

CHILDREN'S RESPONSES TO GRAMMATICALLY COMPLETE
AND INCOMPLETE PROMPTS TO IMITATE

By

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Shelley Laine Bredin-Oja

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Chairperson Marc E. Fey

Nancy Brady

Betty Bunce

Diane Loeb

Diane Nielsen

Date Defended: July 18, 2012

The Dissertation Committee for Shelley Laine Bredin-Oja
certifies that this is the approved version of the following dissertation:

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Chairperson Marc E. Fey, Ph.D.

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ABSTRACT

Purpose: Various language intervention programs instruct clinicians and parents of children with language learning difficulty to expand their child's utterance by adding one or two words. This often results in a telegraphic utterance, one that is devoid of function words and inflectional endings. Other programs not only advocate the use of telegraphic models but explicitly prompt the child to produce a grammatically incomplete, and therefore, incorrect utterance. These programs make the assumption that prompts to imitate telegraphic models aid in production by making a targeted language goal easier for the child to imitate. The purpose of this investigation is to determine if children in the early stage of combining words are more likely to respond to elicited imitation prompts that are telegraphic than to elicited imitation prompts that are grammatically complete.

Method: Five children between the ages of 30-51 months with expressive language delay participated in a single-case alternating treatment design with fourteen sessions evenly split between a grammatical and a telegraphic condition. Children were given 15 elicitive prompts to imitate a semantic relation that was either grammatically complete (e.g., *Say the frog is jumping*) or telegraphic (e.g., *Say duck walking*). Children's responses to the elicitive prompts that contained a semantic relation or a semantic relation with a function word were analyzed separately using a randomization test.

Results: No differences between conditions were found for the number of responses that contained a semantic relation. Children responded to prompts that were

grammatically complete as frequently as to prompts that were telegraphic. In contrast, there was a statistically significant difference for the inclusion of a function word. Three of the five children were more likely to include a function word in their response when the elicitive prompt was grammatical. Two children did not include a function word in either condition.

Conclusion: Reducing an elicitive prompt to imitate to the point that it is no longer grammatical does not offer any advantage as a language intervention technique.

Children are just as likely to respond to a grammatically complete elicitive prompt.

Further, including function words encourages children, who are developmentally ready, to imitate them.

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“Somehow, then, every child processes the speech to which he is exposed so as to induce from it a latent structure.”
(Brown & Bellugi, 1964, p.144)

Input matters. Regardless of one’s theoretical standpoint on the acquisition or development of language, everyone agrees that input of the target language is necessary. Furthermore, it is hardly controversial to claim that language intervention can be beneficial for children with language learning difficulty. What is still debated, however, is the aptness of different intervention features and feature combinations.

This dissertation is designed to explore one such feature that is found in various language intervention programs (e.g., Milieu Teaching, Hancock & Kaiser, 2006). Namely, the use of prompts to imitate telegraphic, or grammatically incomplete, models. Specifically, this study questions whether children who are just beginning to combine words respond more reliably to requests to imitate telegraphic models versus grammatically complete models.

A telegraphic model is one that is missing certain elements such as articles, copulas, auxiliary verbs, and inflectional endings. The following examples contrast a telegraphic utterance with a corresponding grammatically complete utterance.

(1a) boy in house

(1b) the boy is in the house

(2a) girl walk

(2b) the girl is walking

(3a) baby like milk

(3b) the baby likes milk

There have been numerous language teaching programs that have instructed adults to use telegraphic models with the assumption that this technique aids comprehension. For example, the Syntax Teaching Program (Miller & Yoder, 1972a; van Kleeck et al., 2010) explicitly states that the clinician's input to the child should be reduced to telegraphic speech initially. The authors suggest that the use of telegraphic speech by the clinician reduces the adult syntax to the level of a typically developing child's early syntactic code. Thus, the language-delayed child "would not have to pick out from the adult syntax those forms or words which carry the contextual meaning of the linguistic code. Instead the child would have the content words presented directly to him in phrases or two-word combinations" (Miller & Yoder, 1972b, p. 203). By using telegraphic speech, the task of learning language is assumed to be simplified until the child is able to handle meaningfully the basic components of adult syntax (Miller & Yoder, 1972a).

More recent programs also advocate the use of telegraphic models and directly instruct parents of children with language learning difficulty to use telegraphic utterances. Kumin (2003) instructs parents to expand their child's utterance by adding one word. This strategy will often result in a telegraphic model. As a case in point, she provides the following example: Child: "car go" Adult expansion: "car go fast" or "big car go" (p. 87).

It Takes Two to Talk[®] - The Hanen Program[®] for Parents (Pepper & Weitzman, 2004) teaches parents how to encourage their child's language development in naturally occurring communicative circumstances. One of the many

techniques presented is the notion of “expanding your child’s message”. The parent guide book instructs parents to do this by “imitating the words she says and adding one or two more”. Both the parent guide book and the accompanying teaching tape offer multiple examples of parents using telegraphic speech, thereby implicitly suggesting to parents that telegraphic models are appropriate. It must be noted though, that recently Weitzman has stated the use of telegraphic speech does not have to be an essential component of the program and asserts that future editions of the program resources will include examples of language modeling strategies that contain grammatically complete utterances (van Kleeck et al., 2010).

Each of these intervention programs promotes the adult use of telegraphic models based on the assertion that the reduced input will aid the child’s comprehension. By providing language models that are at or above the child’s expressive abilities by just one word, the child will not need to distinguish content words from competing elements such as articles, auxiliaries and inflections; what has been described as “big blobs of acoustic mess” (Bever, 1971, p. 311).

Other programs not only advocate the use of telegraphic models by the adult but also go one step further by explicitly prompting the child to produce a grammatically incomplete, and therefore, incorrect utterance. These programs make the assumption that prompts to imitate telegraphic models, henceforth called telegraphic elicitive prompts, aid in production by making a targeted language goal easier for the child to imitate.

The Behavioral-Psycholinguistic Approach to language training (Stremel & Waryas, 1974) is one such program. This language training program is based on normal language development sequence, that is, children's early utterances contain content words only such as nouns and action verbs followed by semantically less complex adjectives, prepositions, and pronouns. Auxiliaries, determiners, and morphological markers are missing from these early utterances, so they are also omitted from the beginning stages of the program. Because children are initially limited in the length of their utterances, the authors decided to delay training on these functors until children are able to express complete relational concepts with content words. For example, they understandably reasoned that a child at the two-word stage who could say "boy sit" had more functional communication than one who could say "the boy".

In addition to the use of telegraphic elicitive prompts (e.g., "Say 'boy eat' "), the program uses adult expansions of child utterances as a grammatically progressive procedure for the child. For example, if the child is receiving training on subject + verb structures, the expansion, subject + verb + object, devoid of functors, is provided immediately after the child is reinforced for his correct subject + verb response (e.g., Child: "girl eat. " Clinician: "That's right, girl eat cookie"). Furthermore, the clinician is also directed to use telegraphic question stimuli such as "what girl doing?" when prompting for verbal responses, presumably to aid in comprehension.

The Environmental Language Intervention Strategy (MacDonald & Blott, 1974) is another example. This program was designed to increase utterance length

and grammatical complexity for children who were primarily at the single word level. It employs elicited imitation, conversation, and play to facilitate generalization to the child's natural language environment. One of the techniques of the program is to provide telegraphic elicited prompts such as "Say 'put in cup' " or "Say 'ball there' ".

Enhanced Milieu Teaching (Hancock & Kaiser, 2006) is a hybrid intervention that is based on environmental arrangement, responsive interaction, and milieu teaching. It is most appropriate for children in early stage I through stage IV of language development. The selection of goals, as with the intervention programs described above, follows a developmental sequence. Therefore, the specific targets progress from single words to two-word combinations to multi-word utterances. An integral part of milieu teaching is the use of elicitive prompts and Hancock and Kaiser (2006) explicitly teach parents to use telegraphic forms of these prompts (van Kleeck et al., 2010). Kaiser (2007) recommends the use of telegraphic elicitive prompts for children who are making the transition from single words to two-word combinations as well as for children who have three-word combinations as their intervention goal. It is important to note, however, that Kaiser recommends that adult expansions of child utterances be complete and not telegraphic.

As noted above, proponents of telegraphic elicitive prompts make several assumptions, both implicit and explicit. First, there is the implicit assumption that the use of telegraphic elicitive prompts and telegraphic input in general is not detrimental to a child who has difficulty learning language. Second, the use of telegraphic input aids comprehension by reducing the length of an utterance and stripping away those

elements that are deemed difficult for a child. Third, telegraphic elicitive prompts facilitate production by making targets easier to imitate and, ultimately, easier to produce. The purpose of this dissertation is to empirically test this third assumption. That is, are telegraphic elicitive prompts more likely to result in a response from a child?

To develop an understanding of what effect telegraphic models might have, a review of previous work regarding the impact of telegraphic models on comprehension is presented. Next, studies demonstrating children's ability to perceive functors at very young ages, long before they can produce them, are discussed. These sections provide an empirical base that questions a key stance of proponents who advocate the use of telegraphic models in language intervention, namely, that it aids comprehension. A description of other potential problems with the use of telegraphic models follows. This chapter then presents a review of two studies that offer conflicting evidence regarding the effect of function words on imitative language production. Finally, the benefit of elicited imitation as an intervention technique is presented to help validate the importance of this study.

Effects of telegraphic and grammatically complete models on comprehension.

There are several studies that have compared the effects of telegraphic models versus grammatically complete models on comprehension of young children with and without language delays. With only a few notable exceptions, the results of these

studies indicate either no significant difference in comprehension between grammatical and anomalous sentences, or they favor the grammatical models.

Shipley, Smith and Gleitman (1969) evaluated typically developing children's ability to comprehend well-formed commands (e.g., Throw me the ball), telegraphic commands (e.g., Throw ball) and isolated noun commands (e.g., Ball). Seven children had language skills in the late stage I while four children were in the early stage I of language development. The results of their study showed that children at early stage I comprehended single word and telegraphic commands better than grammatically complete commands while children at late stage I comprehended the grammatically complete commands more often.

Miller and Yoder (1972a), in their development of the content for the Syntax Teaching Program, pointed to these results as support for their notion that many linguistic forms could not be acquired until the child was capable of understanding them and, therefore, the adult use of telegraphic utterances was warranted. However, the methods used by Shipley et al. (1969) call into question the validity of this conclusion. The authors considered all "relevant responses" as correct; these included responding to the command, simply touching or looking at the object, as well as repeating the command. Including verbal imitations as a correct response would result in favor of telegraphic utterances. Children's expressive language in Stage I is characterized by absent inflections, articles, and prepositions and has been described as telegraphic (Brown, 1973).

Petretic and Tweeney (1977) conducted a study comparing typically developing children's comprehension of grammatically complete versus telegraphic utterances, in part, to replicate the findings of Shipley et al. (1969). However, the authors used a more rigorous methodology: this included more specific response categories such as "action appropriate to the stimulus sentence", both declarative and imperative utterance types, and a greater number of subjects.

