af	-ina
	off of	DAT

In the experiments reported here, the meanings of the prepositions are conveyed through events acted out with toy animals serving as trajectors and objects serving as bounded landmarks by one experimenter while another experimenter covers his or her eyes during the events. For example, an event may involve a sheep (trajector) initially inside a box (bounded landmark) that jumps in place or a sheep (trajector) initially inside a box (bounded landmark) that jumps out of a box. Production of the prepositions is elicited by probe questions asked by the second experimenter such as (19) in which the target response is (20). Likewise, comprehension of prepositions is tested by probe questions such as (21), in which the target response is (22).

(19) Experimenter 2: *Where did the sheep jump?*

(20) Child: *In the box.*

(21) Experimenter 2: *Which one jumped in the box?*

(22) Child: *The sheep*

Production probes always immediately preceded comprehension probes. This was done for every preposition in English mentioned in the examples above for the English-speaking participants and every preposition and associated case marking in Icelandic mentioned in the examples above for the Icelandic-speaking participants. (Experimental scripts can be found in APPENDICES G and H for each language, respectively.) The next section discusses in more detail why certain prepositional phrases were useful for the experimental design in each language.

5.1.1 English prepositional phrases

For an experimentally sound design, it is necessary to use probe questions that are similar to each other to elicit target utterances that differ only in whether a free function preposition is required or not. Comparing mono-morphemic content prepositions such as the location prepositions *in*, *out*, *on*, and *off* and multi-morphemic content function

prepositions, such as the location+direction prepositions *into*, *onto, out of* and *off of* seems to satisfy this design constraint.[37] To examine the existence and emergence of multi-morphemic prepositions in naturalistic data, a preliminary corpus analysis was performed.[38] Following Littlefield's (2005) corpus study of the function preposition *of* that is discussed in Chapter 2, the CHILDES files for Sarah and Naomi were analyzed; the files for Adam and Eve were added to get more power (Brown, 1973). Comparison to Littlefield required an MLU calculation for each child (based on the utterances in each file). All corpora were searched with a script that looked for multi-morphemic content/function prepositions like *across from, into, next to, off of, onto,* and *out of*. The matched utterances were logged in a file tagged with the child's filename, that file's MLU, and the particular preposition.

We asked whether multi-morphemic prepositions appeared at the same MLU-defined stage as *of* does or later. Recall from Chapter 2 that Littlefield found content prepositions like *in* earlier than the function prepositions *of* in her analysis of spontaneous speech of two children.[39] If a phrase that requires a second preposition affects processing, it would be revealed by a later onset than *of*. We found that multi-morphemic content/function prepositions emerged in the same MLU-defined stage as *of* (the latter MLU range established by Littlefield). Thus, this suggests that comparing mono-morphemic content prepositions with multi-morphemic content/function preposition units does not appear to be effectively different than comparing mono-morphemic content prepositions with mono-morphemic function prepositions. This particular comparison is important

37 Note that the *to* in *into* and *onto* is represented as a free form much like the *of* in *out of* and *off of*, with respect to linguistic theoretic analysis, despite its orthographical representation.

38 This was done with fellow graduate student, Dainon Woudstra, Human Language Technologies Program, Linguistics Department, University of Arizona.

39 Valian (1986) reported *in, on, of,* and *to* at the same time, but she had six subjects and they were older and had longer MLUs. Her lowest studied MLU was 2.13, while Littlefield's was 1.50.

in that one target utterance should contain a function preposition (as part of the multi-morphemic content/function preposition) and one should not (as with the mono-morphemic content preposition).

5.1.2 Icelandic prepositional phrases

Chapter 3 pointed out that similar information regarding case is manifested differently in Icelandic than in English. Case is conveyed as free function prepositions in English (Rauh, 1993; Rooryck, 1996) but presents itself as the bound inflections of prepositional phrases in Icelandic, with accusative case most often assigned to movement location prepositions and dative to non-movement location prepositions (Árnason, 1980). Recall that although a noun stem can appear by itself without inflection in English (e.g., *dog* in utterance *the dog are jumping* when the target is *the dogs are jumping*), a noun stem cannot appear by itself without case inflection in Icelandic prepositional phrases. This difference between free and bound morphemes has consequences for production and shows up differently in Icelandic than in English in telegraphic speech. For example, an Icelandic-speaking child may first say the noun inflected for case, such as *húsi*, instead of the preposition and noun inflected for case, such as *í húsi* (Thordardottir & Weismer, 1998; Sigurjónsdóttir, 2005). This is different from that of an English-speaking child, who may first say a mono-morphemic content preposition, such as *in*, instead of a multi-morphemic content preposition plus function preposition, such as *into*.

Thus, testing of production and comprehension of Icelandic was modeled after the experiments in English to allow for comparing the languages. The same pairing paradigm of location and location+direction prepositional phrases was used. For experimental contrast, pairs of accusative and dative cases were tested for the same preposition, as most prepositions can alternate in case (Einarsson, 1949). In addition, some prepositions that did not alternate for case were tested. This was intended to probe for the likelihood of

incorrect case inflection that would otherwise fit the pattern found for other prepositions For example, do children inflect all location+direction with accusative case even though the correct case for that particular preposition is always dative?

5.2 Techniques of the elicited production paradigm

As mentioned earlier, this dissertation employed two tasks to test each participant: one production task and one comprehension task for each prepositional phrase. The production task relied on felicity conditions or situations that limit pragmatically appropriate responses. This section describes such techniques from the elicited production paradigm with children (Berko, 1958; Bellugi, 1967, 1971; Hamburger & Crain, 1982; Crain, McKee, & Emiliani, 1990; and McKee, McDaniel, & Snedecker, 1998). Obtaining target utterances can be challenging and can be especially challenging with children. In comprehension research, the target items can be manipulated by the experimenter. However, in production research, especially of spontaneous speech, the target utterance is created by the speaker and thus, the experimenter has less or no control over it.

Experimental elicitation of production data offers more control than do naturalistic observations of spontaneous speech. Early use of the elicited production technique has informed morphological (Berko, 1958) and syntactic development studies (Bellugi, 1967, 1971), and most recent use has tested competence of complex syntactic structures, such as relative clauses in English (Hamburger & Crain, 1982; McKee et al., 1998), Italian (Crain et al., 1990), French (Labelle, 1990; Guasti & Schlonsky, 1996), and Spanish (Perez-Leroux, 1995).[40] Elicited production neither leaves researchers passively

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40 Thornton (1996) provides a non-exhaustive list of other grammatical features and constructions that have been researched using elicited production techniques: structure dependence (Crain & Nakayama, 1987), *wanna*-contraction and *that*-traces (Thornton, 1990; Crain, 1991), Italian clitics (McKee & Emiliani,

waiting for a child to say a particular sentence nor requires them to overtly provide the child with the target sentence. Experimenters instead achieve a balance of manipulation by honing in on the message level (in the models of Garrett, 1980, and Levelt, 1989, etc.), providing the lexical items, and maximally narrowing in on the target utterance. This is done through the experimenters specifying what needs to be communicated by (1) conveying events through actions with objects (e.g., the message), (2) labeling the objects in the events with the lexical items, and (3) setting up a discourse (e.g., by simply asking questions, or encouraging the child to tell a puppet to do something, such as *Pick up…* or *Point to…*) in which the target utterance is the most pragmatically appropriate response. Thus, the speaker understands that the best answers to the experimenter's questions refer to events with the lexical items that name the objects that are the topic of conversation. The syntactic structure of the answer is then up to the speaker.[41] However, crucially, the structure is narrowed down to specific options based on the felicity conditions (Hamburger & Crain, 1982). For example, to successfully elicit a specific type of relative clause, a set of referents that a subset can be distinguished from is needed. For example, there could be two physically identical bunnies and a man is patting one of them. That bunny could then jump. The object relative clause *The one that the man patted is jumping* would then be an appropriate answer to *Which bunny is jumping?* to disambiguate between the two bunnies. To further narrow in on this answer and avoid other syntactically and semantically appropriate, yet, untargeted answers (e.g., an utterance like *that one* accompanied by pointing), the experimenter asking the questions

1992), passives (Crain, Thornton, & Murasugi, 1987; Pinker, 1989); subject-auxiliary inversion (Erreich, 1984; Sarma, 1991); negation (Guasti, Thornton, & Wexler, 1995; Guasti, 1996); referential and bare *wh*-questions (Thornton, 1995); control of infinitivals (Eisenberg & Cairns, 1994), negative polarity (O'Leary & Crain, 1994), and quantification (Crain et al., 1996).

41 As noted in Chapter 4, it is also possible to manipulate a speaker's structure indirectly, as in the syntactic persistence literature (see Bock, 1989 and Bock & Loebell, 1990).

would be blindfolded so she cannot see where the child is pointing and would need full descriptions. Remarkably, under these pragmatic constraints, even children as young as 2 years old produce communicative relative clauses of several types more than 80% of the time (McKee et al., 1998).[42]

The goal of the experiments in this dissertation was to provide the message and lexical items with pragmatic constraints to narrow in on function prepositions. One such pragmatic constraint employed during the experiment is the second experimenter's covering of her eyes during each event. This is used to give children a reason to describe the event; with most children, it also has the effect of deterring them from using deictic references (e.g., pointing to the location while saying *right here*).[43] This next section describes the importance for testing comprehension and how it bears on the hypothesis of this dissertation.

5.3 Comprehension measures

The second of the two tasks is a comprehension task in which probing for understanding of the target prepositions primarily serves as a positive control for production of the target prepositions and always came immediately after the production test for each item. This ordering was essential so that the comprehension question itself did not model preposition options for the children.

Testing competence by means of a second modality, comprehension, is critical to the hypothesis of this dissertation. Although a competence-based claim requires both

42 There are several ways to elicit relative clauses. An additional way, for example, is to have the rules of a game encourage the child to direct the puppet to pick up a certain toy (e.g., the particular bunny) in which the best way to communicate that is for the child to say *Pick up the bunny that the man patted*.

43 Note that there may have been other pragmatic constraints that narrowed in on using function prepositions, such as ambiguity avoidance (Ferreira, Slevc, & Rogers, 2005). The possibility of this effect will be discussed in further detail in Chapter 8.

production and comprehension of function morphemes to be affected, the performance-based claim here predicts a dissociation. Recall from Chapter 2 that children's production often lags behind their comprehension during development (Shipley, Smith, & Gleitman, 1969; Shady & Gerken, 1999, etc.). The ability to process language, whether through comprehension or production, presupposes linguistic knowledge, suggesting competence. For English, if a child can comprehend function prepositions but not produce them, the comprehension measure serves as a positive control. It suggests that the omission of function prepositions is not due to a problem with competence, but rather a problem with performance.

5.4 Age and vocabulary size as a participant variable

Before discussing the motivation for using children's vocabulary size as a participant variable, I address the inclusion of adult subjects. Adults are assumed to have complete competence with their native language and barring any aphasia, mastery of the production and comprehension systems. Thus, the reason for testing them is less to see what they are capable of, and more as a baseline for the child's performance. In other words, the adult's performance is the goal but if the adult performs differently from what the experiment would predict of a fully competent user of the production and comprehension, it may highlight the imprecision of the task. Thus, because of the nature of the task, ceiling effects for adults may not necessarily be attainable.

Most commonly age or MLU is used to gauge a child's grammatical development. However, problems arise in both types of measurements. Linguistic performance can vary a lot within an age (Dromi, 1987; Ogura, Yamashita, Murase, & Dale, 1993; Fenson et al., 1994; Caselli et al., 2000). For example, it is not uncommon to come across a child at 2;0 with only a few words in her expressive vocabulary and another child at 2;0 who already speaks in complete sentences. For that reason, age was only used for the gross division of

adults versus young children.

MLU attempts to circumvent this variability by looking instead at number of morphemes per utterance and averaging over several utterances. In English, MLU is strongly correlated with a child's use of morphology and syntax (Brown, 1973; deVilliers & deVilliers, 1973; Scarborough, 1990). This measure does not lend itself to equalized cross-linguistic comparisons, however, since languages vary in the amount of information that a single morpheme may convey. Heavily inflected languages, for example, may use only one or two densely inflected words to express an idea that English requires several words for. To account for this, different kinds of morphemes have been weighed differently but such coding rules introduced the problem of arbitrary decisions, and for some languages a neutral or baseline score was difficult to establish (Dromi & Berman, 1982, coding Hebrew; Allen & Crago, 1996, coding Inuktitut; Hickey, 1991, coding German). Thus, although, these different scoring mechanisms were necessary to capture the specific properties of a language, they still did not offer a reliable way to generalize across languages.

Vocabulary size seems more promising as a consistent indicator of linguistic development for English, such as for a child's function word repertoire. For example, a linear relationship between vocabulary size and proportion of closed-class words is reliably found at around 400 words with it tapering off at around 600 words. (Marchman & Bates, 1994). Marchman and Bates (1994) assessed the vocabulary size of English-speaking toddlers using the *MacArthur Communicative Development Inventory: Words and Sentences (CDI)* (Fenson et al., 1993). The *CDI* is a vocabulary checklist given to parents asking about the child's production of 680 different words. (For more on vocabulary size and linguistic development in English, see Bates & Goodman, 1997; Dale, Dionne, Eley & Plomin, 2000). Vocabulary size is also useful in assessing overall linguistic development for languages like Italian, Japanese, Spanish, and Hebrew

(Caselli et al., 1999; Ogura et al., 1993; Jackson-Maldonado, Thal, Marchman, Bates, & Guitierrez-Clellen, 1993; Maital et al., 2000). Not only does vocabulary size more reliably track a child's grammatical development within a language but it also does so across languages. When comparing English and Italian, Caselli et al. (1999) found that the emergence of grammatical elements in spontaneous speech correlated with vocabulary size for both languages. They assessed the vocabulary size of English-speaking children using the *CDI* and that of Italian-speaking children using a parent report instrument similar to the *CDI* but adapted for Italian (Bates et al., 1979). Again comparing English and Italian, Devescovi et al. (2005) found that vocabulary size (also assessed by the English and Italian versions of the *CDI*) contributed the most variance to MLU and successfully predicted children's inventory of function words for each of the two languages. Thus, vocabulary scores could be the best way to find a common ground among the inherently different MLUs across languages. In Icelandic, which is heavily inflected, vocabulary size also seemed to be a better indicator of grammatical development than MLU (Thordardottir, Weismer, & Evans, 2002). They assessed the vocabulary size of Icelandic-speaking children using the *4* . As with English, for Icelandic, a linear relationship between vocabulary size and proportion of closed-class words is also present at around 400 words, leveling off at around 600 words. (Thordardottir et al., 2002).[44]

5.5 Hypothesis and predictions

The central hypothesis of this dissertation is that children's telegraphic speech patterns reflect issues that arise in engaging the production system. Children are more likely to omit certain elements such as function prepositions because of issues with coordination

44 Note, however, there are two outliers in the data of Thordardottir et al. (2002) that make the curve dip a bit at the end.

of those elements with content elements during online production. These coordination issues could possibly be due to (1) less practice with working with the production system, (2) limited working memory resources, and (3) slower overall processing capacity. Bound function morphemes are less susceptible to omission than free function morphemes because bound morphemes are supported by content stems that are retrieved during lexical retrieval.