They studied 36 children between the ages of 1;9 – 3;6. Children were grouped according to their MLU with 12 children in each group. Group 1 had an MLU range of 1.07 – 1.66; Group 2 had an MLU range of 1.75 – 2.33; and Group 3 had an MLU range of 2.40 – 3.53. The results showed that children in the more advanced telegraphic stages (Group 2 and 3) performed better with grammatically complete sentences, regardless of utterance type. This pattern is consistent with Shipley et al.'s (1969) findings. Contrary to the Shipley et al. study, children in the earliest stage (Group 1) also performed better when presented with grammatically complete declaratives and imperatives than with telegraphic utterances. The authors concluded that function words do appear to facilitate comprehension and when familiar function words are removed, performance is impaired. Thus, both content and function words appear to be processed at even the earliest stage of telegraphic speech.

Fraser (1972) compared the effects of grammatically complete commands versus telegraphic commands (e.g., "give me the key" versus "give key") on the receptive vocabulary skills of children with cognitive delays as well as language

delays. He reasoned that children with language-learning difficulty may have problems in distinguishing verbal labels of objects from competing elements such as negatives, adjectives, or inflections. The purpose of his study was to determine if simplifying the syntax, without losing the meaning of the utterance, would improve the child's attention to a label of an object.

Fifty children between the ages of 3;7 and 15;9 with significant expressive language and cognitive delays were trained to respond to grammatically complete commands and telegraphic commands consisting of a verb ("give" or "see") plus a referent, each with a set of four objects. Correct responses included picking up the object and looking at it or looking directly at the object. Results showed that there was no statistically significant difference between objects taught by grammatically complete commands or by telegraphic commands. Fraser concluded that simplifying the sentence's syntax did not increase the comprehension of referents.

Page and Horn (1987) also studied developmentally delayed children and their ability to comprehend grammatically complete utterances versus telegraphic utterances. Ten children between the ages of 3;3 and 5;4 with language and cognitive delays served as subjects. Five children were functioning in early stage I (MLU of 1.01 – 1.49) and five children were in late stage I (MLU of 1.50 – 1.99). The researchers presented the children with eight forms of four declarative utterances. These consisted of a well-formed grammatically complete utterance (e.g., the dog kicks the ball); a form in which nonsense syllables replaced the function words (e.g., nop dog kicks nop ball); four telegraphic forms (e.g., SVO – dog kick ball; SV – dog

kick; VO – kick ball; and a length-controlled form – OK, [name], dog kick ball); and two inverted forms (e.g., the ball kicks the dog; ball kick dog). The children were instructed to act out the sentences using Fisher-Price toys.

The results indicated that children in the late stage I of language development performed equally well on all non-inverted forms, that is, there was no difference between grammatically complete and telegraphic utterances. Children in the early stage I of language development performed more poorly than late stage I children on all non-inverted utterance types except the telegraphic form of VO. For this type of telegraphic utterance, children in the early stage I performed as well as the children in late stage I.

These results suggest that the linguistic level of developmentally delayed children impacts their comprehension. Children who were in early stage I exhibited reduced comprehension of both grammatically complete and telegraphic declarative utterances compared to children in late stage I, with one exception. The finding that children with less linguistic ability performed better with the telegraphic form of VO could be interpreted as support for the use of telegraphic utterances with children who are in the early stage of language development. However, as the authors point out, there are reasons to question this interpretation.

First, for the VO condition, the children were able to employ a self-as-agent strategy and receive credit for a correct response. This strategy is typical of children at the emerging two-word level (de Villiers and de Villiers, 1973) and so may have been employed by the children in this study when they did not comprehend an

utterance. Children who used this strategy would receive credit for correct responses in only the VO condition. Second, the comprehension task required the children to comply with a request, that is, to act out an action with toys. The utterances presented to the children in this study were declaratives; only the VO condition resulted in an utterance that resembled a request. Therefore, the linguistic form of VO utterances was congruent with the pragmatic function of a request and may have facilitated comprehension.

The authors concluded that the pattern of results found in their study do not support the exclusive use of either grammatically complete or telegraphic utterances to aid comprehension in developmentally delayed children who are at stage I of linguistic development.

Duchan and Erickson (1976) compared comprehension of four different semantic relations in children who were typically developing and children with cognitive and language delays. Twelve typically developing children between the ages of 1;6 and 2;7 and 12 children with cognitive and language delays between the ages of 4;0 and 7;9, all with an MLU in morphemes between 1 and 2.5 served as subjects. The children were required to act out sentences involving the semantic relations of agent-action, action-object, possessive, and locative under three verbal contexts: a grammatically complete context (e.g. "the book is on the chair"); a telegraphic context with deleted auxiliaries, articles, prepositions, and inflectional morphemes (e.g. "book chair"); and a nonsense context where the functors and

inflectional endings were replaced with nonsense syllables so that the utterance was similar in length and prosody to the grammatically complete context.

The results indicated that both the typically developing children and the children with cognitive and language delays performed best in the grammatically complete context, followed by the telegraphic context and did most poorly in the nonsense context. Further, each of the semantic relations was significantly different from the others with possessives best, followed by action-object, agent-action, and locatives poorest. The authors suggest that although prepositions are frequently missing from children's utterances during the telegraphic stage, these words may carry more semantic force than other functors.

The authors concluded that children's comprehension, regardless of language ability, is not facilitated by talking to them in telegraphic utterances. Indeed, children appeared to comprehend utterances better when they were presented as grammatically complete.

In her unpublished dissertation, Larson (1974) asked the question of whether children with cognitive and language delays and children who were developing language typically differed in their comprehension of telegraphic and grammatically complete utterances. Twelve children, ages 3;5 to 6;4, with cognitive scores two standard deviations below the mean, and 12 typically developing children, ages 18 months to 34 months, served as participants. One half of the children in each group were at stage I of language development; the other half were at stage III.

The children were presented with SV, VO, and SVO constructions that were grammatically complete and telegraphic, that is, devoid of articles, prepositions, auxiliary verbs, and inflections. To measure comprehension, a picture identification task from an array of four line drawings was used. Results showed no significant difference for group or language ability; there was a significant difference for sentence type. Specifically, all children identified SV and VO types better than SVO strings. The author attributes this pattern of results to the fact that there are fewer semantic notions in SV and VO constructions than there are in SVO constructions.

Germane to this dissertation is the finding that all children comprehended grammatically complete sentences better than telegraphic strings. Larson (1974) concluded that the redundancy of the grammatically complete utterances makes them more appropriate to use in language remediation programs than telegraphic utterances. That is, because the sequence of words in grammatically complete phrases is more probable in the natural language and would therefore be experienced more often by children, grammatically complete utterances are preferable when teaching language to young children.

Jones' (1978) dissertation was designed to determine whether giving commands in telegraphic form with articles omitted would be a more efficient intervention method than giving them in well-formed sentences with articles included when training receptive language to children with severe cognitive and language delays. Eight children, ages 7;4 to 13;11 with an IQ score of 30 or below served as participants.

The specific hypothesis tested in this study was that it would take fewer trials to train severely cognitively delayed children to comprehend commands presented in telegraphic form with the article “the” omitted than to follow the command presented in well-formed sentences with the article “the” present. Each child received training in one telegraphic action + object command and one well-formed action + object command. A correct response was performance of the action requested.

The results indicated no difference between the two methods. That is, the number of trials needed to demonstrate comprehension of the commands in the telegraphic condition was not remarkably different than the number of trials needed to demonstrate comprehension in the well-formed condition. The author concluded that presenting commands in a telegraphic form with the articles omitted was not a more efficient method of training receptive language acquisition and therefore was unnecessary.

Collectively, these studies serve to refute a main premise of supporters of telegraphic models. Namely, the use of telegraphic models does not appear to aid comprehension of new referents, commands, or declarative sentences and in some cases seems to have a negative impact on comprehension. Fey (2008) in his narrative review and van Kleeck et al. (2010) with their meta-analysis come to a similar conclusion.

Perception of grammatical morphology prior to production.

More recently, methodologies such as the head turn preference or preferential looking procedure have allowed researchers to study sensitivity to grammatical

morphology in much younger children at much earlier stages of development. These studies demonstrate very young children's ability to detect grammatical features in the input as well as their reliance on them for learning syntax and new content words, long before they begin to produce these morphemes themselves. For example, Höhle and Weissenborn (2003) carried out an experiment using the head turn preference method to investigate if very young infants learning German could detect unstressed closed-class elements in continuous speech. Twenty-eight infants ranging in age from 7 months, 14 days to 8 months, 30 days served as participants. Each infant was exposed to two of four closed class morphemes, two prepositions and two determiners, for a period of 30 seconds. Following this familiarization phase, the infants were presented with text passages each containing one of the four target morphemes.

Results revealed that the infants listened longer to text passages containing the familiar words indicating that children as young as 7.5 months are able to detect unstressed closed class morphemes in continuous speech. A second experiment, identical to the first, with 6- month-olds serving as participants did not reveal group differences between listening times for text passages with familiar words versus unfamiliar words; however 16 of the 28 6- month-old infants listened longer to passages with familiar words. The authors suggest that by at least 7.5 months of age, infants have a stable phonological representation of these unstressed monosyllable words and can detect them in continuous speech. Shi, Marquis, and Gauthier (2006) found the same ability to segment function words from continuous speech in 6 to 8

month old infants learning French. It is important to note that function words have less vowel reduction in spoken French or German than in English. Therefore, this early ability to detect function words, long before production of them occurs, may not apply to infants learning a language such as English.

To test this, Shi, Werker, and Cutler (2006) conducted a study to determine the age at which English-speaking infants detect function words. Sixty monolingual English-learning infants served as participants. The infants heard sequences of determiners + nonsense words (e.g., *the breek, his breek, their tink, her tink*) alternated with nonsense determiners + nonsense words (e.g., *kuh breek, ris breek, lier tink, ker tink*). The authors predicted that if infants could recognize the real determiners in these noun phrases, their looking time should be longer for the real functor + nonsense word. Furthermore, because the nonsense determiners differed only segmentally from the real determiners, longer looking time to the real functors would suggest that the functors were represented with detailed segmentation.

Results revealed no distinction between real and nonsense determiners at 8 months, a tendency toward the real determiners at 11 months, and a significant preference for the real determiners at 13 months. Based on these results, the authors suggest that English-learning infants recognize function words with phonetic detail by 13 months of age, an age that this is still prior to use of determiners in their speech production.

The ability to detect function words in continuous speech does not necessarily indicate that young children rely on these function words to learn new words or to

categorize them syntactically as nouns or verbs. Function morphemes do provide cues to the type of content words and phrases that are adjacent to them, however. For example, the function morphemes *the* and *a/an* occur only at the beginning of noun phrases, and the function morphemes *am/is/are/was/were* occur only at the beginning of verb phrases. If young children are aware of the distributional properties of function morphemes, they could potentially use these cues to determine the syntactic class of words and phrases.

Gerken and McIntosh (1993) conducted a series of experiments with young children ranging in age from 21 to 28 months to determine whether they were able to discern the linguistic contexts in which particular function morphemes occurred. The children heard sentences, then, were asked to point to pictures representing a target word. The target word was preceded by either a) an article that was grammatical in the context: "Find *the* bird for me." b) no function morpheme: "Find _ bird for me." c) an auxiliary that was ungrammatical in the context: "Find *was* bird for me." or d) a nonsense syllable: "Find *gub* bird for me." Based on previous findings, the authors predicted that a nonsense syllable would disrupt the children's performance compared to sentences with a grammatical morpheme preceding the target word. The children's performance on sentences such as c) which contained a familiar but ungrammatical function word would inform the authors of whether the children were aware of the linguistic contexts in which particular morphemes should occur. If children are aware of the linguistic contexts, then the presence of an ungrammatical morpheme should hinder their performance. Conversely, if children are only sensitive to the presence of

function words but do not use them to categorize words syntactically, then there should be no difference in their comprehension of sentences with either a grammatical or ungrammatical function word.

The results revealed a significant difference between grammatical morphemes and ungrammatical morphemes and between grammatical morphemes and nonsense syllables. The difference between children's responses to sentences with grammatical function morphemes and their response to those with no function morphemes was not significant. The authors interpreted these results as support for the notion that children not only distinguish and attend to function morphemes but that they also use function morphemes in sentence comprehension. Further, the results indicate that children are sensitive to the pattern of occurrences of particular function morphemes and suggest that very young children use function morphemes to categorize the syntactic properties of words.

The authors offer an explanation for why there was not a significant difference between sentences with grammatical function words and those with no function words despite previous findings to the contrary in the literature (e.g., Duchan & Erickson, 1976; Larson, 1974; Petretic & Tweney, 1977). The sentences in this study omitted only one function word, not all, and used synthesized speech to control for prosodic differences between sentences. Therefore, it is possible that the grammatical and absent function word conditions were more prosodically similar than those in previous studies. Prosody is an important cue for sentence comprehension (Gerken & McGregor, 1998). This explanation notwithstanding, it is important to note that

omitting the function word from the sentence did not improve comprehension for these young children who were not yet using function words consistently.

Höhle, Weissenborn, Kiefer, Schulz, and Schmitz (2004) also asked the question of how children determine the syntactic category of words. These researchers used the head turn preference methodology with German-learning infants between the ages of 14 and 16 months. Two nonsense words were combined with either indefinite articles, turning the nonsense words into nouns, or personal pronouns, turning the nonsense words into verbs. The infants were either familiarized with the determiner + nonsense word sequences or the pronoun + nonsense word sequences. For each nonsense word, two six-sentence passages were created; one with the nonsense word used consistently in contexts that required a noun, the other with the nonsense word used consistently in contexts that required a verb.

Results revealed that the infants familiarized with the determiner + nonsense word listened longer to the verb passages while infants in the pronoun + nonsense word condition showed no significant difference between passages. The same experiment conducted with 12 to 13 month old infants showed no systematic difference in listening times to either passage.

Based on this pattern of results, the authors concluded that 14 to 16 month old infants familiarized to the determiner context had categorized the nonsense word as a noun. When exposed to a passage congruent with this syntactic category, they lost interest. In contrast, when exposed to a passage in which the nonsense word was used in a manner not consistent with their memory representation, their attention was kept

for a longer period of time. To explain the significant finding for the determiner context but not the pronoun context, the authors turned to the child's linguistic environment. German, unlike English, has a relatively free word order. For example, in addition to a verb, a subject pronoun can be immediately followed by a determiner, a noun, a prepositional phrase, or an adverb. This makes pronouns a less reliable cue to the syntactic category of the immediately following word than determiners. That is, there is a greater co-occurrence of determiner + noun than personal subject pronoun + verb. The authors suggest that the reactions of the children in this experiment appear to reflect the distributional pattern for the determiner and the subject pronoun in their input. The finding that it is harder for a child to categorize verbs in the input than nouns is similar to results of studies with older children (e.g., Eyer et al., 2002; Olguin & Tomasello, 1993; Tomasello & Olguin, 1993).

Fernald and Hurtado (2006) directly compared children's recognition of words in contexts with grammatical detail to contexts with all grammatical detail omitted. They used a preferential looking procedure to determine whether 18-month-old toddlers more accurately and more quickly recognized a name of a familiar object when it was presented in isolation (e.g., *baby*) or when it occurred at the end of a carrier phrase (e.g., *Look at the baby*). The results showed that the children were significantly faster to respond accurately to target words when presented in a short familiar sentence.

In a follow-up experiment, the authors asked if the presence of the attentional word *Look* served as a prompt for the upcoming noun, thereby eliciting attention to

the target word, regardless of the grammatical detail. A comparison of the sequence *Look. Baby!* to the sentence *Look at the baby!* revealed similar results. That is, the target word presented with full grammatical detail resulted in faster and more accurate responses. Thus, it appears that complete sentences, with the familiar prosodic contours and predictability of the co-occurrence of determiners with nouns preserved, offer an advantage to young children learning language.

Taken together, the results from these studies with very young children offer evidence of a developmental trend in the perception of and reliance on grammatical detail. It is apparent that relying on a child's expressive ability to produce function words seriously underestimates their ability to perceive and segment these same functors, as well as their reliance on the distributional properties of closed-class morphemes to categorize words by syntactic class.

Potential problems with the use of telegraphic input.

Given the preponderance of evidence that children are aware of function words long before they begin to produce them, one has to wonder what the effects of regularly omitting them in language intervention are. Minimally, this presents the child with impoverished input. It is well documented that children have the most difficulty learning those forms that are infrequent and/or optional in the language (cf. Leonard et al., 2003; Leonard, Eyer, Bedore, & Grela, 1997; Rice & Wexler, 1996; Rice, Wexler, & Cleave, 1995). For example, in English, verbs are not consistently marked for tense and agreement; the third person singular –s is a case in point. Mastery of this form has been shown to be exceedingly difficult for English-speaking

children with specific language impairment (SLI) (Rice et al., 1995). In contrast, Italian-speaking and Spanish-speaking children with SLI do not show this same profile of difficulty with tense and agreement morphology, in part because of the consistency of these forms across verbs (Bedore & Leonard, 2001; Leonard & Bortolini, 1998). Further, as noted above, the predictability of distributional properties of closed class morphemes is an important cue for learning syntax. Providing even less exposure to these infrequent forms through the use of telegraphic models seems counterproductive to teaching them.

As noted by Larson (1974), a child who is exposed to telegraphic forms in intervention must also contend with grammatically complete forms outside of intervention; this may serve to confuse the child. Worse, it may give the child the wrong impression that certain obligatory forms are optional in the language (Fey, 2008). Thus, manipulation of the input in this way may actually hinder development.

There is evidence that even certain types of grammatically correct input can have negative consequences if they are not fully processed by young language learners. In their study of the role yes-no questions have on the acquisition of auxiliaries, Fey and Loeb (2002) hypothesized that exposing children to sentence-initial auxiliaries would increase the saliency and therefore lead to greater auxiliary development. The researchers exposed 3-year-old children with SLI and 2-year-old typically developing children who were not yet producing auxiliaries to either a play session in which the adult produced auxiliaries in declarative sentences or to an experimental session in which auxiliaries were presented as recasts in interrogative

form (e.g., Child: Baby eat. Adult: Will the baby eat?). The results indicated that not only did the use of auxiliary fronted questions not facilitate auxiliary development but the children in the experimental group used fewer auxiliaries than did the children in the play group. Based on these results, the researchers reasoned that if children are not yet using auxiliaries and fail to process the auxiliary at the beginning of the sentence, frequent use of interrogative reversals may wrongly convey to the child that word strings such as “the baby eat” are acceptable.

In a test with novel verbs, Theakston, Lieven, and Tomasello (2003) presented 2-1/2 to 3-year-old typically developing children with either declarative sentences involving the third person singular –s or auxiliary-fronted questions in which the subject is immediately followed by a nonfinite verb. The children were then questioned to elicit use of the verbs in either finite or nonfinite contexts. The results showed that for the novel verbs, the children’s use of verbs closely matched the pattern of verb use to which the child was exposed. This effect was replicated in another study of the auxiliary *BE* (Theakston & Lieven, 2008).

If strings of words found in grammatical input can lead the child to an incorrect hypothesis about the obligatory nature of morphological markers, what impact does telegraphic input have, especially in the case of elicitive prompts where the child is explicitly instructed to produce an incorrect utterance?

In sum, telegraphic models distort the natural prosody of a sentence, reduce exposure to morphemes known to be difficult to learn, and imply optionality when there is none. Given the evidence that refutes the notion that telegraphic models assist

a child's comprehension, the benefit of using telegraphic models as an intervention tool should be powerful enough to overcome these negative factors.

Telegraphic models may not be beneficial for aiding comprehension but, because they are often shorter in length, might they be helpful for promoting language production when used as elicited imitative prompts? Comprehension and production are two different processes. Guess, Sailor and Baer (1974) have suggested that in remedial language training, both modalities should be taught simultaneously or in close succession and that training in one should not be expected to enhance the other without direct training. Therefore, it may be that telegraphic input is better for encouraging production of multi-word utterances. Numerous studies of milieu teaching, which advocates the use of telegraphic elicitive prompts, have shown it to be an effective language intervention technique (e.g., Bolzani Dinehart, Yale Kaiser, & Hughes, 2009; Hancock & Kaiser, 2002; Yoder & Stone, 2006; Warren, 1991; Warren & Gazdag, 1990). Indeed, the teaching strategies that comprise milieu teaching are listed as recommended practices in early intervention by the Division for Early Childhood (Wolery, 2000). A single-case study by Loeb and Armstrong (2001) that directly compared telegraphic input, what the authors referred to as short expansions, to a condition where longer, grammatically complete sentences were modeled found that both techniques were effective for achieving the respective goals. Specifically, children assigned to the short expansion condition met their goal of a higher mean length of utterance (MLU); similarly, children assigned to the grammatical input condition met their goal of increased rates of subject-verb-object

productions. The authors concluded that short expansions, or telegraphic input can be beneficial for children at Stage I-II of development when an increase in MLU is the targeted goal (Loeb & Armstrong, 2001). In their case study on word learning, Wolfe and Heilmann (2010) compared the effect of two types of focused stimulation; a simplified (i.e., telegraphic) input condition and an expanded (i.e., grammatical) input condition for a single child. There was a modest benefit for the simplified condition; the child learned target words in both conditions, however (i.e., five target words produced versus three target words produced). Importantly, the authors note that the child produced more language, defined as more words and less pause time between utterances, in the expanded condition. Despite the gains demonstrated by children in these studies, none of the studies have provided evidence that telegraphic input is necessary for improved language production.

Effects of functor words on production.