In order to assess comprehension and production of (1) content and function prepositions and (2) prepositions and their associated case inflections in the language of children at varying developmental stages, American and Icelandic toddlers were tested. Two- and three-year-olds were grouped based on their vocabulary size, as this measure more reliably indicates function word repertoire across languages (Devescovi et al., 2005). By the time a child is able to produce least 200 different words, two-word combinations start to appear (Nelson, 1993). The threshold for emergence of productive use of function words is around 400 words. At 600 words, emergence of function word use plateaus (Marchman & Bates, 1994). Thus, children were placed into one of three groups: Those having 200 to 399 words and thus, telegraphic speech, 400 – 599 words and thus, transitional use of telegraphic and complete speech, and more than 600 words and thus, complete sentences. English- and Icelandic-speaking adults were also tested to serve as a baseline.

If the patterns found in telegraphic speech are due to problems with coordinating information in the production system, the following is predicted: Since they have a fully developed production system, English-speaking adults should both comprehend and produce content and function prepositions. For the English-speaking children: Those with the lowest vocabulary and telegraphic speech should comprehend but not produce content and function prepositions; those with vocabularies at the 400 word mark or higher and with transitional speech should comprehend and produce content prepositions and

comprehend and sometimes produce function prepositions; and, those with vocabularies over 600 with complete speech should both comprehend and produce content and function prepositions.

The Icelandic-speaking adults should comprehend and produce should both comprehend and produce prepositions and their case inflections. For the Icelandic-speaking children: Those with the lowest vocabulary and telegraphic speech should comprehend prepositions and their case inflections but only produce (sometimes erroneous) inflections; those with vocabularies at the 400 word mark or higher and with transitional speech should comprehend prepositions and their case inflections and produce inflections but only sometimes produce prepositions; and those with vocabularies over 600 with complete speech should both comprehend and produce prepositions and their case inflections, just like the adults.[45]

If these empirical patterns are found in the data, it will support the performance-based hypothesis. First, differences in production and comprehension performance – with children showing comprehension of an element despite not producing that element – will be interpreted as evidence for telegraphic children having limitations in production since they are able to show competence by performing in another modality. Second, differences in English- and Icelandic-speaking children's production of case marking elements – with free function prepositions in English more often being omitted and case inflections in Icelandic rarely if ever being omitted – will be interpreted as reflecting how the production system's organization interacts with an individual language's organization and will provide further evidence that telegraphic speech is not due to limitations of competence in the learner's knowledge of his/her target language per se. However, if empirical patterns differ from the predictions described above, in that children neither produce nor comprehend function prepositions or that there are no cross-linguistic

45 Note that the Icelandic prepositions in the experiments are content prepositions.

differences, this could be due to many factors. One possibility could be a problem with competence, and thus, telegraphic speech could be due to lack of completed acquisition of certain grammatical elements. Chapters 6 and 7 provide greater detail of the experiments conducted and the results obtained for this dissertation.

CHAPTER 6:
EXPERIMENTS 1 AND 2: ENGLISH-SPEAKING CHILDREN AND ADULTS

6.1 Experiment 1: English-speaking children

Experiment 1 tests English-speaking children's production and comprehension of function and content prepositions. It specifically contrasts mono-morphemic location prepositions with multi-morphemic location+direction content+function compound prepositions.

6.1.1 Participants

Forty-two child participants ranged in age from 2;0 to 3;11, with a mean age of 3;0. There were 21 girls and 21 boys. Participants were primarily recruited from and tested in preschools in the Tucson, AZ metropolitan area. One was recruited through a personal contact and tested at the University of Arizona. Parents reported English as each child's dominant language and identified at least one adult who is regularly in the child's home as a native speaker of English. Five children (four females aged 2;4, 2;6, 3;3, and 3;5 and one male aged 2;7) completed the experiment but their data were excluded from the analyses below because they did not meet the test-internal criterion (to be described below). Another five children (one female aged 2;4 and four males aged 2;0, 2;5, 3;1, and 3;8) did not complete the experiment due to shyness, fussiness, or disinterest.[46]

Recall from Chapter 5 that vocabulary size is a better indicator of function word repertoire than MLU across languages. On the basis of these findings, child participants

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46 A child was considered shy if he put his head down or turned his face away and did not respond when a response was requested. A child was considered fussy if he frowned, cried, or said "no" and did not respond when a response was requested. A child was considered disinterested if he walked away from the experiment and refused to come back or said he did not want to do it anymore (after his assent was already obtained) and did not respond when a response was requested.

were placed into one of three groups based on vocabulary scores. Within up to 28 days of the testing session, a parent of each child participant completed the *CDI* (Fenson et al., 1993). Recall from Chapter 5 that this version, tailored to toddlers, probed production of 680 words.[47] If the parent or guardian reported vocabulary items between 200 and 399, the child was placed in Group A. If the report was between 400 and 599, the child was placed in Group B. If the report was over 600, the child was placed in Group C. The vocabulary scores for Group A (n = 3) ranged from 238 to 394 (mean 302), those for Group B (n = 21) ranged from 401 to 590 words (mean 516), and those for Group C (n = 18) ranged from 622 to 680 words (mean 649). Three children were placed in Group A; they ranged in age from 2;0 to 2;7 (mean 2;4). Twenty-one children were placed in Group B; they ranged in age from 2;4 to 3;11 (mean 2;10). Eighteen children were placed in Group C; they ranged in age from 2;9 to 3;11 (mean 3;4). See Tables 6.1.1.1, 6.1.1.2., and 6.1.1.3 for individuals and Table 6.1.1.4 for a summary of these details.

Data collection for Group A children was discontinued due to the difficulty of the task for that vocabulary group. Of the three children placed in Group A, two did not meet the test-internal criterion (due to their waning attention during the last two stories) and one did not complete the experiment. Thus, only children in Groups B and C were included in the analyses. Group membership of the 32 remaining children was fully counterbalanced across the materials and conditions described below. Sixteen children remained in Group B; they ranged in age from 2;4 to 3;11 (mean 2;11). Sixteen children remained in Group C; they ranged in age from 2;9 to 3;11 (mean 3;5). See Table 6.1.1.5 for a summary of the children whose data is analyzed.

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47 Parents were also asked about the prepositions *onto*, *out of* and *off of* in addition to the five prepositions already on the *CDI* checklist (i.e., *in*, *into*, *out*, *on*, and *off*). But these three additional items were not included in calculating the total scores here so the *CDI* scores in this dissertation can be compared to other reports using the same measure.

Table 6.1.1.1

English-speaking Group A participants ordered by CDI scores (200 – 399 words out of possible 680 words)

Participant	Gender	Age (year; month)	Vocabulary score
1*	male	2;0	238
2*	male	2;7	275
3*	female	2;4	394

Note: Asterisks indicate participants whose data was excluded from the analyses.

Table 6.1.1.2

English-speaking Group B participants ordered by CDI scores (400 – 599 words out of possible 680 words)

Participant	Gender	Age (year; month)	Vocabulary score
1	female	2;10	401
2*	female	2;4	409
3*	female	2;6	443
4	female	2;8	466
5	female	2;8	474
6	male	3;1	475
7*	female	3;5	487
8	male	2;5	492
9*	male	2;5	494
10	male	2;11	502
11	female	3;0	508
12*	female	3;3	537
13	female	3;0	556
14	male	3;0	557
15	male	3;11	565
16	male	2;10	566
17	male	2;4	571
18	male	3;11	575
19	male	2;9	586
20	female	2;11	589
21	male	2;7	590

Note: Asterisks indicate participants whose data was excluded from the analyses.

Table 6.1.1.3

English-speaking Group C participants ordered by CDI scores (600 or more words)

Participant	Gender	Age (year; month)	Vocabulary score
1	male	3;11	621
2	male	3;4	622
3	male	3;11	624
4*	male	3;1	624
5	female	3;4	626
6	female	3;9	629
7	female	3;2	634
8	female	3;0	645
9	female	3;3	650
10	female	3;5	651
11	male	3;4	655
12	female	3;3	663
13*	male	3;8	667
14	female	3;7	669
15	female	2;9	672
16	male	3;5	675
17	female	3;1	680
18	male	3;11	680

Note: Asterisks indicate participants whose data was excluded from the analyses.

Table 6.1.1.4

Mean vocabulary score and age for all participants for each vocabulary group of English-speaking children (N = 42)

Group	Vocabulary range	Mean vocab score	Mean age	*N*
A	200 − 399	302	2;4	3
B	400 − 599	516	2;10	21
C	600 +	649	3;4	18

Table 6.1.1.5

Mean vocabulary score and age for included participants for each vocabulary group of English-speaking children (N = 32)

Group	Vocabulary range	Mean vocab score	Mean age	*N*
B	400 − 599	530	2;11	16
C	600 +	650	3;5	16

6.1.2 Procedures

All experimental sessions were audio recorded for subsequent transcription to ensure fidelity of data collection. The child participants were invited to play a game with two experimenters who they already knew.[48] In the game, one of the experimenters told five different stories, each with several distinct, story-internal events. The storyteller used toys to portray the events. At the beginning of each story, the storyteller presented the toy objects and animals one at a time, asking the child to name each one. This was done as a warm-up activity to encourage the child to talk and also to check for variation in individual children's forms.[49] For example, a child might have called the toy sheep *a lamb* or the toy fish *a Nemo*, or in some cases every animal with hooves (the horse, the pig, the cow, the sheep) *a horsey*. The second experimenter watched the labeling of the toys, but then covered her eyes during each of the events. After each event, the second experimenter asked the child a question about the event with her eyes still covered that required an oral response. (Please refer to sample story in example 6.1.2). This question probed the child's production. After the child's response, the second experimenter then uncovered her eyes and asked a second question about the same event. The child could either respond to the second question with an oral response or by pointing. This question probed the child's comprehension. Also, the experimenters were careful not to look at any toys to avoid influencing the child's answer. After each response, the experimenters celebrated the child's efforts with much joy and gaiety.

The first story supported two sets of practice questions. The second experimenter asked the storyteller the first set of questions to model for the child. The second experimenter then asked the child the second set of questions for the remainder of the

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48 Experimenters visited the child participants' classrooms one or more times prior to testing sessions so that the children were comfortable with doing activities with them.

49 Data on the naming of the animals was not used as a pretest or analyzed to inform the study.

practice story and all subsequent stories. After this practice story, four stories, each with three events, were presented. For each experimental story, the first event conveys no change in location, the second event conveys a change in location and the third event conveys an opposite change in location, serving as a semantic contrast. For English, the targets are thus a location content preposition (e.g., *in)*, and two location+direction content/function preposition (e.g., *into* and *out of).* A sample of one of the experimental stories is illustrated below. It shows three events and probes production and comprehension of the prepositions, *in*, *into*, and *out of*. (The English script with all five stories can be found in APPENDIX G.)

Storyteller: For this story we'll need a box. [presents box]. Can you say box?

Child: Box.

Storyteller: And what's this? [presents sheep]

Child: A sheep!

Storyteller: And this? [presents bunny]

Child: A rabbit!

Storyteller: And tweet, tweet, tweet… What is this? [presents bird]

Child: A birdie!

Storyteller: Good job! Now, all of the animals are going to jump!
First the sheep is going to jump…

Experimenter 2: Oh, I'm going to cover my eyes now…[covers eyes]

Storyteller: [makes sheep jump inside box] Jump, jump, jump!

Experimenter 2: [with eyes covered] Where did the sheep jump?

Child: In the box.

Experimenter 2: [uncovers eyes] Which one jumped in the box?

Child: The sheep!

Storyteller: Alright! Now the bunny is going to jump…

Experimenter 2: Oh, I'm going to cover my eyes now…[covers eyes]

Storyteller: [makes bunny jump into box] Jump, jump, jump!

Experimenter 2: [with eyes covered] Where did the bunny jump?

Child: Into the box.

Experimenter 2: [uncovers eyes] Which one jumped into the box?

Child: The bunny!

Storyteller: Alright! Now the bird is going to jump…

Experimenter 2: Oh, my eyes are covered…[covers eyes]

Storyteller: [makes bird jump out of box] Jump, jump, jump!

Experimenter 2: [with eyes covered] Where did the bird jump?

Child: Out of the box.

Experimenter 2: [uncovers eyes] Which one jumped out of the box?

Child: The bird!

Storyteller: Yay! Now this next story is a … etc.

6.1.3 Materials and design

Table 6.1.3.1 lists the five verbs, five objects, 14 animals, and target prepositions used in the each story. The verbs, objects, and animals were selected from the *MacArthur Communicative Development Inventories Lexical Development Norms* based on their high ranking in lists of words ordered by percentage of 2-year-olds who produce them, as shown in Table 6.1.3.2 (Dale & Fenson, 1996).[50]

Table 6.1.3.1

Verbs, objects, animals, and target prepositions in stories

Story	Verbs	Objects	Animals	Preposition
practice	crawl	bottle	squirrel	down
			monkey	up
1	jump	box	sheep	in
			bunny	into
			bird	out of
2	swim	cup	fish	out
			frog	out of
			duck	into
3	dance	blanket	pig	on
			horse	onto
			dog	off of
4	run	towel	bear	off
			cow	off of
			cat	onto

50 The *MacArthur CDI Lexical Norms* are available on the following website: http://www.sci.sdsu.edu/cdi/lexical_e.htm. Note the verb *crawl* in the practice story is not listed.

Table 6.1.3.2

Experimental words ordered by percentage of Toddlers (16 to 30 months) who produce them according to the CDI Lexical Development Norms

	Percent (%)	Rank
	Verbs (Action Words)	
crawl	--	--
jump	58.9	21
dance	57.9	24
run	56.1	26
swim	55.1	27
	Objects (Small Household Items)	
bottle	81.3	2
cup	79.4	3
blanket	75.7	5
towel	66.4	12
box	57	21
	Animals (Real or Toy)	
dog/puppy	91.6	1/8
bird	89.7	2
duck	87.9	3
kitty/cat	86/81.3	4/6
horse	82.2	5
fish	80.4	7
cow	78.5	9
pig	78.5	10
bunny	77.6	11
bear	75.7	12
monkey	68.2	15
frog	63.6	16
sheep	52.3	27
squirrel	43.9	31

The practice story used one verb to convey two events while each experimental

story used one verb to convey three events. The verbs in the four experimental stories (*jump*, *swim*, *dance*, and *run*) were selected because they were manner of motion verbs included in the *MacArthur CDI Lexical Development Norms Word Group of Action Words*. Each event required a bounded landmark and a trajector, as defined in Chapter 5. For each of the stories, one object served as the bounded landmark. The objects in the practice story (*bottle*) and the four experimental stories (*box*, *cup*, *blanket*, and *towel*) were selected because they easily served as bounded landmarks and were ranked high within the *MacArthur Communicative Development Inventories Lexical Development Norms Word Group of Small Household Items*. For each event, one animal was selected to serve as the trajector. Animals were partially selected on their natural tendency to participate in the events of the stories (e.g., a frog, a fish, and a duck were used in the swimming story.) The 14 animals included in the stories were also chosen because they were ranked high within the *MacArthur CDI Lexical Development Norms Word Group of Animals (Real or Toy)*. See APPENDIX E for the list of target sentences and APPENDIX G for the full script.[51]

Each experimental story had questions that probed for production and comprehension of one content preposition and two function prepositions. The presentation order of preposition probes was fixed so that the content preposition probe was always first (e.g., *in*), followed by the function preposition counterpart (e.g., *into* after *in*) followed by the function preposition that was the opposite in meaning to the first function preposition (e.g., *out of* after *into*).[52] (See Table 6.1.3.1.) The presentation order

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51 Note however that a participant's response did not necessarily have to include the animal or verb. In fact, a more pragmatically appropriate response would be a prepositional phrase as opposed to a complete sentence.

52 Content preposition probes were the first item since they are more likely to be in the child's vocabulary than function prepositions.

of stories was counterbalanced so that a quarter of the children saw story 1 first, followed by story 2, a quarter of the children saw story 2 first, followed by story 3, etc. A priority for counterbalancing was vocabulary group membership for initial and ongoing recruitment and replacement. Gender was also counterbalanced across story order conditions as much as possible. Each condition had at least one girl and one boy (There were more boys than girls who had scores placing them in Group B.)

6.1.4 Results

6.1.4.1 Coding of responses

Each audio-recorded experimental session was transcribed. Responses to questions probing production (e.g., *Where did the sheep jump?* or *Where did the bunny jump?*) were coded as target (e.g., the child said *in* for the expected response of *in* or *into* for the expected response of *into*), target with only the content preposition (e.g., the child only said *in* for the expected response of *into*), other preposition (e.g., the child said *from* for the expected response of *into*), or deictic (e.g., the child said *right here* for the expected response of *into*). Responses were considered non-codable if the child remained silent, mimicked the question, or offered other information (e.g., *We have a bunny at my house and his name is Charlie.*). For codable responses that were ambiguous, the code closest to the target response was used. For example if the child said *right here in this box* for the expected response of *into*, the response was coded as target with only the content preposition.

Responses to questions probing comprehension (e.g., *Which one jumped into the box?*) were coded as either target, non-target or non-codable. Oral (child said *the bunny*) or gesture (child pointed to the bunny) responses were accepted. Responses were considered non-codable if the child did not answer the question by not gesturing to at least one of the animals in the story, mimicking the question, or offering irrelevant

information. See Table 6.1.4.1 for summary of coding.

Table 6.1.4.1

Summary of coding of production responses for English

Code	Example Response	Target
target	*in*	*into*
target with only content preposition	*in*	*into*
other preposition	*from*	*into*
deictic	*right here*	*into*

The following test-internal criterion was used to determine inclusion of a participant's data: If a child gave two or more non-codable responses within a condition (e.g., the child was silent after the production questions for two content prepositions like *on* and *off* or after the comprehension questions for two of the same function prepositions like *off of* targeted first and *off of* targeted second), the data was insufficient to analyze (e.g., the child only responded to two of the four production questions for the content prepositions or no data was obtained for comprehension of one of the function prepositions). As noted earlier, all three children in Group A, five in Group B and two in Group C were not included in the analyses.

6.1.4.2 Scoring and analyses

The *Wilcoxon Matched-Pairs Signed-Ranks Test* (Siegel, 1956) was used for each vocabulary group to test for significant differences between (1) measures of production and comprehension of content prepositions, (2) measures of production and comprehension of function prepositions, and (3) measures of production of content and function prepositions when the targets were function prepositions. Scoring was conservative for both production and comprehension data. For production, only answers coded as "target" (e.g., *into* for

into) or "target with only the content preposition" (e.g., *in* for *into*) received a 1 whereas all other coded answers received a 0. Totals were tallied for each subject for a maximum total of 4 for each condition: Content prepositions said for target prepositions, content prepositions said for the first-targeted function prepositions, content prepositions said for the second-targeted function prepositions, function prepositions said for the first-targeted function prepositions, and function prepositions said for the second-targeted function prepositions. For comprehension, only answers coded as "target" received a 1 whereas all other coded answers received a 0. Totals for the content prepositions, the first-targeted function prepositions, and the second-targeted function prepositions were tallied for each subject for a maximum total of 4 for each condition.

Since there is a small set size (and thus a true mean is not obtainable to verify whether there is normal distribution), parametric analyses such as a paired t-test cannot be used. For these data I used the non-parametric *Wilcoxon Matched-Pairs Signed-Ranks Test* which offers the advantages of determining not only the direction but also the magnitude of differences between groups of pairs.[53]

6.1.4.2.1 Measures of production and comprehension of content prepositions

For each group, the differences between comprehension and production scores were tested for the question pairs probing for content prepositions. As Figure 6.1.4.2.1 shows, there was a significant difference for both Group B, $W+ = 114$, $W- = 6$, $N = 15$, $p < .001$, and Group C, $W+ = 136$, $W- = 0$, $N = 16$, $p < .001$. This indicates that children in both groups show understanding of a content preposition more often than they say a content preposition.

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53 The on-line calculator for the *Wilcoxon Matched-Pairs Signed-Ranks Test* was used and is available on the following website: http://www.fon.hum.uva.nl/Service/Statistics/Signed_Rank_Test.html

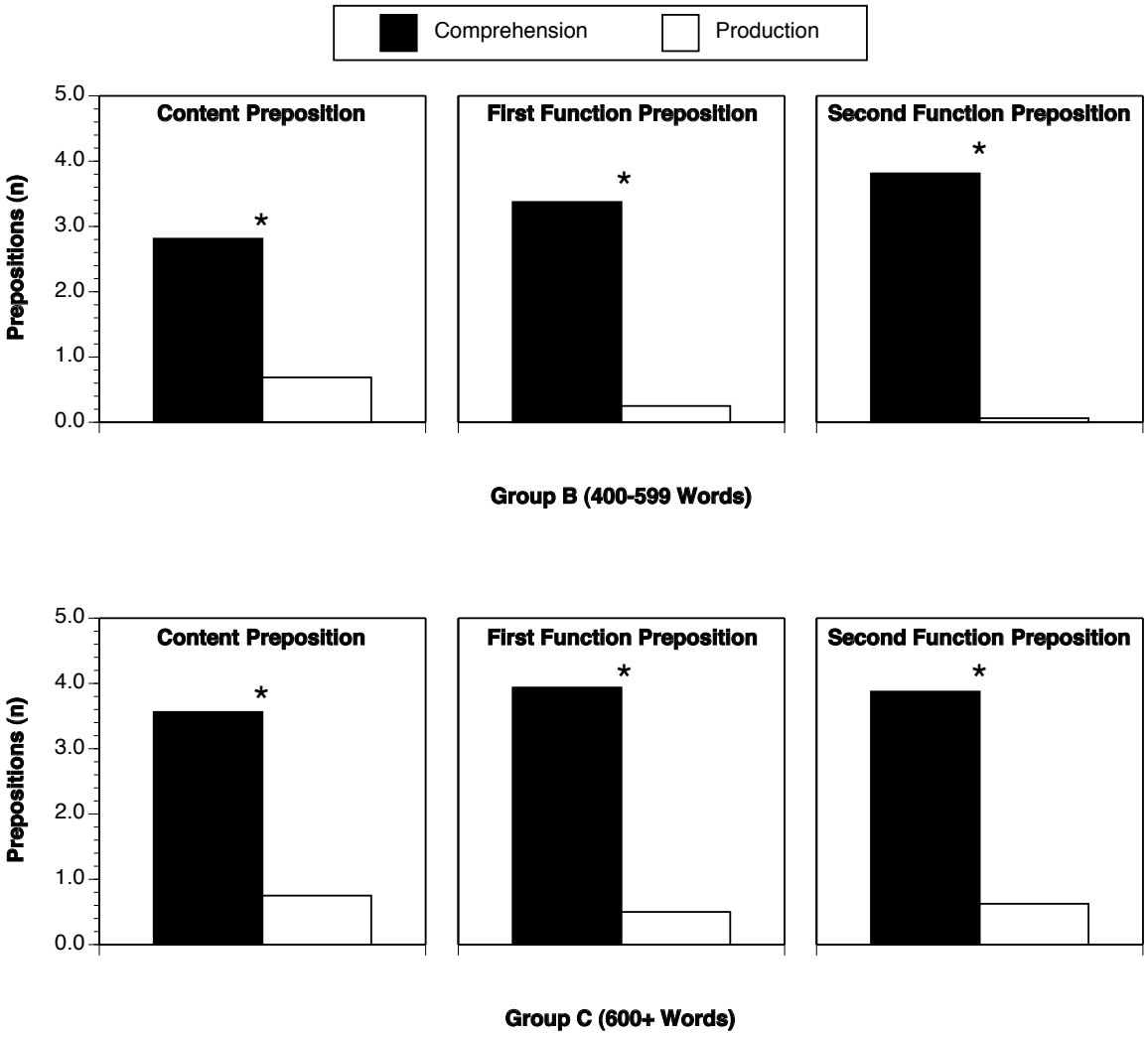

Figure 6.1.4.2.1. Production and comprehension of content prepositions, first-targeted function prepositions, and second-targeted function prepositions for English-speaking children

6.1.4.2.2 Measures of production and comprehension of function prepositions

For each vocabulary group, the differences between comprehension and production scores were tested for the question pairs probing for the first-targeted function prepositions. As Figure 6.1.4.2.1 also illustrates, there was a significant difference within both Group B, $W+ = 136$, $W- = 0$, $N = 16$, $p < .001$ and Group C, $W+ = 136$, $W- = 0$, $N = 16$, $p < .001$.

Additionally, for each vocabulary group, the differences between comprehension

and production scores were tested for the question pairs probing for the second-targeted function prepositions. Again, Figure 6.1.4.2.1 shows there was a significant difference for both Group B, $W+ = 136$, $W- = 0$, $N = 16$, $p < .001$ and Group C, $W+ = 136$, $W- = 0$, $N = 16$, $p < .001$. This suggests that children in both groups show understanding of a function preposition more often than they say a function preposition.

6.1.4.2.3 Measures of production of content and function prepositions for function preposition targets

For each vocabulary group, the differences between producing content prepositions and function prepositions for the first-targeted function preposition were tested. Figure 6.1.4.2.3 shows there was a significant difference for Group B, $W+ = 75$, $W- = 3$, $N = 12$, $p = 0.002$ but not for Group C, $W+ = 42.50$, $W- = 12.50$, $N = 10$, $p = 0.131$. This suggests that when children in Group B have the opportunity to use a function preposition, they use content prepositions more often function prepositions. However, children in Group C used content prepositions and function prepositions equally as often for the first-targeted function preposition. This result was not found with the second-targeted function prepositions. For each vocabulary group, the differences between producing content prepositions and function prepositions for the second-targeted function preposition were tested. As seen in Figure 6.1.4.2.3, there was a significant difference for both Group B, $W+ = 66$, $W- = 0$, $N = 11$, $p < .001$ and Group C, $W+ = 56$, $W- = 10$, $N = 11$, $p = 0.042$. This shows that when children in Group B have the opportunity to use a function preposition, they use content prepositions more often than function prepositions.

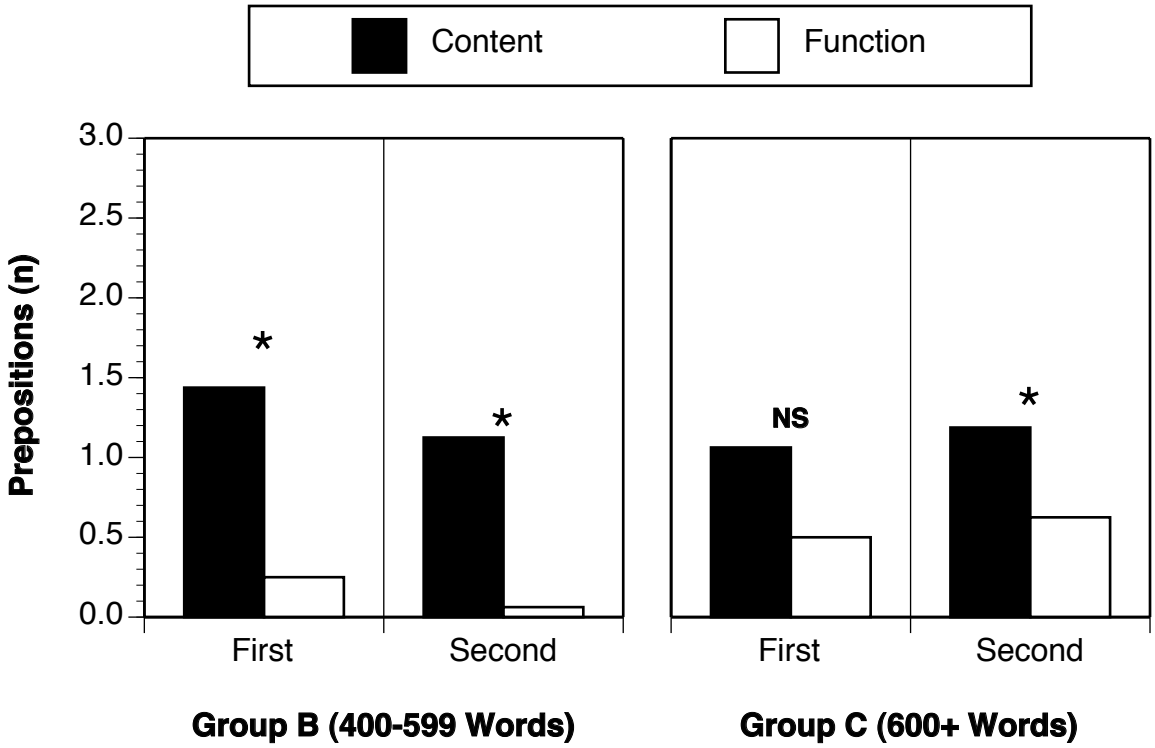

Figure 6.1.4.2.3. Production of content and function prepositions for function preposition targets for English-speaking children

6.2 Experiment 2: English-speaking adults

Experiment 2 tests English-speaking adult's production and comprehension of function and content prepositions. As with Experiment 1, it contrasts mono-morphemic location prepositions with multi-morphemic location+direction content/function prepositions.

6.2.1 Participants

Thirty-four University of Arizona students ages 18.00 to 21.75 years (with a mean age of 19.30 years) volunteered to participate for course credit in an introductory psychology class. There were 16 females and 18 males. Participants identified themselves as native speakers of English. Two participants (males, ages 18.75 and 21.16) did not consent to audio recording and thus, no data were recorded or reported for those sessions. Therefore,

the analyses included 32 participants (16 females and 16 males) ages 18.25 to 21.75 years (mean of 19.26). Although vocabulary size was not assessed for the adults in this experiment, it is assumed that they have at least 17,000 base words, which is the conservative estimate for the average, educated native-speaker of English (Goulden, Nation, & Read, 1990).[54]

6.2.2 Procedures

Experimental procedures used with English-speaking adults were identical to those with English-speaking children except the following preamble was used before data collection: *As you read in the consent form, this is an experiment designed for children. Now, you may wonder why you, an adult, are being invited to participate in an experiment for a child. The answer is that we need adult responses to serve as a baseline for children's responses. With that in mind, some of the tasks may be a little silly or slow, so please bear with us. It is also important that you please not pretend to be a child or guess what a child may say. Please just give your natural responses as an adult.*

6.2.3 Materials and design

Materials and design used for adult English-speaking participants were identical to those used for the child English-speaking participants.

6.2.4 Results

6.2.4.1 Coding of responses

Coding of responses for adult English-speaking participants was the same as for the child English-speaking participants.

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54 Derivatives, inflected words, compounds, and proper names are not counted as separate words in this estimate.

6.2.4.2 Scoring and analyses

Scoring for adult data was the same as for the child data. The *Wilcoxon Matched-Pairs Signed-Ranks Test* was used to test for significant differences between (1) measures of production and comprehension of content prepositions, (2) measures of production and comprehension of function prepositions, and (3) measures of production of content and function prepositions when the targets were function prepositions.

6.2.4.2.1 Measures of production and comprehension of content prepositions

The differences between comprehension and production scores were tested for the question pairs probing for content prepositions. Figure 6.2.4.2.1 shows a significant difference: $W+ = 345.50$, $W- = 5.50$, $N = 26$, $p < .001$.