Gerken, Landau, and Remez, (1990) used an imitation task to investigate children's production of function and content words. They were primarily interested in the role that stress plays and whether children's omission of function words was due to limitations in processing or in speech production. Typically developing children ranging in age for 23 to 30 months served as participants in a series of experiments where the weakly stressed function words and/or the strongly stressed content words were presented as either English words or nonsense syllables. Children were instructed to imitate four syllable strings that were the V-NP portion of a sentence they had just heard. For example, in the English content word/English

functor condition, children heard “Pete pushes the dog” and were instructed to imitate “pushes the dog”; in the Nonsense content word/Nonsense functor condition, children heard “Pete bazo na dep” and were instructed to imitate “bazo na dep”.

Findings from each of the three experiments revealed the same results. That is, children reliably imitated the strongly stressed content words regardless of whether these words were English or nonsense syllables and omitted the weakly stressed functors. This suggests that stress plays a primary role in determining which elements are omitted in early speech. However, the authors note that stress alone cannot account for the pattern of omissions. This is because children in Stage II of language development, who were not yet producing function words, omitted English functors more frequently than nonsense functors that received the same stress and occurred in the same position. More interesting is the finding that the presence of English functors helped children in both stage II and stage IV to imitate content words. While not a direct comparison of telegraphic models to grammatically complete models, results of this study do suggest that the presence of function words are a benefit, not a hindrance, for production of language.

The only published study found that directly compares telegraphic models to grammatically complete models is a small randomized trial conducted by Willer (1974). This study investigated the hypothesis that telegraphic models increase the expressive language skills of children with intellectual disabilities primarily because telegraphic models are easier to imitate. Ten children, aged 5;6 to 13;6 with moderate intellectual disabilities who were using only single words served as participants. The

children were arranged into matched pairs and randomly assigned to either a grammatical stimulus group or a telegraphic stimulus group.

Each child received a 15-minute intervention session, once a day, 5 times a week, for 5 weeks. There were five lessons involving the presentation of 15 pictures, each followed by a request to respond to a question and a request to imitate.

Therefore, each child received the same lesson five days in a row. Lessons included object identification, action description, and a prepositional item. The lessons were identical for each group with one exception. Children in the telegraphic stimulus group received only elicitive models that were devoid of all determiners, auxiliary verbs, and copula BE forms (e.g., ball; boy running; ball on table). Children in the grammatical group received complete phrases (e.g., the ball; the boy is running; the ball is on the table). Responses to the imitative trials were judged as correct if the equivalent of the telegraphic model was produced by the child, regardless of the type of imitative prompt presented. That is, the children were not expected to imitate functors properly to receive credit for imitation.

Willer considered both the mean daily performance of the groups as well as scores on a series of post-tests when examining the results. Results of the daily performance showed that children in the telegraphic group performed significantly better on imitative trials and responsive language trials (i.e., responding appropriately to questions about each of the vocabulary items) by the end of each lesson, that is, by the last class of each section (class numbers 5, 10, 15, 20, and 25).

Post-testing was conducted to compare the two group's imitative language performance when presented with telegraphic models and when presented with grammatically complete models. The results of these tests revealed that children in the telegraphic group performed significantly better when presented with telegraphic models. The telegraphic group also did better, but not significantly so, when presented with grammatically complete models. These post-test results support the results of the daily performance comparison.

Willer noted that length discrepancy could not account for the differences in imitative ability. An examination of the daily performance showed that children who were given telegraphic elicitive models performed better with action description and preposition items compared to performance with object identification items by children in the grammatical group, despite an equal or greater number of syllables in the telegraphic model.

Willer concluded that sentences containing function words were more difficult to imitate and subsequently master by children with cognitive and language impairments. He suggests, therefore, that telegraphic models can be employed to facilitate language development. He cautions, however, that while short term language goals may be produced using telegraphic elicitive models, these may be stereotypical responses and may not lead to grammatical speech. Indeed, the apparent advantages of telegraphic imitative prompts did not carry over to new sentences in later lessons. Children's performance on newly introduced lessons dropped to the same or lower level of performance reached during the introduction of the preceding

lesson despite containing similar words and concepts. Children failed to transfer learning from lesson to lesson, indicative of stereotyped response learning.

The results of this small study, then, offer the only support for the use of telegraphic elicitive models as an intervention technique to increase children's productive language skills. From an evidence-based perspective, this hardly seems sufficient to support the technique when there is reason to believe that it may negatively impact grammatical development among children with cognitive and language impairment.

The role of imitation in language development.

The role of imitation in language development is viewed as an integral part in developing expressive language skills by some scholars. Charman (2006) notes that at least three aspects of imitation are relevant to appreciating its role in the development of spoken language. First, imitation is a form of social learning that involves observing others, listening to others, and learning from others. Second, imitation involves the acquisition of novel responses on the basis of social experience and reinforcement. Third, imitation can provide evidence that children are able to form internal representations of the actions they observe and reproduce these representations in their own actions.

Whitehurst and Vasta (1975) proposed a Comprehension-Imitation-Production hypothesis. This is a 3-stage process for the acquisition of grammar whereby comprehension of a grammatical form sets the stage for selective imitation of that

structure, which then leads to spontaneous production. Thus imitation provides a mechanism by which new syntactic structures can be first produced.

Scherer and Olswang (1984) also view imitation as an important learning strategy for children. They examined the role of mother's expansions on children's imitation and subsequent spontaneous production of newly learned semantic relations. They hypothesized that adult expansions of a child's immediately preceding utterance facilitates language development because the expansions encourage the child to take a turn by serving as a cue for the child to imitate. The child's imitation of the expansion facilitates the production of semantic or syntactic information that was not previously expressed in the child's utterance. These imitated forms eventually become spontaneous. Thus, the combination of adult expansion and child imitation serves as a powerful language learning strategy for young children.

While theorists differ on the importance of imitation in the development of language, most agree that it does, at the very least, play a role. Indeed, it is of historical interest to note that Chomsky (1959), in his critique of Skinner's position, wrote "children acquire a good deal of their verbal and non-verbal behavior by casual observation and imitation of adults and other children" (p. 49).

It must be noted, however, that elicited imitation is not the same as self-selected or spontaneous imitation. Despite this, the use of elicited imitation as an effective technique has received support in the literature. Connell (1987) compared the intervention techniques of elicited imitation and modeling to teach an invented bound morpheme to children developing language typically and to children with SLI.

The results indicated that children who were developing language typically learned significantly more from the modeling procedure than from the imitation technique while just the opposite was found for children with SLI. Children who have difficulty learning language fared better when they were required to imitate the target. Connell concluded that the use of elicited imitation provides children who have difficulty learning language with an advantage not demonstrated by the use of modeling alone.

In a follow-up study Connell and Stone (1992) again found that children with SLI were better able to produce an invented morpheme when required to imitate the target. However, this superiority of the elicited imitation intervention technique over the modeling procedure was not found on a comprehension task. Children with SLI were able to demonstrate comprehension of the invented morpheme regardless of the teaching technique to which they were exposed. This finding led the researchers to conclude that, for children with language learning difficulty, imitation facilitates retrieval of a known morpheme rather than learning a morpheme.

Kouri (2005) compared a mand-elicited imitation (MEI) procedure to a modeling with auditory bombardment (Mod-AB) procedure to teach expressive vocabulary to 29 children with expressive language delay and mild developmental delay. Children randomly assigned to the MEI procedure were required to imitate a target word if they did not respond correctly to a mand (e.g., *What do you want?*) during a play session. Children in the Mod-AB procedure used headphones to listen to each target word a total of 40 times and engaged in an interactive play session with a clinician. The clinician provided at least ten models of each target word when the

child was focused on the target item. At no time was the child required to produce the target word. The results revealed that the MEI procedure was more effective during the treatment phase. Children who were required to produce a target word acquired more words and used them more consistently than children who were required to only listen to target words. During the generalization phase, two weeks after the final treatment session, children in the Mod-AB group produced more spontaneous target words, however. Thus, these children acquired nearly as many new target words overall as the children in the MEI group. Kouri (2005) concluded that in the end, both procedures were effective in facilitating lexical production.

The intervention technique of elicited imitation crosses several theoretical positions. Strict behaviorists, using an operant conditioning paradigm, employ elicited imitation as an important and often first step in teaching a language structure (Guess, Sailor, and Baer, 1974; Guess, Sailor, Rutherford & Baer, 1968; Wheeler & Sulzer, 1970). Peterson (1968) regards vocal imitative behavior as a necessary condition for the establishment of speech. Social learning theorists also view imitation as important (Bandura, 1977; Whitehurst & Vasta, 1975). These theorists contend that imitation focuses a listener's attention to certain characteristics of models thus helping the learner to recognize the critical aspects of complex models. Social-interactionists, as well, include elicited imitation in their language teaching programs (Warren, 1991; Hancock & Kaiser, 2006). The Enhanced Milieu Teaching program (Hancock & Kaiser, 2006) considers the child's ability to imitate a prerequisite skill for this procedure. Fey and Proctor-Williams (2000) maintain that elicited imitation has an

important role to play in intervention that targets grammar. They recommend the use of elicited imitation as an intervention technique, particularly when first introducing new forms, because it provides practice in production that may strengthen and stabilize syntactic representations.

Research Question

Given that telegraphic input does not aid comprehension and may not be necessary to improve language production, does the intervention technique of elicitive prompts to imitate need to be telegraphic as Kaiser (2007, 2010) purports?

This experiment was designed to address the following question: Do children in the early stage of combining words imitate syntactic constructions (i.e., semantic relations) more consistently when presented with elicited imitation prompts that are telegraphic than with elicited imitation prompts that are grammatically complete?

An affirmative response to this question would provide support for the use of telegraphic models during intervention. Any negative response, however, would serve to challenge this practice. Clearly, if children more often imitate semantic relations when given grammatically complete elicitive prompts, this would provide direct evidence in support of consistent use of grammatical input. Finding no difference between the two types of prompts would also support consistent use of grammatical input. If telegraphic models provide no benefit to the child then, because there are reasons to believe they may cause additional problems in processing, segmenting, and learning the obligatory nature of function words, it makes little sense to include them as an intervention technique for children who have difficulty learning language.

Method

Participants

Five children with expressive language delay between the ages of 30 – 51 months served as participants in this single-case experiment. Children were recruited through Speech-Language Pathologists and a research participant directory at The University of Kansas Medical Center (KUMC) with age and a diagnosis of expressive language delay set as search parameters. Three children were receiving speech-language services at the time of their study enrollment. One child was enrolled in therapy at the end of his participation in the study; the other child attended an early Head Start program and was being followed by the Center for Child Health and Development at KUMC.