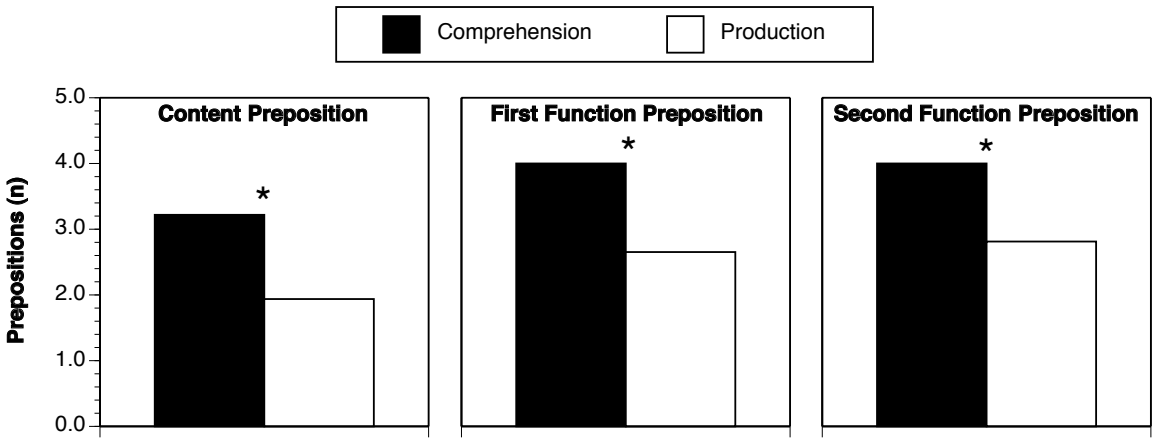

Figure 6.2.4.2.1. Production and comprehension of content prepositions, first-targeted function prepositions, and first-targeted function prepositions for English-speaking adults

6.2.4.2.2 Measures of production and comprehension of function prepositions

The differences between comprehension and production scores were tested for the question pairs probing for first-targeted prepositions. As shown by Figure 6.2.4.2.1 there was a significant difference: $W+ = 435$, $W- = 0$, $N = 29$, $p < .001$. The differences

between comprehension and production scores were also tested for the question pairs probing for the second-targeted prepositions. Figure 6.2.4.2.1 also indicates that there was a significant difference: $W+ = 300$, $W- = 0$, $N = 24$, $p < .001$.

6.2.4.2.3 Measures of production of content and function prepositions for function preposition targets

The difference between producing content prepositions and function prepositions for the first-targeted function preposition was tested. Figure 6.2.4.2.3 indicates there was a significant difference: $W+ = 54$, $W- = 352$, $N = 28$, $p < .001$. The difference between producing content prepositions and function prepositions for the second-targeted function preposition was also tested. Figure 6.2.4.2.3 suggests there was a significant difference: $W+ = 38$, $W- = 340$, $N = 27$, $p < .001$.

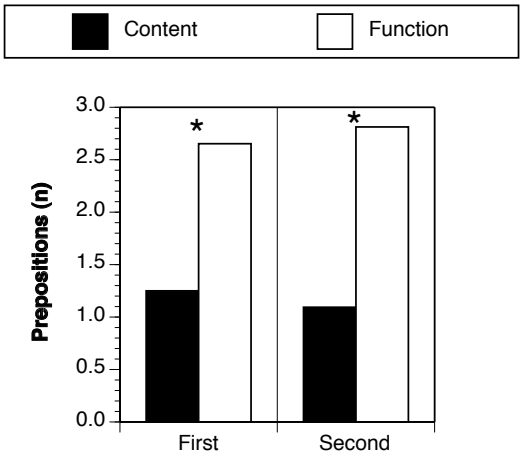

Figure 6.2.4.2.3. Production of content and function prepositions for function preposition targets for English-speaking adults

CHAPTER 7:
EXPERIMENTS 3 AND 4: ICELANDIC-SPEAKING CHILDREN AND ADULTS

7.1 Experiment 3: Icelandic-speaking children

Experiment 3 tests Icelandic-speaking children's production and comprehension of prepositions and their associated case markings. It specifically contrasts dative assigning location prepositions with accusative assigning location+direction prepositions.

7.1.1 Participants

Forty child participants ranged in age from 2;2 to 3;11 with a mean age of 3;2. There were 18 girls and 22 boys. Participants were recruited from preschools and personal contacts Reykjavík metropolitan area. They were tested in preschools, the University of Iceland, and homes in Reykjavík. Parents reported Icelandic as the child's dominant language and identified at least one adult who is regularly in the child's home as a native speaker of Icelandic. Five children (three females aged 2;5, 2;8, and 3;7 and two males aged 2;2 and 3;6) completed the experiment but their data were excluded from the analyses below because they did not meet the test-internal criterion described below. Another three children (one female aged 2;8 and two males aged 2;2 and 2;3) did not complete the experiment due to shyness, fussiness, or disinterest (using the same criteria as described for Experiment 1 in Chapter 6).

On the basis of findings discussed in Chapter 5 that vocabulary size also serves as a good indicator of a child's inventory of function words in Icelandic (Thordardottir et al., 2002), child participants were placed into one of three groups based on vocabulary scores. Within up to 20 days of the testing session, a parent of each of the child participants completed the *Icelandic Parent Report Vocabulary Measure* [*Orðaskil Málþroskapróf*] (Thordardottir & Weismer, 1996). Recall from Chapter 5 that this

version, tailored to toddlers, probed production of 705 words. Unlike the English *CDI*, it did not include the section on Sounds but included additional items on adverbs. If the parent or guardian reported vocabulary items between 200 and 399, the child was placed in Group A. If the report was between 400 and 599, the child was placed in Group B. If the report was over 600, the child was placed in Group C. The vocabulary scores for Group A (n = 4) ranged from 267 to 394 (mean 343), those for Group B (n = 18) ranged from 403 to 593 words (mean 521), and those for Group C (n = 18) ranged from 600 to 705 words (mean 648). Four children were placed in Group A; they ranged in age from 2;2 to 2;5 (mean 2;3). Eighteen children were placed in Group B; they ranged in age from 2;3 to 3;11 (mean 3;2). Eighteen children were placed in Group C; they ranged in age from 2;7 to 3;11 (mean 3;3). See Tables 7.1.1.1, 7.1.1.2., and 7.1.1.3. for individuals and Table 7.1.1.4 for a summary of these details.

Similar to the English experiments, data collection for Group A children was discontinued due to the difficulty of the task for that vocabulary group. Of the four children in Group A, two did not meet the test-internal criterion (due to their waning attention during the last two stories) one only mimicked the experimenters and one did not complete the experiment due to experimenter distraction. Thus, only children in Groups B and C were included in the analyses. Group membership of the 32 remaining children was fully counterbalanced across the materials and conditions described below. Sixteen children remained in Group B; they ranged in age from 2;3 to 3;11 (mean 3;1). Sixteen children were placed in Group C; they ranged in age from 2;7 to 3;11 (mean 3;4). See Table 7.1.1.5 for a summary of the children whose data is analyzed.

Table 7.1.1.1

Icelandic-speaking Group A participants ordered by Orðaskil Málþroskapróf scores (200 − 399 words out of 705 words possible)

Participant	Gender	Age (year; month)	Vocabulary score
1*	male	2;2	267
2*	male	2;2	335
3*	male	2;3	375
4*	female	2;5	394

Note: Asterisks indicate participants whose data was excluded from the analyses.

Table 7.1.1.2

Icelandic-speaking Group B participants ordered by Orðaskil Málþroskapróf scores (400 − 599 words out of 705 words possible)

Participant	Gender	Age (year; month)	Vocabulary score
1	male	2;9	403
2	female	3;9	407
3	female	2;3	408
4	female	3;3	469
5	male	3;4	487
6	male	3;2	504
7	male	3;0	513
8*	female	3;7	540
9	male	2;9	541
10	female	2;3	545
11	male	3;9	546
12	male	2;10	556
13	male	3;2	556
14	male	3;6	561
15	male	3;10	562
16*	male	3;6	568
17	female	2;9	570
18	male	3;11	593

Note: Asterisks indicate participants whose data was excluded from the analyses.

Table 7.1.1.3

Icelandic-speaking Group C participants ordered by Orðaskil Málþroskapróf scores (600 or more words)

Participant	Gender	Age (year; month)	Vocabulary score
1	female	3;1	600
2	male	2;10	602
3	female	3;8	607
4	female	3;4	621
5	male	2;10	625
6*	female	2;8	626
7	female	3;10	626
8	male	2;7	628
9	female	3;8	636
10	female	3;1	649
11	male	3;11	651
12*	female	2;8	667
13	female	3;11	669
14	female	2;11	683
15	male	3;8	683
16	male	3;3	693
17	female	3;10	696
18	male	3;3	705

Note: Asterisks indicate participants whose data was excluded from the analyses.

Table 7.1.1.4

Mean vocabulary score and age for all participants for each vocabulary group of Icelandic-speaking children (N = 40)

Group	Vocabulary range	Mean vocab score	Mean age	*N*
A	200 − 399	343	2;3	4
B	400 − 599	521	3;2	18
C	600 +	648	3;3	18

Table 7.1.1.5

Mean vocabulary score and age for included participants for each vocabulary group of Icelandic-speaking children (N = 32)

Group	Vocabulary range	Mean vocab score	Mean age	*N*
B	400 − 599	513	3;1	16
C	600 +	648	3;4	16

7.1.2 Procedures

Procedures used with Icelandic-speaking children were identical to the procedures used with English-speaking children except that Icelandic was spoken and tested. (The Icelandic script with all five stories can be found in APPENDIX H.)

7.1.3 Materials and design

Materials used with Icelandic-speaking children were similarly selected to those used with English-speaking children with the following exceptions. As with English, manner of motion verbs were selected. The verbs in the practice story and the four experimental stories were *klifra, hoppa*, *synda*, *fljúga*, and *skríða* (translated to *climb*, *jump*, *swim*, *fly*, and *crawl*, respectively). Objects were selected because of their containment properties and compatibility with prepositions and associated case markings for location with and without movement. The objects in the practice story and the four experimental stories were *peli*, *stóll*, *bolli*, *borð*, and *motta* (translated to *bottle*, *chair*, *cup*, *table*, and *rug,* respectively). The five verbs, five objects, 14 animals in the stories and their translations are listed in Table 7.1.3.1. Animals not common in Icelandic culture (e.g., a squirrel) were replaced with animals that were more familiar (e.g., a seal). Animals were also selected on their natural tendency to participate in the events of the stories (e.g., a bee, duck, and bird were used in the flying story.) Animals with short, pronounceable labels in Icelandic were preferred; the English translation is not always short (e.g., the Icelandic word for *elephant*, a rather long word in English, is *fíll*, a shorter word.) Also, unlike in the English version, objects were introduced with the definite article (nominative case) to set up the discourse of the story to encourage the participants to use definite articles in their responses (and the differentiating case markings). A direct translation for *off* and *out* without movement was not possible so *under* and *over* were used.[55]

55 For example, the English expression *Keep off the grass!* would be translated to *Ekki ganga á grasinu!*

Table 7.1.3.1

Verbs, objects, animals, and target prepositions in stories (with English glosses)

Story	Verbs	Objects	Animals	Preposition
practice	*klifra* climb	*peli* bottle	*bangsi* bear	*niður* down
			api monkey	*upp* up
1	*hoppa* jump	*stóll* chair	*kind* sheep	*undir* under
			kanína bunny	*undir* under
			hundur dog	*yfir* over
2	*synda* swim	*bolli* cup	*fiskur* fish	*(inni) í* in
			froskur frog	*(inn) í* in(to)
			selur seal	*(út) úr* out of
3	*fljúga* fly	*borð* table	*fluga* bee/fly	*yfir* over
			önd duck	*yfir* over
			fugl bird	*undir* under
4	*skríða* crawl	*motta* rug	*köttur* cat	*á* on
			fíll elephant	*á* on
			hestur horse	*af* off

which is glossed as *Not walk on grass-the!*

Also, location without movement comprehension questions were asked with *hvar* which translates to *where* and location with movement comprehension questions were asked with *hvert* which translates to *where to/from*. See APPENDIX F for the list of target sentences with English glosses and APPENDIX H for the full script in Icelandic.

7.1.4 Results

7.1.4.1 Coding of responses

As with English, each audio-recorded experimental session was transcribed. Responses to questions probing production were coded separately for preposition use and case marking use. For prepositions, responses were coded as target (e.g. *í*), target with adverb (e.g., *inni í*), no preposition used, using the wrong preposition, or deictic (e.g., the child said *hér* or *right here* for the expected response of *í*). Responses were considered non-codable if the child remained silent, mimicked the question, or offered other information. (For codable responses that were ambiguous, the code closest to the target response was used.) For case marking, responses were coded as either target (e.g., *stólnum*), generalized form (e.g. *stólinum* in which the suffix *–inum* is the correct case but not the correct form for the particular word), other case, or the wrong object.

Responses to questions probing comprehension were coded as either target, non-target or non-codable. Either oral or gesture responses were accepted. Responses were considered non-codable if the child did not answer the question by not gesturing to at least one of the animals in the story, mimicking the question, or offering irrelevant information. The same test-internal criterion used for the English experiments was used for the Icelandic experiments to determine inclusion of a participant's data. See Table 7.1.4.1a for summary of coding of prepositions and Table 7.1.4.1b for summary of coding of case marking.

Table 7.1.4.1a

Summary of coding of production responses for prepositions for Icelandic

Code	Example Response	Target
target	*í*	*í*
target with adverb	*inni í*	*í*
no preposition	—	*í*
other preposition	*við*	*í*
deictic	*hér*	*í*

Table 7.1.4.1b

Summary of coding of production responses for case marking for Icelandic

Code	Example Response	Target
target	*stólnum*	*stólnum*
generalized form	*stólinum*	*stólnum*
other case	*stólinn*	*stólnum*
wrong object	*borðinu*	*stólnum*

7.1.4.2 Scoring and analyses

For each vocabulary group, I tested for significant differences between (1) measures of production and comprehension of prepositions, (2) measures of production and comprehension of case marking , and (3) measures of production of prepositions and case marking. *Wilcoxon Matched-Pairs Signed-Ranks Tests* were used to test for statistical significance for (1) and (2). Chi-squares Tests were used to test for statistical significance for (3) since a linkage or co-dependence of a preposition and case marking within an utterance was examined.

For the *Wilcoxon* analyses, scoring was conservative for both production and comprehension data. For production, only answers coded as "target" for prepositions or case markings received a 1 whereas all other coded answers received a 0. Totals for the prepositions and case markings were tallied for each subject for a maximum total of 4 for each condition. For comprehension, only answers coded as "target" received a 1, whereas all other coded answers received a 0. Totals were tallied for each subject for a maximum total of 4 for each condition.

Using Chi-squares analyses, preposition and case marking responses were combined and categorized as fitting one of the following categories: Utterances having no preposition or case marking (e.g., deictic expressions such as *hér!*), utterances having no preposition but having case marked for the definite article (e.g., *bollanum*), utterances having a preposition but no case marking (e.g., *inni í*), or utterances having both a preposition and a case marking (e.g., *inni í bollanum*). Utterances were considered case marked if they either had the target case in the correct form (*stólnum*) or the target case in a generalized form (*stólinum*). Responses that used non-target prepositions (e.g., *á* for *af*) and thus, non-target case, objects with indefinite articles and thus, homonyms for each of the cases (*a rug, mottu* is used for accusative, dative and genitive instead of *the rug*, *mottuna* for accusative and *mottunni* for dative) or synonyms for objects that did not

have distinct forms for accusative and nominative (*the blanket* with *teppið* for accusative and *teppið* for nominative) were not included. "No responses" were also excluded. The number of utterances per category were tallied.[56]

7.1.4.2.1 Measures of production and comprehension of prepositions

For each vocabulary group, the differences between comprehension and production scores were tested for the question pairs probing for the first-targeted prepositions in the story (location without movement). Figure 7.1.4.2.1 shows that there was a significant difference within both Group B, $W+ = 0$, $W- = 120$, $N = 15$, $p < .001$, and Group C, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$. Additionally, for each vocabulary group, the differences between comprehension and production scores were tested for the question pairs probing for the second-targeted prepositions (location with movement) as well. Figure 7.1.4.2.1 shows a significant difference within both Group B, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$ and Group C, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$. Likewise, for each vocabulary group, the differences between comprehension and production scores were tested for the question pairs probing for the third-targeted prepositions (location with movement opposite to that of the second-targeted preposition) as well. Figure 7.1.4.2.1 illustrates a significant difference within both Group B, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$ and Group C, $W+ = 0$, $W- = 120$, $N = 15$, $p < .001$. This shows that children in both groups show understanding of prepositions more often than they say prepositions.

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56 Table 7.1.4.2.3 shows the total number of utterances for each condition. The Chi-square analysis was only performed for the Icelandic case marking/preposition pairs showing up in the same utterance. There is no Chi-square analysis in English and thus no comparable denominators.

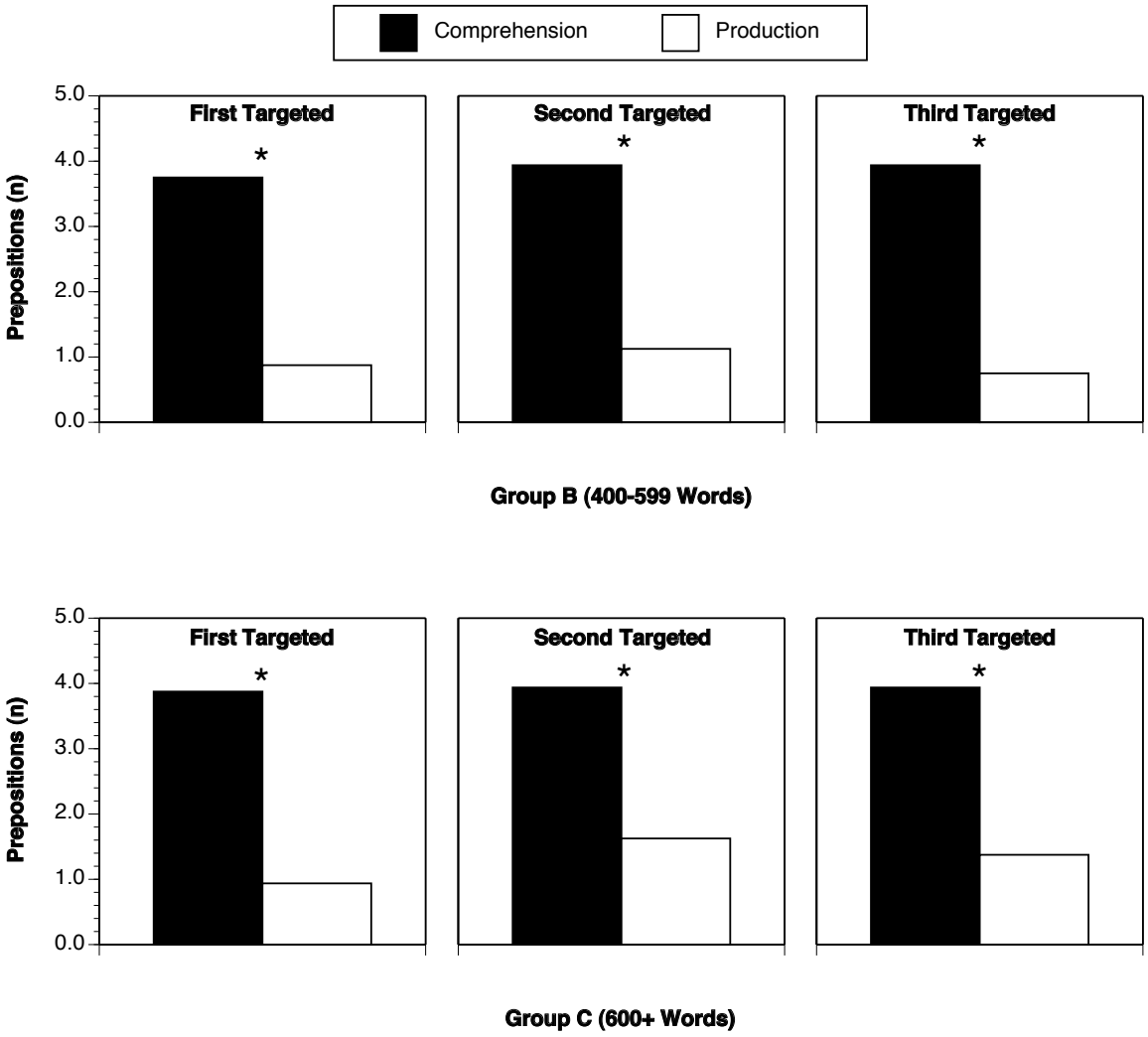

Figure 7.1.4.2.1. Production and comprehension of prepositions for Icelandic-speaking children

7.1.4.2.2 Measures of production and comprehension of case markings

For each vocabulary group, the differences between comprehension and production scores were tested for the question pairs probing for the first-targeted case markings in the story (location without movement). Figure 7.1.4.2.2 indicates a significant difference for both Group B, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$, and Group C, $W+ = 0$, $W- = 120$, $N = 15$, $p < .001$. Additionally, for each vocabulary group, the differences between

comprehension and production scores were tested for the question pairs probing for the second-targeted case markings (location with movement) as well. Figure 7.1.4.2.2 illustrates a significant difference for both Group B, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$, and Group C, $W+ = 0$, $W- = 120$, $N = 15$, $p < .001$. Likewise, for each vocabulary group, the differences between comprehension and production scores were tested for the question pairs probing for the third-targeted case markings (location with movement opposite to that of the second-targeted one) as well. Figure 7.1.4.2.2 shows a significant difference for both Group B, $W+ = 0$, $W- = 136$, $N = 16$, $p < .001$ and Group C, $W+ = 0$, $W- = 120$, $N = 15$, $p < .001$. This indicates that children in both groups show understanding of case marking more often than they say case markings.

7.1.4.2.3 Measures of production of prepositions and case markings

Across vocabulary groups, the differences between production scores for different combinations of prepositions and case markings were tested. Table 7.1.4.2.3 shows tallies with *P* standing for Preposition and *C* standing case marking, and the plus sign standing for present and the minus sign standing for absent. Thus, $P-C-$ means that the response had no preposition and no case marking, $P-C+$ means that the response had no preposition but did have a case marking, etc. Using *P* for Preposition and *C* for case marking, and the plus sign for present and the minus sign for absent, Figure 7.1.4.2.3 illustrates a significant difference between Groups B and C: χ^2 (3, $N = 32$) = 14.579, $p = 0.002$. This suggests that children in both groups produce case markings without prepositions at the same proportions, and children in Group C produce prepositions with case markings twice as much as children in Group B do.

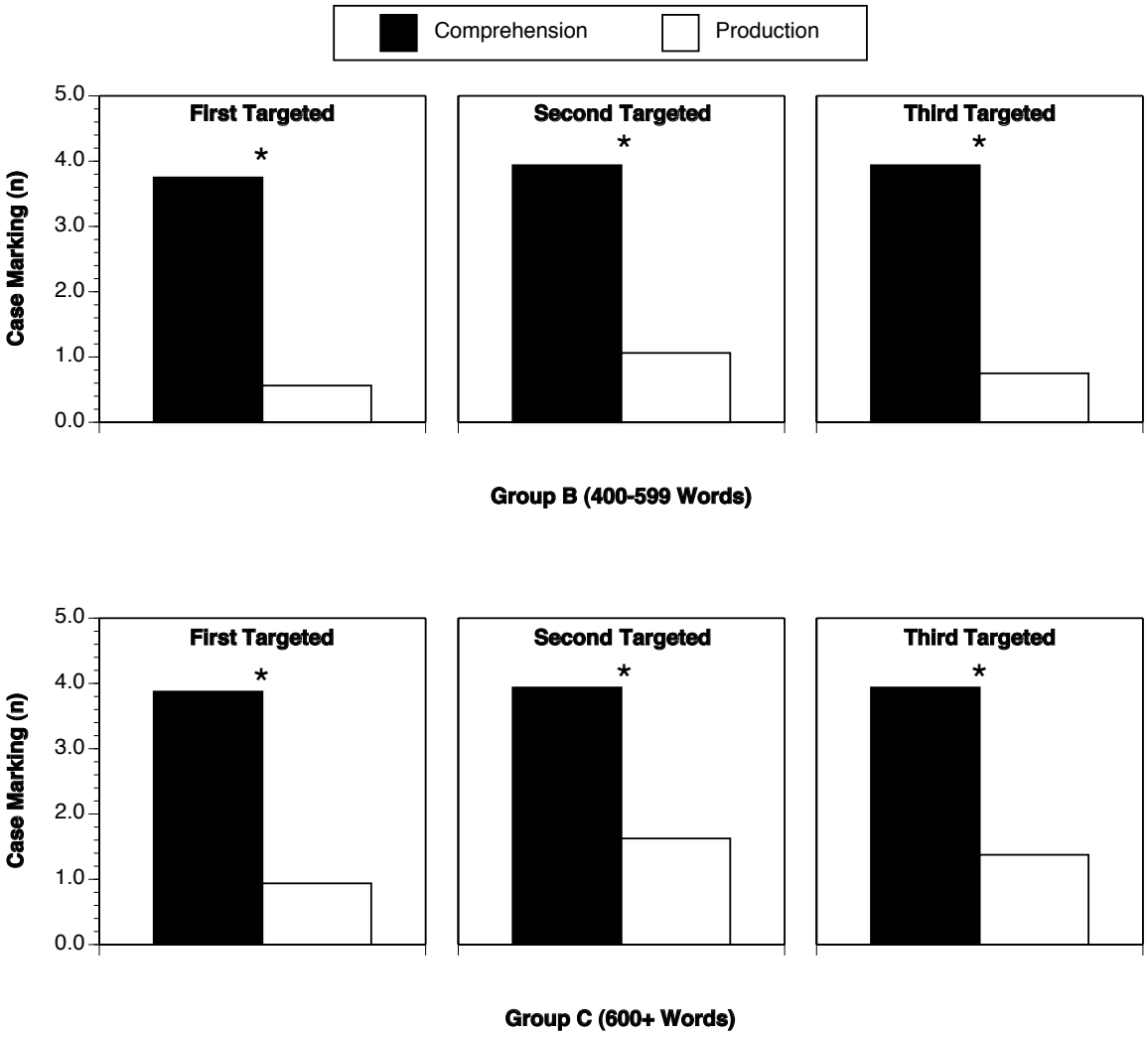

Figure 7.1.4.2.2. Production and comprehension of case markings for Icelandic-speaking children

Table 7.1.4.2.3

Number of utterances with combinations of prepositions/no prepositions and case marking/ no case marking for Icelandic-speaking children

Vocabulary group	*P−C−*	*P+C−*	*P−C+*	*P+C+*
400 to 599 words	44	4	10	17
600+ words	28	7	12	43

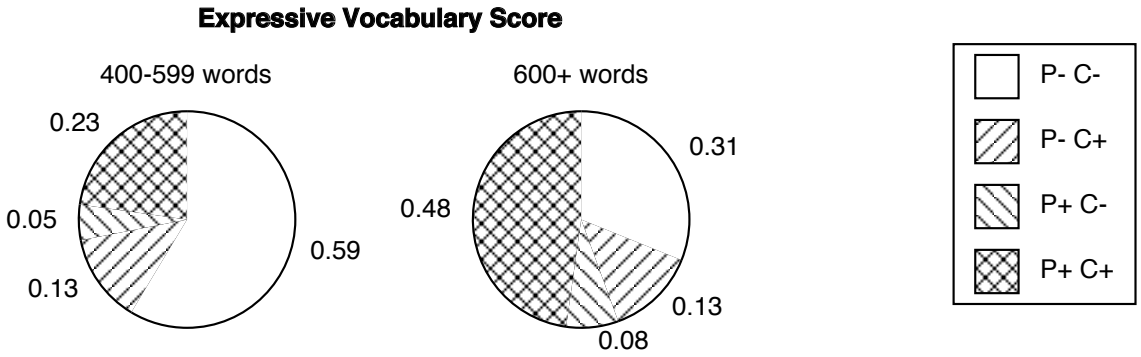

Figure 7.1.4.2.3. Production of prepositions and case markings for Icelandic-speaking children

7.2 Experiment 4: Icelandic-speaking adults

Experiment 4 tests Icelandic-speaking adult's production and comprehension of prepositions and their associated case markings. As with Experiment 3, it specifically contrasts dative assigning location prepositions with accusative assigning location+direction prepositions.

7.2.1 Participants

Thirty-two adults associated with The University of Iceland ages 18;7 to 27;5 (years; months), with a mean age of 23;7 volunteered to participate.[57] There were 16 females and 16 males. Participants identified themselves as native speakers of Icelandic. Although vocabulary size was not assessed for the adults in this experiment, it is assumed that their vocabulary levels are comparable to those of college students in the United States.

7.2.2 Procedures

Experimental procedures used with the Icelandic-speaking adults were identical to those used with the child Icelandic-speaking participants except that there was a preamble before data collection similar to the one used with adult speakers of English translated in Icelandic (see Section 6.2.2).

57 Each participant was offered a University of Arizona pencil as compensation for their participation.

7.2.3 Materials and design

Materials and design used for adult Icelandic-speaking participants were identical to those used for the child Icelandic-speaking participants.

7.2.4 Results

7.2.4.1 Coding of responses

Coding of responses for adult Icelandic-speaking participants was the same as for the child Icelandic-speaking participants.

7.2.4.2 Scoring and analyses

Scoring for adult Icelandic-speaking participant data was the same as for the child Icelandic-speaking participant data. As with the child Icelandic-speaking participant data, the *Wilcoxon Matched-Pairs Signed-Ranks Test* was used to test for significant differences. No statistical analyses were performed for the production patterns of prepositions and case markings.

7.2.4.2.1 Measures of production and comprehension of prepositions

Differences between comprehension and production scores were tested for the question pairs probing for the first-targeted prepositions in the story (location without movement). Figure 7.2.4.2.1 shows a significant difference: $W+ = 0$, $W- = 78$, $N = 12$, $p < .001$. Additionally, the differences between comprehension and production scores were tested for the question pairs probing for the second-targeted prepositions (location with movement) as well. Figure 7.2.4.2.1 indicates that there was not a significant difference: $W+ = 0$, $W- = 1$, $N = 1$, $p = 1$. Likewise, the differences between comprehension and production scores were tested for the question pairs probing for the third-targeted prepositions (location with movement opposite to that of the second-targeted preposition)

as well. Figure 7.2.4.2.1 also indicates that there was not a significant difference: $W+ = 0$, $W- = 0$, $N = 0$, $p = 1$.