Children were seen on two separate occasions to determine eligibility. During the first qualifying session, the parents were asked to complete the MacArthur-Bates Communicative Development Inventories; Words and Sentences (MCDI) (Fenson et al., 2007). A 60-minute language sample was collected using a standard set of toys including a baby doll, bottle, blanket, brush, dishes, spoons, a farm set with animals, trucks, balls, stacking cups, necklaces, sun glasses, a mirror, and a book. This sample was digitally recorded and entered into the Systematic Analysis of Language Transcripts (Miller & Iglesias, 2006) to determine the child's mean length of utterance in morphemes (MLUm) and to document use of semantic relations. To document the child's willingness to imitate, the child was asked to imitate 10 words that were reported on the MCDI. In addition, the motor imitation portion of the Screening Tool

for Autism in Two-Year-Olds (STAT) (Stone, Conrod, Turner, & Pozdol, 2004) was administered. This measure includes four tasks: (1) Rattle – the examiner shakes a rattle, then encourages the child to do the same; (2) Car – the examiner rolls a small car back and forth across the table, then encourages the child to do the same; (3) Drum hands – the examiner alternately drums her hands on the table, then encourages the child to do the same; and (4) Hop dog – the examiner hops a small dog across the table, then encourages the child to do the same. During the second session, which occurred a few days later, the child was given the Leiter-R Brief IQ (Roid & Miller, 1997) and a language elicitation task, designed to measure the child's productive use of semantic relations that were identified from the spontaneous language sample. To be considered productive, a semantic relation must be used at least two times by the child during the play-based language sample but spontaneously produced in no more than three out of five opportunities during the language elicitation task. The language elicitation task was modeled after Scherer and Olswang's (1989) elicitation task. The examiner manipulated objects known to be familiar to the child and prompted for a verbal response by asking a WH-question. For example, to elicit the semantic relation Agent-Action, the examiner made a figure of a man kick a ball and asked "What's happening?"; to elicit the semantic relation Action-Object, the examiner made a boy puppet eat a cookie and asked "What's the boy doing?". Selection of targets then, were based on the child's spontaneous use of the semantic relations during the language sample and limited use during the elicitation task. Qualifying children met the following criteria:

1. pass a hearing screening of 25 dB HL at 500, 1000, 2000, and 4000 Hz using a portable audiometer
2. a minimum of 100 words in their expressive lexicons as determined by the MCDI (Fenson et al., 1993)
3. standard score within the average range on the Leiter-R Brief IQ test (Roid & Miller, 1997)
4. produce at least two examples of two different semantic relations (i.e., not including recurrence and existence) during a 60-minute language sample
5. produce two semantic relations from the language sample in no more than three out of five opportunities during the language elicitation task
6. a mean length of utterance in morphemes (MLUm) between 1.2 -2.1 based on 100 utterances
7. comply with 6 out of 10 elicited imitation prompts of single words known to be used by the child
8. comply with all four motor imitation tasks from the STAT

Twelve children were evaluated in this manner; five children met the eligibility criteria and were assigned a random alternating order of the grammatical and telegraphic conditions as they entered the study. Pre-experimental child characteristics are presented in Table 1.

Table 1. Pre-experimental Participant Characteristics

Participant ID	Sex	Age in mos at entry	MLUm/100 utterances	Brown's Stage	Leiter-R Brief IQ	MCDI vocabulary checklist, total words used
P1	Male	35	1.80	Late I	97	106
P2	Male	51	2.10	II	97	540
P3	Female	33	1.44	Early I	115	335
P4	Male	33	1.77	Late I	103	117
P5	Male	30	1.85	Late I	103	319

Note. MLU/m = mean length of utterance in morphemes; MCDI = MacArthur-Bates Communicative Development Inventories Words and Sentences.

Experimental Design

A single-case alternating treatments design (ATD) was employed to determine whether telegraphic prompts to imitate or grammatically complete prompts to imitate result in more reliable imitations by children who are just beginning to produce semantic relations. The ATD is one of the most powerful and practical designs in all of time-series methodology (Hayes, Barlow & Nelson-Gray, 1999). It is ideally suited for this investigation precisely because it is not an intervention study. Change in language ability over time is not being questioned. Rather, the research question of interest pertains to the pattern of children's immediate responses to a specific intervention technique, such as one used extensively in milieu teaching (Hancock & Kaiser, 2006). An ATD is a strong, clinically useful strategy that does not require a baseline or a withdrawal phase as other single-subject designs such as the multiple-

baseline or variations of the A-B-A design do. A baseline phase is not necessary because the purpose is to compare the effect of two conditions rather than to document improvement over time (Barlow & Hersen, 1984).

The ATD directly compares two distinct conditions while avoiding the problem of inter-subject variability. Ostensibly, extraneous factors that may affect the performance of a participant will have an equal effect on both conditions. A further benefit of the ATD is its superior control over other threats to internal validity, such as history and maturation. This does not imply that the alternating treatments design is ideally suited for all single-subject research. For example, the alternating treatments design may suffer from interference of multiple interventions; that is, the effects of one experimental intervention may interfere with the other (Barlow, Nock, & Hersen, 2009). Specifically, order effects and carryover effects are a concern.

Order effects refer to the fact that Treatment B might be different if it always follows Treatment A. Randomizing the order of conditions alleviates this problem. Carryover effects refer to the influence of one treatment on an adjacent treatment, irrespective of the overall order. Providing only one condition per session and separating sessions by at least one day are recommended practices to minimize carryover effects (Barlow, Nock & Hersen, 2009). To enhance external validity, that is, the generality of findings to other similar participants, the experiment was conducted five times with four additional participants at a similar stage of development. While it is typical for single subject studies to demonstrate effects with

at least three different participants (Horner et al. 2005), five participants were enrolled in this study to increase generalizability of the findings.

Each child participated in seven sessions involving grammatically complete elicited prompts alternating with seven sessions involving telegraphic elicited prompts for a total of 14 sessions. For an alternating treatments design with two levels, the number of ways a unique random order occurs is calculated by the following formula: number of ways = $N!/n_1!n_2!$ where N = total number of sessions, n_1 is the number of sessions for Treatment A and n_2 for Treatment B.

Fourteen sessions of two equal number of prompt conditions results in 3,432 possible random orders [$14!/7!7! = 3,432$]. Not all of these orders are desirable however. For example, one order involves seven Condition A sessions followed by seven Condition B sessions. This would essentially result in an AB design and possible order effects could make the results difficult to interpret. To ensure greater alternation of conditions, the design was restricted so that randomization of conditions resulted in no more than three consecutive sessions of the same condition. This restriction resulted in 1,972 possible random orders of seven sessions per condition.

Experimental Procedure

One semantic relation served as a target in both the grammatically complete condition and the telegraphic condition until the child demonstrated mastery level performance of the semantic relation. Mastery level was defined as 13 multi-word responses to elicitive prompts in two consecutive sessions. If a child produced 13

semantic relations in response to the elicitive prompt during two consecutive sessions, the second semantic relation was introduced as the target in both conditions. This was necessary for only one child, P5.

Assigning a different semantic relation to each condition would require that the two semantic relations be at the same developmental level and be matched for degree of difficulty; however, it's difficult to ascertain a matched level of difficulty between semantic relations. Therefore, one semantic relation served as the target for both conditions. Specific examples of the semantic relation did not occur in both conditions, however. For example, the specific elicitive prompt of *Say, duck walking* only occurred in the telegraphic condition. The grammatically complete version of this example (i.e., *Say, the duck is walking*) was never used in the grammatical condition. Further, different sets of toys were used for each condition.

Prompting for the same semantic relation in both conditions may have increased the risk of carryover effects but procedures such as requiring an interval of time between sessions and administering only one condition per session were put in place to minimize these. Implementing procedural safeguards to minimize carryover effects is arguably more defensible than claiming two semantic relations are developmentally equivalent.

The children were seen in their homes or at their daycare either two or three times per week with at least one day between consecutive sessions for a total of 14 sessions. Only one condition was given during a session and each condition occurred seven times. The conditions alternated in a semi-randomized fashion with the

stipulation that no condition was presented during more than three consecutive sessions. Randomizing the conditions controlled for order effects; providing each condition on a different day with at least one day between sessions reduced carryover effects (Barlow, Nock, & Hersen, 2009). To determine the order of conditions for each child, the 1,972 possible random orders were numbered from 1 to 1,972 and the random number function of the Excel[®] software program was used to select an order. This was done each time a child entered the study. Table 2 lists the random orders selected for each child and their target semantic relation.

Table 2. Random Order of Conditions and Target Semantic Relation for Each Participant

Participant ID	Random Order	Target Semantic-Relation	2nd Target
P1	BBABBBABAABAAA	Agent-Action	N/A
P2	ABAABABBABBAAB	Agent-Action	N/A
P3	AABABABABABABB	Agent-Action	N/A
P4	BBAABABABABABA	Action-Object	N/A
P5	ABABABBABABABA	Action-Object	Agent-Action

Fifteen elicited prompts were presented during the context of a 20- to 30-minute play session. Other intervention studies have used a range of 10 to 20 prompts to imitate, adult models, or expansions of child comments (cf., Loeb & Armstrong, 2001; Scherer & Olswang, 1989; Willer, 1974). A study by Fey, Yoder, Warren, and Bredin-Oja (submitted) had a targeted rate of 60 prompts in 60 minutes; however, the

prompts used in their study ranged from a nonintrusive time delay to a more intrusive prompt to imitate. Because the only prompt used in this study was the intrusive elicited imitation prompt, a maximum of 15 trials per session was imposed to prevent child fatigue. Results from a pilot study indicated that 15 prompts in a 20- to 30-minute session yielded sufficient responses from the child without causing aversion to the prompts.

The sessions adhered to the basic principles of milieu teaching; specifically, environmental arrangement and following the child's attentional lead (Hancock & Kaiser, 2006). To create multiple opportunities for a child to communicate it is important to arrange the environment so that the child is more likely to interact with the adult. Making toys visible but not accessible by the child is one way to arrange the environment; failing to complete an expected action is another (Warren et al., 2006).

Children are more likely to attend to objects or events of their own choosing (Bruner, Roy, & Ratner, 1980). Thus, following the child's attentional lead means that the adult plays with toys or engages in activities that the child prefers (Warren et al., 2006). As such, the targeted semantic relation remained constant but a specific prompt varied by the child's interest. For example, the target semantic relation action-object may have consisted of specific prompts to imitate *push (the) button*, *open (the) box*, *kick (the) ball*, and so on. Each specific prompt contained lexical items that were known by the child as evidenced by the language sample, MCDI, and observations during previous experimental sessions.

Results of a pilot study showed consistent two-word responses to most, if not all, of the 15 prompts after the fifth session in both conditions. To guard against these ceiling effects, each specific prompt was given no more than three times during a single session. Further, if a specific example of a semantic relation was spontaneously produced by the child during two consecutive sessions, that specific example of the semantic relation was no longer prompted. Table 3 illustrates this procedure.

Table 3. An Example of Specific Prompts

Target semantic relation	Specific Prompts given a maximum of 3 times	Child's spontaneous production during two sessions	New specific prompts
Agent – Action	Say (The) dog (is) driving Say (The) man (is) kicking Say (The) bug (is) crawling Say (The) frog (is) jumping Say (The) duck (is) walking	Dog driving	Say (The) cow (is) eating Say (The) man (is) kicking Say (The) bug (is) crawling Say (The) frog (is) jumping Say (The) duck (is) walking

During the experimental session, the child and investigator played with a set of toys and the investigator arranged the environment to create opportunities for the child to request an object or action from the investigator or to make a comment. Once the child was prompted to imitate and given an opportunity to respond, the investigator provided natural consequences such as responding appropriately to the child's request or comment, and or, continuing the interaction. A recast of the child's verbal response to the prompt was not provided as the last step in a request for imitation sequence. This is a deviation from the milieu teaching technique (Hancock

& Kaiser, 2002, 2006; Warren, 1991); however, the purpose of the experimental sessions was to determine how children respond to prompts to imitate, not to provide therapeutic language intervention. Indeed, if children learned the targets too quickly, the highly supportive intervention technique of providing a direct model to imitate would not be necessary, limiting the amount of usable data.