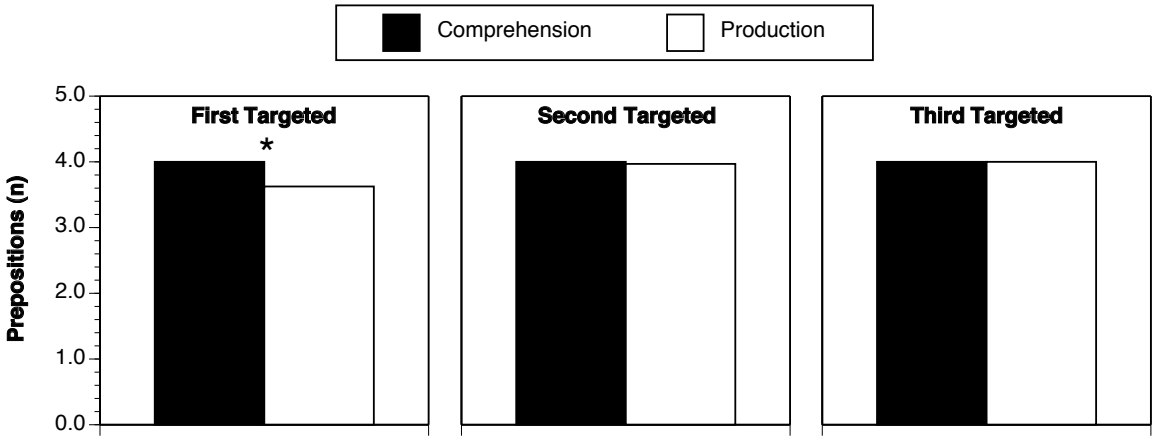

Figure 7.2.4.2.1. Production and comprehension of prepositions for Icelandic-speaking adults

7.2.4.2.2 Measures of production and comprehension of case markings

The differences between comprehension and production scores were tested for the question pairs probing for the first-targeted case markings in the story (location without movement). Figure 7.2.4.2.2 shows that there was a not significant difference: $W+ = 0$, $W- = 15$, $N = 5$, $p = 0.063$. Additionally, the differences between comprehension and production scores were tested for the question pairs probing for the second-targeted case markings (location with movement) as well. Figure 7.2.4.2.2 also shows there was not a significant difference: $W+ = 0$, $W- = 1$, $N = 1$, $p = 1$. Likewise, the differences between comprehension and production scores were tested for the question pairs probing for the third-targeted case markings (location with movement opposite to that of the second-targeted one) as well. Figure 7.2.4.2.2 also shows there was not a significant difference: $W+ = 0$, $W- = 0$, $N = 0$, $p = 1$.

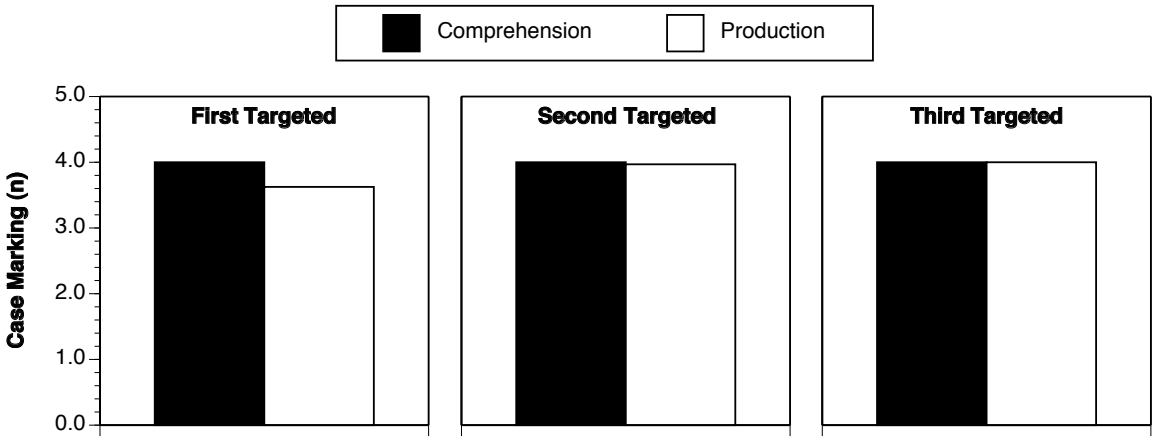

Figure 7.2.4.2.2. Production and comprehension of case markings for Icelandic-speaking adults

7.2.4.2.3 Measures of production of prepositions and case markings

Tallies of the scores for different combinations of prepositions and case markings in utterances produced by adults are shown in Table 7.2.4.2.3a (again with *P* standing for Preposition and *C* standing case marking, and the plus sign standing for present and the minus sign standing for absent). Almost every utterance contained a preposition and associated case marking. Table 7.2.4.2.3b summarizes these results across both Groups B and C and adults with percentages.

Table 7.2.4.2.3a

Number of utterances with combinations of prepositions/no prepositions and case marking/ no case marking for Icelandic-speaking adults

	P−C−	*P+C−*	*P−C+*	*P+C+*
	3	3	10	368

Table 7.2.4.2.3b

Percentages of utterances with combinations of prepositions/no prepositions and case marking/ no case marking for Icelandic-speaking children with 400 to 599 words, children with 600 words or more and adults

Vocabulary group	*P−C−*	*P+C−*	*P−C+*	*P+C+*
400 to 599 words	44	4	10	17
	59%	5%	13%	23%
600+ words	28	7	12	43
	31%	8%	13%	48%
adults	3	3	10	368
	1%	1%	3%	96%

CHAPTER 8:

DISCUSSION AND CONCLUSIONS

8.0 Summary of the hypothesis and results

This dissertation tested the hypothesis that children's omissions of certain elements in early speech are performance-based (McKee, 1994; McKee & Iwasaki, 2001), not competence-based (Felix, 1987; Radford, 1990, 1995; Tomasello, 2000). Specifically, children are more likely to omit free function morphemes, like function prepositions such as *of* in English, because of lack of practice, and limitations in memory and processing capacity that affect lexical and structural integration during utterance generation. However, bound function morphemes, like case markings in Icelandic, are less likely to be omitted because of their attachment to stems that cannot stand alone. Results indicated a difference between comprehension and production for both English- and Icelandic-speaking children. They also indicated a difference between Icelandic treatment of function morphemes (lexically linked bound forms) and English treatment of function morphemes (free structural features), leading to a difference in rates of omission of those elements. These results corroborated existing evidence that comprehension surpasses production (Shipley et al., 1969; Sachs & Truswell, 1978; Gerken et al., 1990; and Shady & Gerken, 1999) and that production performance is better with bound function elements than with free function elements (McKee & Emiliani, 1992).

For English-speaking children in both vocabulary groups (400 – 599 words and 600 words and more), comprehension was significantly greater than production of function prepositions. Likewise, for Icelandic-speaking children in both vocabulary groups (400 – 599 words and 600 words and more), comprehension was significantly greater than production for prepositions and case markings. These findings of variation across modalities support the hypothesis that omissions in telegraphic speech are due to performance-based limitations rather than competence-based limitations.

Note that English-speaking adults, who we assume have fully developed production systems, showed differences between production and comprehension that were similar to the English-speaking children. The Icelandic-speaking adults, however, showed equal comprehension and production of prepositions and case markings. This emphasizes that production of a function element is better when it is supported by a content element stem. Another interpretation is that there may have been a task artifact for the English experiments. (This will be discussed in greater detail in section 8.3.) Additionally, Icelandic-speaking children with 600 or more words had a significantly higher proportion of producing combinations of prepositions and case markings than those with 400 –599 words did. Further, both Icelandic vocabulary groups had very similar proportions of producing combinations of case markings without prepositions. Icelandic-speaking adults used prepositions with their associated case markings almost exclusively. The fact that Icelandic-speaking children who are at the same vocabulary level as English-speaking children, produce function morphemes, such as case markings, points towards a performance-based explanation. Specifically, a plausible processing difference between Icelandic treatment of function elements (e.g., lexically linked bound forms) and English treatment of function elements (e.g., free structural features) leads to a difference in rates of omission of those elements.

Additional noteworthy results are that, when the target was a function preposition, English-speaking children with 400 to 599 words produced content prepositions significantly more than function prepositions for both the first-targeted function preposition condition and the second-targeted function preposition condition. English-speaking children with 600 words or more also produced content prepositions significantly more than function prepositions but only for the second-targeted function preposition condition. They produced content and function prepositions equally as much in the first-targeted function preposition condition. English-speaking adults used function

prepositions significantly more than content prepositions in both conditions. (A possible explanation for this will also be discussed in greater detail in 8.3.) Discussion and possible explanations of the results for each language is discussed in subsequent sections.

8.1 Discussion of cross modality differences as support for a performance-based hypothesis

As listed above, English-speaking children in both vocabulary groups showed understanding of function prepositions despite not always using them in their utterances. Similarly, Icelandic-speaking children in both vocabulary groups showed understanding of prepositions and also of case markings despite not always using them together in their utterances. The data in this dissertation maintain the cross-modality dissociation shown in the literature (e.g., Shipley et al., 1969; Sachs & Truswell, 1978; Gerken et al., 1990; and Shady & Gerken, 1999). This suggests telegraphic speech produced by young children is not a reflection of their underdeveloped competence since performance on comprehension tasks probing for the same items mirrors adult performance. As noted in Chapter 2, production measures are often the only basis of accounting for children's telegraphic speech. This dissertation thus demonstrates the importance of exploring children's competence through other ways to achieve a more complete picture of children's true abilities. The next section shows the importance of using cross-linguistic comparisons.

8.2 Discussion of Icelandic production results and implications of cross-linguistic differences

Recall from Chapter 3 that the underlying syntactic structure for English function prepositions (which contain case information) is very similar to the underlying syntactic structure for Icelandic prepositional phrases that mark for case. Thus, the problem

space of achieving competence of these structures is comparable for learners of each language. As indicated in Figure 7.1.4.2.3, Icelandic-speaking children with 600 or more words produced combinations of prepositions and case markings more often than those with 400 –599 words did. Both vocabulary groups also used combinations of case markings without prepositions at similar rates. As listed in Table 7.2.4.2.3a, adults used prepositions with their associated case markings almost exclusively. Icelandic children produce function morphemes more often in their early utterances than English-speaking children do. In fact, as the results show, case marking emerges before preposition production. Thus, the Icelandic data do not support competence-based theories that claim grammatical morphemes are not present in telegraphic speech because the child does not yet know them.

This corroborates findings on work in other heavily inflected languages with stems that cannot stand alone, such as Italian (McKee & Emiliani, 1992). Tomasello concludes from his work with English-speaking children that they often say whole phrases without knowing how to break them down into individual items. His 1987 paper specifically attributes the delayed onset of grammatical, or function, prepositions such as *to* and *of* to the child's initial lack of analytical knowledge of the grammatical relationships that function prepositions participate in. However, the Icelandic findings provide important pieces of evidence for performance-based hypotheses. First, the findings show children's knowledge of grammatical relationships with their production of inflections with the correct case associated with particular prepositions. Second, the findings show that children can break down the prepositional phrase because they only produce the object inflected for case and do not produce the entire phrase that includes the preposition that determines the case. Further, some of the data show that children used the correct case but sometimes an overgeneralized form (*stólinum* with the common and productive ending -*inum* instead of *stólnum* which is the correct irregular form

for that particular stem, *stól*-) providing further evidence of their analytic knowledge of the language. This dissertation thus show that cross-linguistic studies of children's competence are critical in gaining full understanding of children's true abilities. These differences in cross-linguistic evidence for function morphemes in telegraphic speech support a performance-based hypothesis.

So, what is the locus of difference in the online multi-level production system as espoused by Garrett (1975, 1982), Dell (1986), Bock, (1987), Levelt (1989), and Bock and Levelt (1994)? The critical distinction is whether the function morphemes are free or bound to a stem that cannot be independent. As described in Chapter 4, forms of content morphemes are accessed at the lexeme level, but forms of function morphemes are not retrieved until after positional level processing. If they are free morphemes they are assigned by the structure but their *forms* are not supported by content stems as with bound morphemes and thus are susceptible to omission. If they are bound morphemes, they are anticipated by the lexeme that they attach to. In other words, if the lexeme cannot stand alone, then some form is required. Thus, omissions in children's telegraphic speech may be plausibly linked to the architecture in the production system as it interacts with lexical and grammatical features of the particular language it applies to.

8.3 Discussion of English production results and ambiguity avoidance

As noted above, English-speaking adults showed similar differences between production and comprehension as the English-speaking children. Clearly, this does not indicate that adults lack a fully usable production system. What might account for their performance? One likely possibility lies in the task or materials. Recall in the experimental design that the location content preposition trial is first (e.g., the target is *in*), the first-targeted location+direction content/function preposition follows it (e.g., the target is *into*), and the second-targeted location+direction content/function preposition which is a semantic

contrast is next (e.g., *out of*). Note that the location content prepositions used for the experiment (*in, out, on,* and *off*) are ambiguous in English and could convey either location or location and direction just as their content/function counterparts (*in* can be used instead of *into, out* can be used instead of *out of*, etc.) Thus, saying only a content preposition for a location+direction meaning is an acceptable and grammatical answer in English. This could be why adults did not always produce function prepositions and gave similar results to the child patterns of comprehending function prepositions but seemingly not being able to produce them. This is obviously not the case here, as adults are able to fully use their production systems to produce function prepositions and thus must be attributed to ambiguity of certain prepositions.

English-speaking children with 600 words or more exhibited an interesting pattern in which they produced content and function prepositions equally as much in the first-targeted function preposition condition but produced content prepositions significantly more than function prepositions for the second-targeted function preposition condition. The children with 400–599 words produced content prepositions significantly more than function prepositions for both the first- and second-targeted function preposition condition. One possible interpretation is the older children may be exhibiting a growing sensitivity to pragmatic pressure, in particular avoiding the ambiguity that location content prepositions present. Well-established referential communication tasks with adult participants show avoidance of ambiguity for both non-linguistic ambiguity of objects (Horton & Keysar, 1996; Nadig & Sedivy, 2002; Wardlow & Ferreira, 2003; Wardlow Lane, Groisman, & Ferreira, 2006; Ferreira, Slevc, & Rogers, 2005) and linguistic ambiguity of nouns (Ferreira et al., 2005). To avoid non-linguistic ambiguity, speakers will distinguish between two similar objects that differ only in size or color (e.g., saying "small bat" instead of "bat"; see Ferreira et al., 2005), even if the listener cannot see the other object, rendering the distinction unnecessary for communication. Since they overlap

in meaning, these representations are thought to be at the message level (e.g., as in Garrett (1982) or Levelt's (1989) model) prior to linguistic representations. Similarly, to avoid linguistic ambiguity, speakers distinguish between two different objects that share the same label (i.e., homonyms) most effectively after articulating the ambiguous form of the first mentioned object. For example, when asked to name a picture of a mammalian bat before a picture of a wooden bat, subjects will say "bat" for the first one and "baseball bat" for the second. If the pictures are presented in the opposite order, subjects will again say "bat" for the first one; but they will say something like "bat with wings" for the second (Ferreira et al., 2005). Since they overlap in form, these representations are thought to first exist at the lexeme/positional level in Garrett's (1982) or Levelt's (1989) production model. Ferreira et al. (2005) attributed to production-based strategies the increased efficacy of avoiding an ambiguous utterance only after one has already been uttered, namely incrementality at the word-form level. In other words, if representations are uttered (i.e., the word forms are realized) as soon as they are retrieved, it is too late by the time the second description is retrieved to modify the first. But, once the first description is uttered, that form is available to the speaker through perception or memory of production.

If the effects that Ferreira et al. (2005) found with nouns extend to prepositions, speakers will avoid ambiguity by using a description to distinguish between a location event and location+direction event. It is possible that using a function preposition could disambiguate between the two events. For example, instead of using *in the box* to describe the location+direction, a speaker may say *into the box*. Ambiguity avoidance is an interesting possible explanation of the increase of function preposition use for the children at the 600 word level for the first-targeted function preposition condition or "disambiguating" condition (e.g., *into* follows *in)* and not for the second-targeted function preposition condition or "neutral context" condition (e.g., *out of* follows *into*).