The third child enrolled in the study (i.e., P3) frequently responded to the elicitive prompts with only a single word, regardless of the condition. To ensure this did not occur with future participants, the milieu teaching technique of corrective prompts was implemented for the fourth and fifth participant (Hancock & Kaiser, 2006). A corrective prompt is an immediate and identical second prompt if the child fails to produce a target response. Example: Adult: *Say duck walking*. Child: *walking*. Adult: *Say duck walking*. The interventionist ended the sequence by providing a natural consequence regardless of the child's response to this corrective prompt. Corrective prompts were included in the 15 total prompts per session.

Each session was digitally audio recorded for data collection purposes; the number of prompts administered and the number of responses given by the child were tallied for each session. A response was credited as imitated if the child's production was equivalent to the telegraphic version of the prompt regardless of the condition of the session. An exact imitation of a grammatically complete phrase was not required during a session utilizing grammatical prompts. For example, a response of "roll ball" was credited in either a telegraphic session or a grammatically complete session. Similarly, a response of "duck walking" was credited regardless of the prompt used.

Child responses that included function words (e.g. "roll *the* ball"; "*the* duck is walking") were tallied separately and analyzed independently.

Data Analysis

The data were analyzed two ways. First, data from each session was graphed and the two data lines were visually examined to determine whether there is overlap or complete separation of the lines. In this method, known as visual inspection, both conditions are found to be similarly effective when the data lines overlap. When there is clear divergence between the data lines, differential effectiveness of conditions is indicated (Barlow, Nock, & Hersen, 2009).

Fisch (2001) suggests that experiments that use single-subject designs and rely only on visual inspection to evaluate the efficacy of interventions often miss treatment effects. Therefore, to augment visual inspection of the data, the computer program Single-Case Randomization Tests (SCRT) developed by Onghena and Van Damme (1994) (Edgington & Onghena, 2007) was used to conduct a randomization test for restricted alternating treatments design to test the null hypothesis. The null hypothesis can be stated, as follows: For each of the experimental sessions, the responses are independent of the prompt condition given at that time. That is, the observed responses would have occurred regardless of the type of prompt given.

Randomization tests.

Randomization tests are a subclass of statistical tests called permutation tests (Edgington & Onghena, 2007). Permutation tests are tests in which the P-value is the proportion of data permutations or configurations providing a test statistic as large as the value for the observed results. Any test statistic that is sensitive to the predicted effect can be used with randomization tests (Bulte & Onghena, 2008). In this investigation, a difference in the level of child responses to elicitive prompts was of primary interest; therefore, the test statistic used was the absolute value of the difference between the mean scores of Condition A and Condition B sessions. The absolute value was used because no a priori predictions regarding a child's pattern of responses were made. The following example, using hypothetical data, illustrates how a randomization test works.

A child is assigned a possible random order of telegraphic and grammatical conditions of [A B B A A B A B B A A B B A] where A refers to the grammatical condition, and B refers to the telegraphic condition. The observed scores, that is, the number of child responses to the 15 elicitive prompts that contain at least a two-word targeted semantic relation, are in order: [5, 9, 8, 9, 7, 10, 10, 10, 7, 9, 8, 11, 10, 9]. This results in a mean of 8.14, for Condition A $[(5+9+7+10+9+8+9)/7 = 8.14]$ and a mean of 9.29 for Condition B $[(9+8+10+10+7+11+10)/7 = 9.29]$. The difference between A and B is -1.14 $[8.14 - 9.29 = -1.14]$ and the absolute difference, denoted as $|A-B|$, is 1.14. As the null hypothesis states, the observed scores would have occurred, regardless of the condition. That is, the same results would have been

achieved with any other random order of conditions. As such, the score obtained at each session is kept fixed, and the order of conditions is shuffled for all remaining possible orders. A new test statistic is derived for each possible order. These values form the randomization distribution and the observed test statistic is compared to the distribution. The P-value is determined by the number of test statistics that result in a value equal to or greater than the observed test statistic for the 1,972 possible restricted data permutations. Note that the highest level of significance that can be obtained in a two-tailed test with 1,972 permutations is .001. Table 4 contains a small sampling of the randomization distribution for the hypothetical data.

Table 4. A Sample of Random Orders and Distribution for Hypothetical Data

Random order	Observed scores	 A – B = test statistic
ABBAABABBAABBA	5 9 8 9 7 10 10 10 7 9 8 11 10 9	$ 8.14 - 9.29 = 1.14$
AAABAAABBBABBB	5 9 8 9 7 10 10 10 7 9 8 11 10 9	$ 8.14 - 9.29 = 1.14$
AAABAABABBBABB	5 9 8 9 7 10 10 10 7 9 8 11 10 9	$ 8.57 - 9.29 = 0.71$
AAABAABBABABBB	5 9 8 9 7 10 10 10 7 9 8 11 10 9	$ 7.71 - 9.14 = 1.42$
ABABBAABABABAB	5 9 8 9 7 10 10 10 7 9 8 11 10 9	$ 8.28 - 8.14 = 0.14$
BBBABBBAABAAA	5 9 8 9 7 10 10 10 7 9 8 11 10 9	$ 9.26 - 8.17 = 1.12$

Note. The first order is the randomly assigned order with the observed scores; all other orders are possible permutations with fixed observed scores.

Randomization tests provide valid alternatives, with greater sensitivity, to non-parametric tests because they do not discard information in the data by reducing them to ranks (Todman & Dugard, 2001). The permutation method gives an unbiased estimate of the P-value without relying on the assumption of normally distributed

errors (Hayes, 1996). The only assumption required for a randomization test is the assumption of exchangeability. This assumption establishes that all possible data permutations must be equally likely under the null hypothesis. The most effective way to ensure exchangeability is to randomly assign an order of conditions prior to data collection. (Hayes, 1996). When the exchangeability assumption is met, the randomization test can be a valid and highly accurate method of computing statistical significance (Hayes, 1996).

As noted above, because there were no a priori predictions about the outcome, a two-tailed or non-directional randomization test was used to determine the P-value of the observed test statistic. To achieve a P-value (two-tailed) of at least .05 the observed test statistic, that is, the absolute difference between the mean of Condition A and the mean of Condition B must be equal to or greater than the test statistic for 49 of the possible 1,972 restricted random orders. The power for a randomization test is directly proportional to the number of ways the prompt condition sessions can be randomly ordered; the greater the number of sessions, the greater the power. A greater number of sessions would have resulted in more power; however, the advantage of more power is offset by the risk of a ceiling effect. Although this is not an intervention study per se, it does employ a specific intervention technique, and it was possible that learning of targeted semantic relations would take place, rendering the elicitive prompts unnecessary and possibly changing the child's pattern of responses to imitation requests. Fourteen sessions was deemed adequate to find a statistically significant difference between the two conditions.

Fidelity of Conditions

Four sessions, two from each condition, were chosen at random by a graduate student in speech-language pathology for a check of fidelity to the experimental procedure. The graduate student was not informed of the research question or of the total number of prompts per session that was required. Sessions were re-labeled so that the temporal order of the sessions could not be determined by the student. The student listened to all four sessions and reported the number of elicitive prompts given. She also judged whether all prompts adhered to the same condition during a session, that no more than three specific examples of a prompt were used in the same session, and that a specific prompt from one condition did not occur in the second condition. Any deviation from these procedures was considered a violation. Fidelity of the experimental procedure was 98%. During one session, the examiner gave one extra elicitive prompt. For this session, the child's response to the 16th prompt was excluded from the analyses.

Inter-rater Reliability

The same four sessions chosen for the fidelity check were transcribed and scored independently by the graduate student for reliability. Inter-rater reliability agreement was based on a point-by-point agreement for the child responses. Inter-rater agreement was calculated using the percentage agreement index (Suen & Ary, 1989); the number of agreements divided by the sum of the number of agreements and the number of disagreements, multiplied by 100. Inter-rater reliability was 93%, 95%, 98%, 93%, and 95% for participants P1 to P5, respectively.

An examination of the disagreements between scorers did not reveal any discernible patterns between conditions. That is, the disagreements did not occur in one condition more so than the other. Five of the disagreements occurred when the reliability scorer credited three different children with the production of a function word as well as a semantic relation in the grammatical condition and the primary scorer only credited the semantic relation in the grammatical condition. Importantly, there was 100% agreement regarding the presence or absence of function words in the telegraphic condition. Therefore, these disagreements would not have resulted in a different outcome for production of semantic relations containing a function word.

Results

Data for P1

The target semantic relation throughout the experimental protocol for this child was agent-action. Examples of elicitive prompts are *Say: The frog is jumping* and *Say: Dog driving* for the grammatical and telegraphic conditions, respectively. There was no difference in P1's level of responding across conditions. He had a mean of 7 (range = 5 – 8; sd = 1.07) responses that contained at least a semantic relation for the grammatical condition and a mean of 7 (range = 5 – 10; sd = 1.85) responses for the telegraphic condition. This resulted in a test statistic of 0; the proportion of data permutations giving a difference of number of responses containing a multi-word semantic relation at least as large as the experimentally obtained difference (i.e., the P-value) was 1.00. Therefore, the obtained difference in responses between the grammatical condition and the telegraphic condition was not statistically significant

($p > .05$, two-tailed). Figure 1 displays his pattern of responses. There was also no statistically significant difference in the number of times P1 provided no response to an elicitive prompt between conditions (M of grammatical = 7.0; M of telegraphic = 6.43; $|A-B| = 0.57$; P -value = .612; $p > .05$, two-tailed). A figure displaying his pattern of no responses appears in Appendix A.

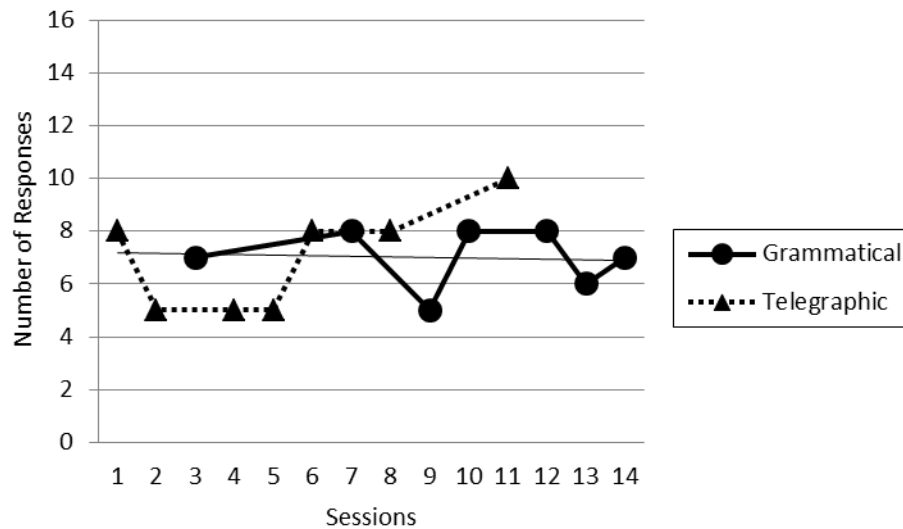


Figure 1. P1's Number of Responses Containing a Target Semantic Relation

In contrast, there was a remarkable difference for the number of responses that contained a function word as well as the target semantic relation. P1 produced a mean of 3.43 function words (range = 0 – 7; $sd = 2.23$) in the grammatical condition and a mean of 0.14 functions words (range = 0 – 1; $sd = 0.35$) in the telegraphic condition. This resulted in a test statistic of 3.29 with a P -value of .002. Therefore, the obtained difference in the production of function words between the grammatical condition

and the telegraphic condition was statistically significant ($p < .05$, two-tailed). These results are displayed in Figure 2.

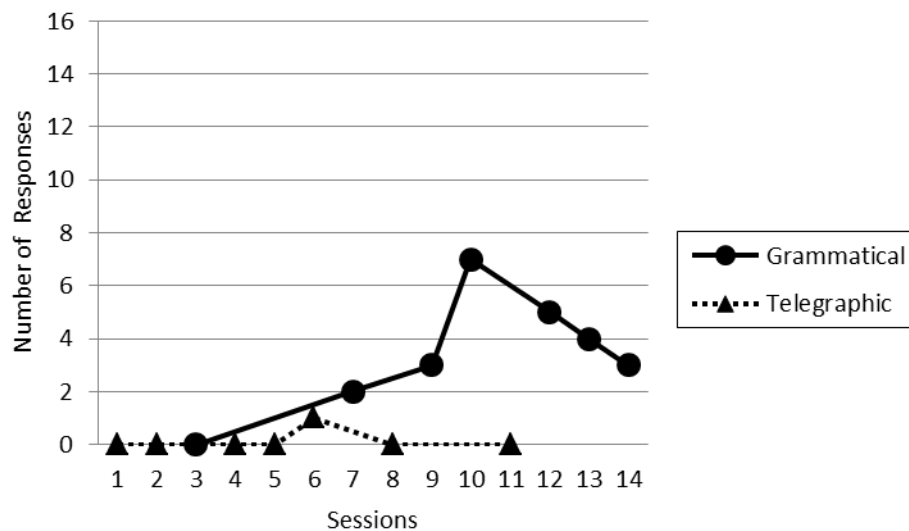


Figure 2. P1's Number of Responses Containing a Function Word and a Target Semantic Relation

Data for P2

The target semantic relation for all 14 sessions for this child was also agent-action. Examples of elicitive prompts used for this child are *Say: The bug is flying* and *Say: Duck walking* for the grammatical and telegraphic conditions, respectively. Similarly, there was no difference in P2's level of responding across conditions. He had a mean of 7.29 (range = 4 – 12; sd = 3.25) responses for the grammatical condition and a mean of 8.86 (range = 6 – 11; sd = 2.12) responses for the telegraphic condition. This resulted in a test statistic of 1.57 with a P-value of .35. Therefore, the obtained difference in responses between the grammatical condition and the telegraphic condition was not statistically significant ($p > .05$, two-tailed). Figure 3

displays his pattern of responses. There was no statistically significant difference in the number of times P2 provided no response to an elicitive prompt between conditions (M of grammatical = 4.0; M of telegraphic = 4.29; $|A-B| = 0.29$; P -value = .89; $p > .05$, two-tailed). A figure displaying his pattern of no responses appears in Appendix B.

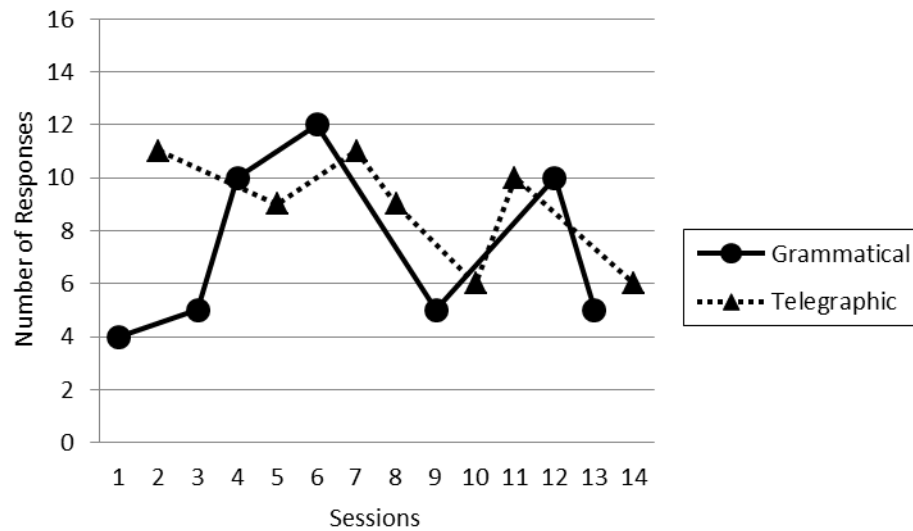


Figure 3. P2's Number of Responses Containing a Target Semantic Relation

P2 also had a significant difference for the number of responses that contained a function word as well as the target semantic relation. P2 produced a mean of 1.86 responses that contained a function word (range = 0 – 5; $sd = 1.95$) in the grammatical condition and a mean of 0 responses that contained a function word (range = 0; $sd = 0$) in the telegraphic condition. This resulted in a test statistic of 1.86 with a P -value of .025. Therefore, the obtained difference in the production of responses that contained a function word as well as a semantic relation between the

grammatical condition and the telegraphic condition was statistically significant ($p < .05$, two-tailed). These results are displayed in Figure 4.

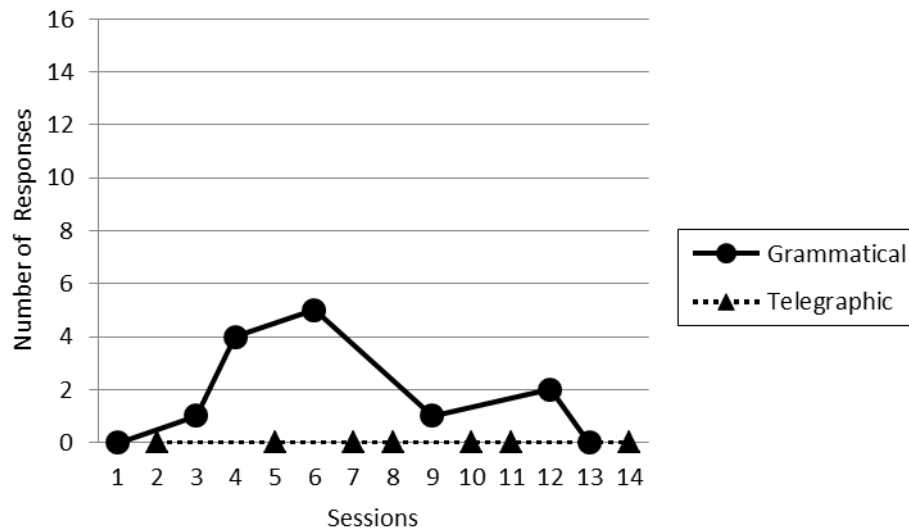


Figure 4. P2's Number of Responses Containing a Function Word and a Target Semantic Relation

Data for P3

P3 rarely responded to the elicitive prompts for her target of agent-action by producing a semantic relation. Examples of elicitive prompts for P3 are *Say: The dog is sleeping* and *Say: bear driving*. Instead, she frequently responded with just a single word regardless of the condition. P3 had a mean of 0.29 responses that contained a semantic relation (range = 0 – 1; sd = 0.49) in the grammatical condition and a mean of 0.57 responses (range = 0 – 1; sd = 0.53) in the telegraphic condition. The resulting test statistic, after rounding, is 0.29 with a P-value of .54. Therefore, the obtained difference in responses between the two conditions was not statistically significant ($p > .05$, two-tailed). These results are displayed in figure 5. There was also no

statistically significant difference in the number of times P3 provided no response to an elicitive prompt between conditions (M of grammatical = 5.43; M of telegraphic = 5.86; $|A-B| = 0.43$; $P\text{-value} = .75$ $p > .05$, two-tailed). A figure displaying her pattern of no responses appears in Appendix C. P3 did not produce any function words in response to the elicitive prompts in either condition.

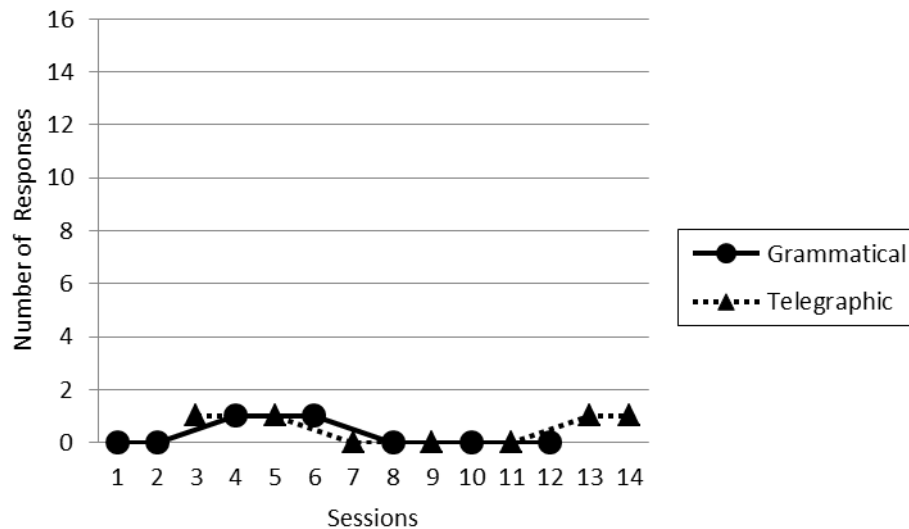
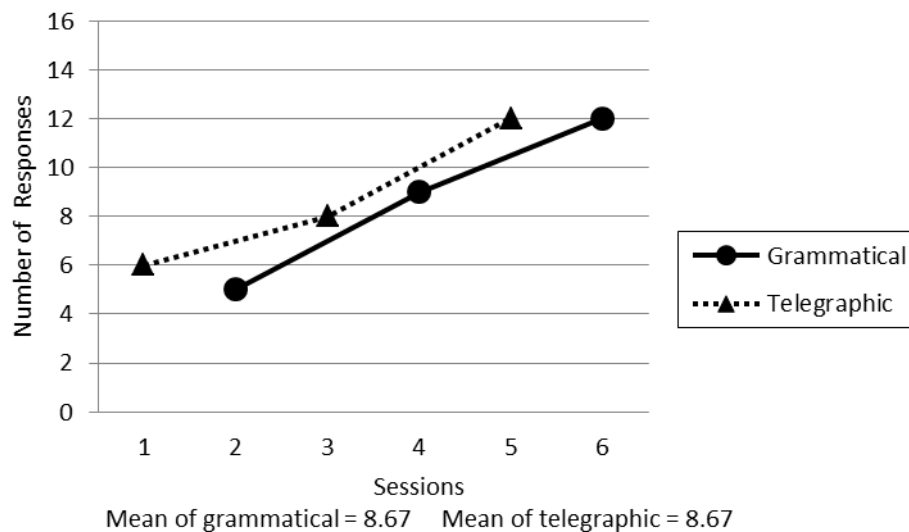