However, the adult data do not clearly support these results. If ambiguity avoidance were employed in these tasks, there would be clear difference in increase of function preposition use for the first-targeted condition as compared to the second-targeted condition. However, the results showed that adults used function prepositions more than content prepositions in both conditions. It is possible that there may have been a disambiguating effect and that using a function preposition in the "disambiguating" condition primed adults to also use function prepositions for the next "neutral" location+direction event, but more research would have to be done to evaluate this.

8.4 Limitations and alternative interpretations

This study is not without limitations. First, for both the English- and Icelandic-speaking children, the participant variable of vocabulary size was determined through scores calculated from the *MacArthur CDI* and *Orðaskil Málþroskapróf*, respectively. Thus, the vocabulary scores are based on the parent's report of a child's lexical inventory and may include observer biases (e.g., the parent may report that the child says more words than they actually do because the parent hopes that their children do). But the parent report measure has been validated (e.g., Reznik & Goldsmith, 1989). Also, although the instructions are typed clearly at the beginning of both the English and Icelandic vocabulary inventories, no additional step was used to verify that the parent read or fully understood the instructions before filling out the form. Thus, some parents may have been assessing their child's vocabulary using different criteria (e.g., a parent may have reported receptive vocabulary instead of productive vocabulary, leading to an inflated score).

Second, production tasks often cannot allow for as precise a narrowing in on the target response as comprehension tasks can. In other words, it is easier for a participant to provide the "correct" or expected answer in a comprehension task than it is in a production task. For example, a comprehension task can allow for a participant to

respond with one of two possible answers – match or non-match, for instance. However, a production task can allow for a participant to respond with one of several answers, most of which may be pragmatically correct from the participant's perspective but non-codable from the experimenter's perspective (e.g., compare how much data is "missing" for the production task versus the comprehension task). Thus, an alternative interpretation of the difference between comprehension and production abilities in children found in the dissertation could possibly be attributed to the difference in targeting a response.

8.5 Future research

An interesting disfluency pattern was observed for the English-speaking children. They were more likely to restart their utterances when the targets were function prepositions than content prepositions. For example, when the target was *into the box*, the child might utter *in the, in the, in the box*. Although a study would have to be specifically designed to investigate this phenomenon (The current study did not have enough disfluent items for the kind of comparative analyses needed), this could suggest that repeating a phrase is used as a strategy to try to hold on to an unrealized representation of a function element with the goal of evoking its realization.[58] This dovetails nicely with the interpretation of children's restarts in work by McDaniel, McKee, & Garrett (2010). Similar phenomena were observed by Radford (1995) – although with a very different competence-based interpretation that children are "bigrammatical".[59] He found that the same child at the

58 Although the goal in this instance is to evoke yet unrealized material, this strategy could be engaging a mechanism similar to Baddeley's (1986) "phonological" or articulatory loop used to aid in working memory.

59 Radford (1995) asserts that children between the ages of 24 – 44 months are in a transitional place that reveals emerging *functional categorical* knowledge. Termed *Later Child English*, he argues that children toggle between the not yet discarded *Early Child English* (lexical-based) grammar and the not yet fully developed adult (lexical- and functional-based) grammar. Roeper and de Villiers (1991) also attribute

same age will sometimes use telegraphic speech and sometimes use complete sentences, sometimes even in contiguous utterances, as shown in examples (23) - (29) (selected from examples of target auxiliary utterances from Radford (1995), pp. 501-502, presented in order of age):

(23) I teasing Mummy. I*'m* teasing Mummy. (Holly, 24 months)

(24) We been there. We*'ve* been there. (Robert, 26 months)

(25) He sleeping. He*'s* sleeping. (Alistair, 30 months)

(26) I eat you all up. I*'ll* eat you all up. (Hannah, 32 months)

(27) That dress not fit me. That dress *does*n't fit me. (Betty, 33 months)

(28) I not got that. I*'ve* not got that. (Tony, 36 months)

(29) I find it. I *can* find it, Mummy. (Nancy, 39 months)

Notice that the first sentence in all of the examples above is telegraphic, but the second sentence is complete, and not the other way around. This ordering again suggests that most likely a performance-based account, as opposed to a competence-based account, would best describe these utterances and further experimental investigation would be a worthwhile endeavor.

Furthermore, the results of this dissertation neither confirm nor refute the possibility that factors such as lack of practice, limitations of memory, and processing speed of coordinating lexical and structural information contribute to difficulty with using the production system. Future experiments tailored for free function morphemes could ask questions like: How much practice is critical for fluent use of free function morphemes in the production system? How would fewer memory resources affect

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this pattern to a type of *grammatical code switching*, in which they claim that some utterances use the underlying structure of lexical VPs and some utterances functional IPs.

free function morphemes in particular? And how is complexity of multiple types of information and levels for insertion problematic for free function morphemes?

8.6 Conclusions

Cross-modality and cross-linguistic evidence suggest that telegraphic speech is best explained by a performance-based account, with omissions attributable to the architecture of the multi-level production system in its handling of free and bound morphemes. Children of both languages show comprehension of items that they are not able to or consistently able to produce, suggesting the problems lies with production and not competence. This finding stresses the importance of studying children at the telegraphic speech level in a modality other than production. Further, young speakers of Icelandic, which uses the same syntactic structures for prepositional phrases as English, include case information in their utterances when young speakers of English omit that information, again suggesting that it must be due to problems with using the production system architecture and not the competence of the syntactic structure. Specifically, the locus of difference is whether a content word stem in the lexeme require a function morpheme for their form. If it does, then a bound function morpheme accessed after positional level processing is easily summoned; if it does not, then a free function morpheme accessed after positional level processing is not expected by the lexeme and thus, is more vulnerable to omission. This finding stresses the importance of studying children at the telegraphic speech level in languages other than English. The study of the phenomenon of telegraphic speech is a complex issue; however, this dissertation has shown that cross-modality and cross-linguistic research can elucidate the mechanisms behind it.

APPENDIX A: LIST OF 50 MOST FREQUENT ENGLISH WORDS
(according to Kucera-Francis, with prepositions bolded)[60]

Source: http://www.midland.edu/abe/worksheets/Need%20to%20Read/kucera-francis.htm

1. the
2. **of**
3. and
4. **to**
5. a
6. **in**
7. that
8. is
9. was
10. he
11. **for**
12. it
13. **with**
14. as
15. his
16. **on**
17. be
18. **at**
19. **by**
20. I
21. this
22. had
23. not
24. are
25. but
26. **from**
27. or
28. have
29. an
30. they
31. which
32. one
33. you
34. were
35. her
36. all
37. she
38. there
39. would
40. their
41. we
42. him
43. been
44. has
45. when
46. who
47. will
48. more
49. no
50. if

60 The preposition *out* is listed as #57 and *off* as #141.

APPENDIX B: LIST OF ENGLISH PREPOSITIONS

Source: http://en.wikipedia.org/wiki/List_of_English_prepositions

Single words

abaft
aboard
about
above
absent
across
afore
after
against
along
alongside
amid
amidst
among
amongst
an
apropos
around
as
aside
astride
at
athwart
atop
barring
before
behind
below
beneath
beside
besides
between
betwixt
beyond
but
by
circa
concerning
despite
down
during
except
excluding
failing
following
for
from
given
in
including
inside
into
like
mid
midst
minus
near
next
notwithstanding
of
off
on
onto
opposite
out
outside
over
pace
past
per
plus
pro
qua
regarding
round
sans
save
since
than
through, thru
throughout, thruout
till
times
to
toward
towards
under
underneath
unlike
until
up
upon
versus
via
vice
with
within
without
worth

Two words

according to
ahead of
as of
as per
as regards
aside from
because of
close to
due to
except for
far from
in to
inside of
instead of
left of
near to
next to
on to
out from
out of
outside of
owing to
prior to
pursuant to
regardless of
right of
subsequent to
thanks to
that of

Three words

as far as
as well as
by means of
in accordance with
in addition to
in case of
in front of
in lieu of
in place of
in point of
in spite of
on account of
on behalf of
on top of
with regard to
with respect to

Archaic or infrequently used

anent
anti (loan word)
behither
betwixt
cum (loan)
ere
fornenst
fornent
outwith
pro (loan)
qua (loan)
re (loan)
sans (loan)
'twixt (from betwixt)
unto
vis-à-vis (loan)

Not fully grammaticalised

concerning
considering
regarding
worth

Preposition-like modifiers of quantified noun phrases

apart from
but
except
plus
save

APPENDIX C: CHART OF ICELANDIC CASE INFLECTION

Neuter, singular (Example: ‘house’)

Case	indefinite	with definite article
nominative	hús-∅	-ið
accusative	hús-∅	-ið
dative	hús-i	-inu
genitive	hús-s	-ins

Masculine, singular (Example: ‘horse’)

Case	indefinite	with definite article
nominative	hest-ur	-inn
accusative	hest-∅	-inn
dative	hest-i	-inum
genitive	hest-s	-ins

Feminine, singular (Example: ‘rug’)

Case	indefinite	with definite article
nominative	mott-a	-in
accusative	mott-u	-ina
dative	mott-u	-inni
genitive	mott-u	-innar

Note: These are paradigms for these specific nouns. For example *hestur* is a masculine noun, but there are other masculine nouns that inflect in a different way, so there are many inflectional paradigms for each gender and strong and weak inflections.

APPENDIX D: LIST OF ICELANDIC PREPOSITIONS

(Thráinsson, 2005 translated by Einar Freyr Sigurðsson, June 2010)

Some prepositions which always govern the accusative (Thráinsson, 2005: 113)

a. gegnum, kringum, um, umfram, umhverfis
b. austur, norður, suður, vestur
c. fram, heim, inn, niður, upp, út
d. aftur fyrir, austur fyrir, fram fyrir, inn fyrir, niður fyrir, norður fyrir, suður fyrir, upp fyrir, vestur fyrir
e. fyrir aftan, fyrir austan, fyrir framan, fyrir handan, fyrir innan, fyrir neðan, fyrir norðan, fyrir ofan, fyrir sunnan, fyrir utan, fyrir vestan

Prepositions which sometimes govern the accusative, sometimes the dative, based on meaning (Thráinsson, 2005: 119)

á ‘on’, í ‘in’, undir ‘undir’, yfir ‘over’, eftir ‘after’, fyrir ‘for, before’, með ‘with’, við ‘with, to, at’

Thráinsson (2005: 119)

a1. Hún skrapp á ballið
she went dance-the.acc
‘She went to the dance’

b1. og var á ballinu
and was dance-the.dat
‘and [she] was at the dance’

a2. Ég fór í skólann
I went school-the.acc
‘I went to the school’

b2. og var í skólanum
and was school-the.dat
‘and [I] was at/in the school’

a3. Hundurinn skreið undir borðið
dog-the crawled table-the.acc
'The dog crawled under the table'

b3. og lá undir borðinu
and lay table-the.dat
'and [the dog] lay under the table'

a4. Við hengdummyndina yfir stólinn
we hung picture-the chair-the.acc
'We hung the picture over the chair'

b4. og hún hékk yfir stólnum
and she hung chair-the.dat
'and she [= the picture] hung over the chair'

a5. Kvæðið er eftir hann
poem-the is him.acc
'The poem is by him'

b5. Ég tók eftir honum
I took him.dat
'I noticed him'

a6. Gerðu þetta fyrir mig
do.you this me.acc
'Do this for me'

b6. Þú ert fyrir mér
you are me.dat
'You are in my way'

a7. Stelpan kom með kærastann
girl-the came boyfriend-the.acc
'The girl brought her boyfriend'

b7. Stelpan kom með kærastanum
girl-the came boyfriend-the.dat
'The girl came alongside with? accompanied by? her boyfriend'

a8. Konan talaði við mig
woman-the talked me.acc
'The woman talked to me'

b8. Konan brosti við mér
woman-the smiled me.dat
'The woman smiled at/to me' [not sure of meaning]

Prepositions which always govern the dative (Thráinsson, 2005: 117)
að 'to', af 'of, by', andspænis 'opposite, facing', ásamt 'together with, along with', frá 'from', gagnvart 'opposite, facing', gegn 'against', gegnt 'opposite', handa 'for', hjá 'with, beside', meðfram 'along', mót = móti?, móti/á móti 'towards, facing, against', samkvæmt 'according to', undan/á undan 'away [only for *undan*], before', úr 'out of, from, of', öndvert 'opposite', á eftir 'after'

Prepositions which always govern the genitive (Thráinsson, 2005: 118)
auk 'beside', án 'without', meðal/á meðal 'among', milli/á milli 'between', millum 'between', sakir 'because of, for sake of', sökum 'because of, for sake of', til 'to', vegna 'because of'
[Thráinsson also puts *megin*]

Prepositions which sometimes govern the accusative, sometimes the genitive, based on meaning (Thráinsson, 2005: 119)
a. austan, norðan, sunnan, vestan
b. innan, ofan, neðan

APPENDIX E: ENGLISH TARGET RESPONSES

STORY ONE

(1)	The bear ran off the towel.	without movement
(2)	The cow ran off of the towel.	with movement
(3)	The cat ran onto the towel.	with movement

STORY TWO

(4)	The sheep jumped in the box.	without movement
(5)	The bunny jumped into the box.	with movement
(6)	The bird jumped out of the box.	with movement

STORY THREE

(7)	The fish swam outside the cup.	without movement
(8)	The frog swam out of the cup.	with movement
(9)	The duck swam into the cup.	with movement

STORY FOUR

(10)	The pig danced on the blanket.	without movement
(11)	The horse danced onto the blanket.	with movement
(12)	The dog danced off of the blanket.	with movement

APPENDIX F: ICELANDIC TARGET RESPONSES

STORY ONE

(1) Kindin hoppaði undir stólnum.
Sheep-the jumped under chair-the (dative) without movement

(2) Kanínan hoppaði undir stólinn.
Bunny-the jumped under chair-the (accusative) with movement

(3) Hundurinn hoppaði yfir stólinn.
Dog-the jumped over chair-the (accusative) with movement

STORY TWO

(4) Fiskurinn synti inni í bollanum.
Fish-the swam inside cup-the (dative) without movement

(5) Froskurinn synti inn í bollann.
Frog-the swam into cup-the (accusative) with movement

(6) Selurinn synti út úr bollanum.
Seal-the swam out of cup-the (dative) with movement

STORY THREE

(7) Flugan flaug yfir borðinu.
Bee/fly-the flew over table-the (dative) without movement

(8) Öndin flaug yfir borðið.
Duck-the flew over table-the (accusative) with movement

(9) Fuglinn flaug undir borðið.
Bird-the flew under table-the (accusative) with movement

STORY FOUR

(10) Bangsinn skreið á mottunni.
Bear-the crawled ran on rug-the (dative) without movement

(11) Fíllinn skreið á mottuna.
Elephant-the crawled ran onto rug-the (accusative) with movement

(12) Hesturinn skreið af mottunni.
Horse-the crawled ran off of rug-the (dative) with movement

APPENDIX G: ENGLISH EXPERIMENT SCRIPT

NOTE: “K” is Questioner, “S” is storyteller, and “C” is child

PREAMBLE & INSTRUCTIONS:

S: [with a lot of enthusiasm] I’m going to tell some stories with these toys over here. But there’s a big problem: [Questioner] is a silly girl and always covers her eyes when I tell my stories!

K: [covers eyes] I can’t see you, but I can hear you!

S: So, you can tell her what she doesn’t see. Does this sound like a game you want to play?

PRACTICE [DOWN/ UP]

S: This first story has a special thing! It is this bottle!
Here's the bottle!
And tell me, what's this? – [place squirrel ON bottle]
And what's this? – [place monkey at bottom of bottle]
Now, ooohhhh…the animals are going to crawl.

S: First the squirrel crawls.
K: [covers eyes]
S: Crawling down, crawling down, crawling down [squirrel crawls DOWN bottle]

K: [Says Storyteller's name], where did the squirrel crawl?
S: Right here!
K: I don't know where "right here" is because I can't see! Can you TELL me – where did the squirrel crawl?
S: Oh! DOWN the bottle

K: [uncovers eyes] Which one crawled DOWN the bottle?
S: the squirrel

S: Now the monkey is going to crawl
K: [covers eyes]
S: Crawling up, crawling up, crawling up. [monkey crawls UP bottle and stays on top]

K: [Says child's name] where did the monkey crawl?
C: UP the bottle [code]

K: [uncovers eyes] Which one crawled UP the bottle?
C: the monkey [code]

K: Oh, I get it now! Okay! Thank you for helping me!

STORY #1 [INSIDE / INTO]

S: Now this next story also has a very special thing, but it is this box!
Here is the box!
And tell me, what's this? – [place sheep INSIDE box]
What's this? – [place bunny OUTSIDE box]
And this? – [place bird INSIDE box]
Now, all of the animals are going to jump

S: First the sheep is going to jump.
K: [covers eyes]
S: Jump, jump, jump [sheep jumps up and down INSIDE box]

K: Where did the sheep jump?
C: INSIDE the box

K: [uncovers eyes] And which one jumped INSIDE the box?
C: the sheep

S: Okay, so now the bunny is going to jump.
K: [covers eyes]
S: Jump, jump, jump [bunny jumps INTO box]

K: where did the bunny jump?
C: INTO the box

K: [uncovers eyes] Which one jumped INTO the box?
C: the bunny

S: Now, look! The bird is going to jump.
K: [covers eyes]
S: Jump, jump, jump [bird jumps OUT OF box]

K: Where did the bird jump?
C: OUT OF the box

K: [uncovers eyes] Which one jumped OUT OF the box?
C: the bird

K: Oh, I get it now! Alright!
S: Yaaay!

STORY #2 [OUTSIDE / OUT OF]

S: Now this next story has my favorite thing, but this time it is this cup!
Here is the cup!
And what is this? – [place fish OUTSIDE cup]
And now tell me, what is this? – [place frog INSIDE cup]
What's this? – [place duck OUTSIDE cup]
Now, all of the animals are going to swim

S: First the fish is going to swim
K: [covers eyes]
S: Swim, swim, swim [fish swims OUTSIDE cup]

K: where did the fish swim?
C: OUTSIDE the cup

K: [uncovers eyes] And which one swam OUTSIDE the cup?
C: the fish

S: Then look! The frog is going to swim
K: [covers eyes]
S: Swim, swim, swim [frog swims OUT OF cup]

K: And where did the frog swim?
C: OUT OF the cup

K: [uncovers eyes] Which one swam OUT OF the cup?
C: the frog [code]

S: Now the duck is going to swim
K: [covers eyes]
S: Swim, swim, swim [duck swims INTO cup]

K : Where did the duck swim?
C: INTO the cup

K: [uncovers eyes] Which one swam INTO the cup?
C: the duck

S & K: Yaaaay!!!

STORY #3 [ON / ONTO]

S: This story has a very special thing, too… Look! It is this blanket!
Here is the blanket! Feel how soft it is!
And tell me, what is this? – [place pig ON blanket]
And what is this? – [place horse OFF blanket]
What is this? – [place dog ON blanket]
Now, all of the animals are dance

S: So first the pig is going to dance.
K: [covers eyes]
S: Dance, dance, dance [pig dances ON blanket]

K: Where did the pig dance?
C: ON the blanket

K: [uncovers eyes] Which one danced ON the blanket?
C: the pig

S: Okay, so now the horse is going to dance
K: [covers eyes]
S: Dance, dance, dance [horse dances ONTO blanket]

K: Where did the horse dance?
C: ONTO the blanket

K: [uncovers eyes] Which one danced ONTO the blanket?
C: the horse

S: Then … oh… the dog is going to dance
K: [covers eyes]
S: Dance, dance, dance [dog dances OFF OF blanket]

K: Where did the dog dance?
C: OFF OF the blanket

K: [uncovers eyes] And which one danced OFF OF the blanket?
C: the dog

K: Oh, I get it now!
S: Alright!

STORY #4 [OFF / OFF OF]

S: Oh, look! Now this story has a special thing and it is this towel!
Here is the towel!
Aaaand, what is this? – [place bear OFF towel]
And this? – [place cow ON towel]
And what is this? – [place cat OFF towel]
Now, all of the animals are going to run

S: First the bear is going to run
K: [covers eyes]
S: Run, run, run [bear runs OFF towel]

K: Where did the bear run?
C: OFF the towel

K: [uncovers eyes] Which one ran OFF the towel?
C: the bear

S: Now the cow is going to run
K: [covers eyes]
S: Run, run, run [cow runs OFF OF towel]

K: And where did the cow run?
C: OFF OF the towel

K: [uncovers eyes] Which one ran OFF OF the towel?
C: the cow

S: Then the cat is going to run
K: [covers eyes]
S: Run, run, run [cat runs ONTO towel]

K: where did the cat run?
C: ONTO the towel

K: [uncovers eyes] Which one ran ONTO the towel?
C: the cat

K: Alright!

APPENDIX H: ICELANDIC EXPERIMENT SCRIPT [HANDRITIÐ Á ÍSLENSKU]

Formáli og leiðbeiningar:

Sögumaður: [Af miklum ákafa] Ég ætla að segja þér nokkrar sögur með þessum leikföngum hérna. En það er eitt stórt vandamál: [Spyrill] er algjör kjáni og tekur alltaf fyrir augun þegar ég segi sögurnar mínar!

Spyrill: Ég sé þig ekki, en ég heyri í þér!

Sögumaður: Þannig að þú getur hjálpað henni og sagt henni frá því sem hún sér ekki. Langar þig að koma í svoleiðis leik?

ÆFINGARSAGA [niður / upp]

Sögumaður: Þá er það fyrsta sagan! Hérna er pelinn sem við þurfum að nota.
[Storyteller: Now it‘s first story-the! Here is bottle-the which we need to use]
Og hvað er þetta? - [setja bangsann Á pelann]
Og hvað er þetta? - [setja apann upp við pelann]
Og núna, úúúúú.... Núna ætla öll dýrin að klifra.

Sögumaður: Fyrst ætlar bangsinn að klifra.
Spyrinn: [Tekur fyrir augun]
Sögumaður: Klifra niður, klifra niður, klifra niður [bangsinn klifrar NIÐUR pelann]

Spyrill: Gyða, hvert klifraði bangsinn?
[K: Gyða, where to did the bear climb?]
Sögumaður: þangað!
[S: Right there to!]
Spyrill: Ég veit ekki hvar „þangað“ er því ég sé ekki neitt! Þú verður að SEGJA mér; Hvert klifraði bangsinn?
Sögumaður: Óóóó... Niður pelann
[Oh! Down bottle the (dative)]

Spyrill: [Tekur hendurnar frá augunum] Hver klifraði niður pelann?
Sögumaður: Bangsinn.

Sögumaður: Nú ætlar apinn að klifra.
Spyrill: [tekur fyrir augun]
Sögumaður: Klifra upp, klifra upp, klifra upp.
[apinn skríður UPP pelann og situr kyrr á honum]

Spyrill: [segir nafn barnsins] hvert klifraði apinn?
[K: says child´s name where to did monkey the climb?]

Barn: UPP pelann [skrá]

Spyrill: [Tekur hendurnar frá augunum] Hver klifraði UPP pelann?
Barn: Apinn [skrá]

Spyrill: Jáá! Ég skil þetta núna! Takk fyrir að hjálpa mér!

Saga 1: [undir…dative / undir…accusative]

Sögumaður:	Jæja, þá er það næsta saga! Og við ætlum að nota stólinn!
	Og hvað er þetta? [Setja kindina UNDIR stólinn]
	Og hvað er þetta? [Setja kanínuna við hliðina á stólnum]
	Og hvað er þetta? [Setja hundinn við hliðina á stólnum]
	Og núna ætla öll dýrin að hoppa!
Sögumaður:	Fyrst ætlar kindin að hoppa.
Spyrill:	[Tekur fyrir augun]
Sögumaður:	Hopp, hopp, hopp [kindin hoppar undir stólnum]
Spyrill:	Hvar hoppaði kindin?
	[Where jumped sheep the]
Barn:	Undir stólnum
	[UNDER chair the (dative)]
Spyrill:	[tekur hendurnar frá augunum] Hver hoppaði UNDIR stólnum?
Barn:	Kindin
Sögumaður:	Flott! Jæja, nú ætlar kanínan að hoppa.
Spyrill:	[tekur fyrir augun]
Sögumaður:	Hopp, hopp, hopp [kanínan hoppar UNDIR stólinn]
Spyrill:	Hvert hoppaði kanínan?
	[where to jumped bunny the]
Barn:	UNDIR stólinn
	[UNDER chair-the (accusative)]
Spyrill:	[tekur hendurnar frá augunum] Hver hoppaði UNDIR stólinn?
Barn:	Kanínan
Sögumaður:	Flott! jæja, sjáðu, nú ætlar hundurinn að hoppa.
Spyrill:	[Tekur fyrir augun]
Sögumaður:	Hopp, hopp, hopp [hundurinn hoppar YFIR stólinn]
Spyrill:	Hvert hoppaði hundurinn?
	[where to jumped dog the (nominative)]
Barn:	YFIR stólinn
	[YFIR chair the (accusative)]
Spyrill:	[Tekur hendurnar frá augunum] Hver hoppaði UPP ÚR kassanum?
Barn:	Hundurinn

Spyrill: Jáá, ég fatta þetta núna!
Sögumaður: Jeiiiiij!

Saga 2: [Inni í …dative/ Inn í …accusative]

Sögumaður: Þá er það næsta saga og þetta er bollinn sem við ætlum að nota!
Og hvað er þetta? - [setja fiskinn INN Í bollann]
Og hvað er nú þetta?- [setja froskinn FYRIR UTAN bollann]
En hvað er þetta?- [setja selinn INN Í bollann]
Og nú ætla öll dýrin að synda!

Sögumaður: Fyrst ætlar fiskurinn að synda.
Spyrill: [tekur fyrir augun]
Sögumaður: Synda, synda, synda [fiskurinn syndir INNI Í bollanum]

Spyrill: Hvar synti fiskurinn?
[where swam fish the]
Barn: INNI Í bollanum

Spyrill: [tekur hendurnar frá augunum] og hver synti INNI Í bollanum?
Barn: Fiskurinn

Sögumaður: Og sjáðu, nú ætlar froskurinn að synda.
Spyrill: [tekur fyrir augun]
Sögumaður: Synda, synda synda [froskurinn syndir INN Í bollann]

Spyrill: Hvert synti froskurinn?
Barn: INN Í bollann
[INTO cup the (accusative)]
Spyrill: Hver synti INN Í bollann?
Barn: Froskurinn

Sögumaður: Og nú ætlar selurinn að synda.
Spyrill: [tekur fyrir augun]
Sögumaður: Synda, synda, synda [selurinn syndir ÚT ÚR bollanum]
Spyrill: Hvert synti selurinn?
[where to swam seal the?]
Barn: ÚT ÚR bollanum
[OUT OF cup the (dative)]

Spyrill: [tekur hendurnar frá augunum] Hver synti ÚT ÚR bollanum?
Barn: Selurinn

Sögumaður og spyrill:Jeiiiiij!!!

Saga 3: [YFIR…dative / YFIR…accusative]

Sögumaður: Þá er það næsta saga og við ætlum að nota borðið.
Og hvað er þetta? - [setja fluguna á borðið]
Og hvað er þetta? - [setja öndina í kjöltuna]
Og hvað er svo þetta? - [setja fuglinn í kjöltuna]
Og nú ætla öll dýrin að fljúga!

Sögumaður: Fyrst ætlar flugan að fljúga.
Sögumaður: [tekur fyrir augun]
Sögumaður: Fljúga, fljúga, fljúga [flugan flýgur YFIR borðinu (dative)]

Spyrill: Hvar flaug flugan?
[where flew bee the?]
Barn: YFIR borðinu.
[OVER table the (dative)]

Spyrill: [tekur hendurnar frá augunum] Hver flaug yfir borðinu?
Barn: Flugan

Sögumaður: Og nú ætlar öndin að fljúga
Spyrill: [Tekur fyrir augun]
Sögumaður: Fljúga, fljúga, fljúga [Öndin flýgur YFIR borðið (accusative)]

Spyrill: Hvert flaug öndin?
[where to flew duck the]
Barn: YFIR borðið
[OVER table the (accusative)]

Spyrill: [Tekur hendurnar frá augunum] Hver flaug yfir borðið (accusative)?
Barn: Öndin

Sögumaður: Og nú ætlar fuglinn að fljúga
Spyrill: [Tekur fyrir augun]
Sögumaður: Fljúga, fljúga, fljúga [Fuglinn flýgur UNDIR borðið]

Spyrill: Hvert flaug fuglinn?
[Where to flew bird the]
Barn: Undir borðið
[UNDER table the (accusative)]

Sögumaður: Hver flaug undir borðið?
Barn: Fuglinn

Spyrill: Jáá! Ég skil þetta núna
Sögumaður: Flott!

Saga 4: [Á…dative / Á…accusative]

Sögumaður: Þá er það næsta saga og þetta er mottan sem við ætlum að nota!
Og hvað er þetta? - [Setja köttinn á mottuna]
En hvað er þetta? - [Setja fílinn ekki á mottuna]
Og hvað er nú þetta? - [Setja hestinn á mottuna]
Og nú ætla öll dýrin að skríða

Sögumaður: Fyrst ætlar kötturinn að skríða.
Spyrill: [tekur fyrir augun]
Sögumaður: skríða, skríða, skríða [kötturinn skríður Á mottunni (dative)]

Spyrill: Hvar skreið kötturinn?
[where crawled cat the?]
Barn: Á mottunni.
[ON rug the (dative)]

Spyrill: [tekur hendurnar frá augunum] Hver skreið Á mottunni (dative)?
Barn: Kötturinn

Sögumaður: Síðan ætlar fíllinn að skríða.
Spyrill: [Tekur fyrir augun]
Sögumaður: Skríða, skríða, skríða [Fíllinn skríður Á mottuna (accusative)]

Spyrill: Hvert skreið fíllinn?
[where to crawled elephant the?]
Barn: Á mottuna.
[ONTO rug the (accusative)]

Spyrill: [Tekur hendurnar frá augunum] Hver skreið Á mottuna (accusative)?
Barn: Fíllinn

Sögumaður: Síðan ætlar hesturinn að skríða.
Spyrill: [Tekur fyrir augun]
Sögumaður: Skríða, skríða, skríða [Hesturinn skríður AF mottunni (dative)]

Spyrill: Hvert skreið hesturinn?
[where to crawled horse the?]
Barn: Af mottunni.
[OFF OF rug the (dative)]

Spyrill: [Tekur hendurnar frá augunum] Hver skreið AF mottunni (dative)?

Barn: Hesturinn

Spyrill: Já!
Sögumaður: Flott hjá þér!

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