Figure 5. P3's Number of Responses Containing a Target Semantic Relation

As noted above, P3 frequently produced a single word in response to the elicitive prompts. To ensure this did not occur with future participants, this child was seen for an additional six sessions to pilot the use of corrective prompts. Recall that a corrective prompt is an immediate and identical second prompt if the child fails to produce a target response, in this case a semantic relation. The two conditions were alternated, with each condition occurring three times. The only change in procedure was the use of corrective prompts, which were included in the total 15 prompts given

per session. Figure 6 displays the pattern of responses that contained at least a target semantic relation for these six sessions. The mean number of responses are identical for both conditions (i.e., $M = 8.67$) and the range of scores are similar (i.e., grammatical range = 5 – 12; telegraphic range = 6 – 12). Therefore, there is no clear divergence of the lines, indicating that both conditions were similarly effective (Barlow, Nock, & Hersen, 2009). A randomization test could not be completed on these data because the order of sessions was not randomly assigned. Regardless, the procedure of corrective prompts was judged to be effective in eliciting multi-word responses and, therefore, was used with the final two participants when necessary.

Figure 6. P3's Number of Responses to Corrective Prompts that Contained a Target Semantic Relation



Data for P4

The target semantic relation for P4 was action-object. Examples of elicitive prompts for this child are *Say: Pull the tube* and *Say: Roll ball* for the grammatical and telegraphic conditions, respectively. As with the first three participants, P4 responded equally in both conditions. He had a mean of 2.71 responses (range = 1 – 5; sd = 1.38) in the grammatical condition and a mean of 2.29 responses (range = 1 – 4; sd = 1.11) in the telegraphic condition. This resulted in a test statistic of 0.43 with a P-value of .69. Therefore, the obtained difference in responses between the grammatical condition and the telegraphic condition was not statistically significant ($p > .05$, two-tailed). Figure 7 displays his pattern of responses. Likewise, there was no significant difference in the number of times P4 provided no response to an elicitive prompt between conditions (M of grammatical = 0.57; M of telegraphic = 1.28; $|A-B| = 0.71$; P-value = .40 $p > .05$, two-tailed). P4 also did not produce any function words in response to the elicitive prompts in either condition. A figure displaying his pattern of no responses appears in Appendix D.

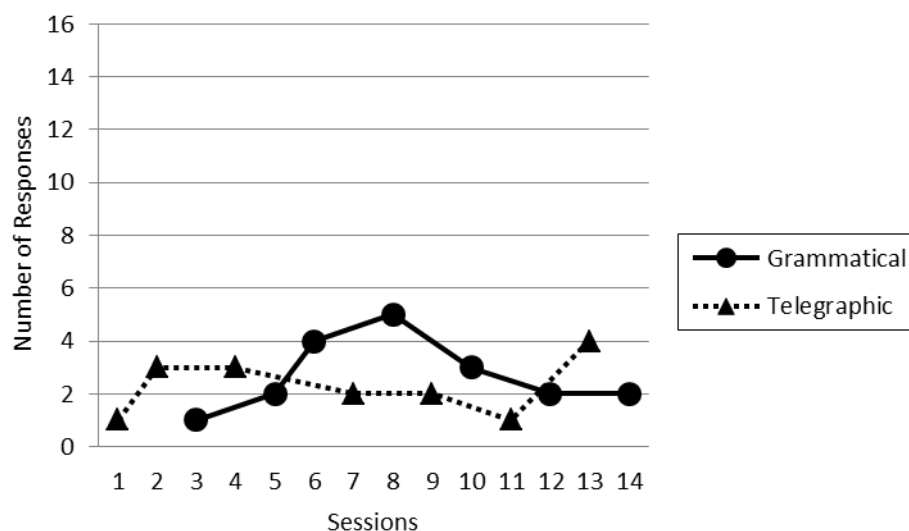


Figure 7. P4's Number of Responses Containing a Target Semantic Relation

Data for P5

P5 began the experimental protocol with the semantic relation of action-object as his target. During the fourth and fifth sessions, he imitated 13 out of 15 prompts, meeting the ceiling criteria for a target. Therefore, his second target semantic relation, agent-action, was used for all remaining sessions. Examples of elicitive prompts for this child are *Say: throw the ball* [action-object] or *Say: The fish is swimming* [agent-action] and *Say: blow fan* [action-object] or *Say: bug crawling* [agent-action] for the grammatical condition and telegraphic condition, respectively. His level of responding immediately dropped far below the ceiling, indicating that agent-action was a more appropriate target. Despite this change of targets, P5 responded similarly in both conditions. He had a mean of 6.0 responses (range = 2 – 13; sd = 3.61) in the grammatical condition and a mean of 6.14 responses (range = 2 – 13; sd = 4.78) in the telegraphic condition. This resulted in a test statistic of 0.14 with a P-value of 1.0.

Therefore, the obtained difference in responses between the grammatical condition and the telegraphic condition was not statistically significant ($p > .05$, two-tailed).

Figure 8 displays his pattern of responses; the vertical line indicates when the second target was implemented. As with the previous four participants, there was no statistically significant difference in the number of times P5 provided no response to an elicitive prompt between conditions (M of grammatical = 5.43; M of telegraphic = 7.43; $|A-B| = 2.0$; P -value = .25; $p > .05$, two-tailed). A figure displaying his pattern of no responses appears in Appendix E.

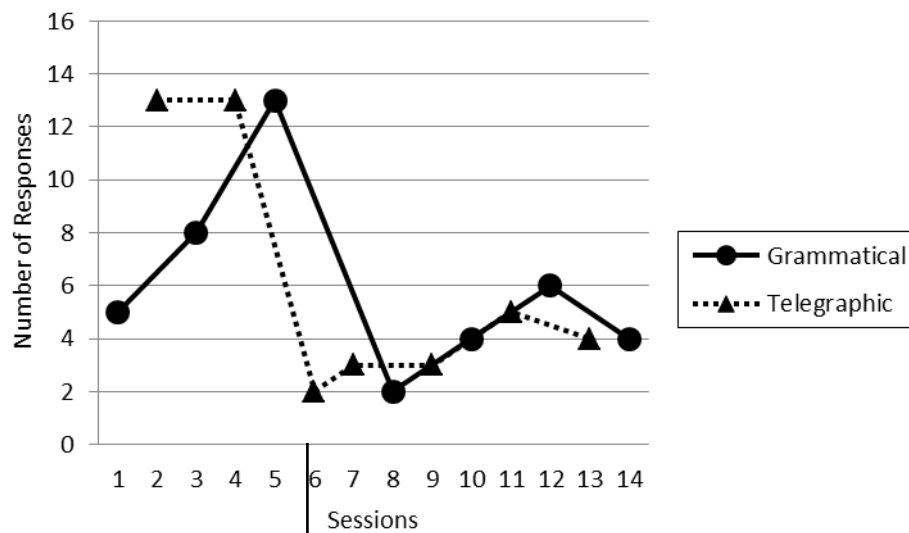


Figure 8. P5's Number of Responses Containing a Target Semantic Relation

P5 had a significant difference for the number of responses that contained a function word as well as the target semantic relation. He produced a mean of 4.43 responses that contained a function word (range = 0 – 12; $sd = 3.95$) in the grammatical condition and a mean of 0 responses that contained a function word (range = 0; $sd = 0$) in the telegraphic condition. This resulted in a test statistic of 4.43 with a P-value

of .008. Therefore, the obtained difference in the production of responses that contained a function word as well as a semantic relation between the grammatical condition and the telegraphic condition was statistically significant ($p < .05$, two-tailed). These results are displayed in Figure 9; the vertical line indicates when the second target was implemented.

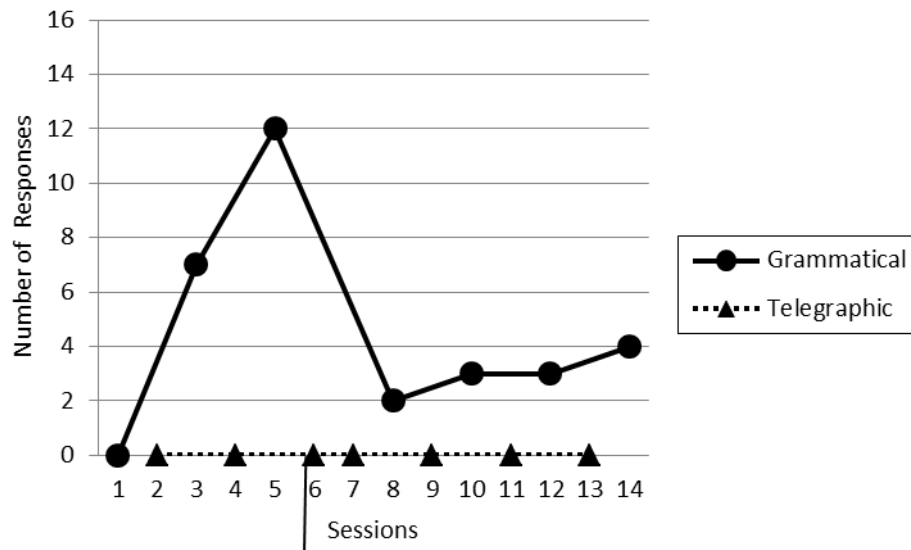


Figure 9. P5's Number of Responses Containing a Function Word and a Target Semantic Relation

Discussion

This investigation sought to determine whether children, who are just beginning to combine words to express semantic relations, respond more reliably to elicitive prompts that are telegraphic than to elicitive prompts that are grammatically complete. A single-case experimental design repeated with four additional children at a similar level of delayed expressive language ability provides the unequivocal answer: The children in this study did not respond more reliably to telegraphic

elicitive prompts. For all five children, the level of responses was similar across the two conditions. In addition, because the number of no responses was not significantly different for the two conditions, one can conclude that the children did not find the grammatically complete prompts to be functionally more complex or, in any way, aversive.

In contrast to this finding, there was a significant difference between the two conditions, favoring the grammatical condition, for the production of a function word with the semantic relation. This effect was found for three of the five children. In one case, P1 produced a function word an average of 3.43 times in the grammatical condition and only one time in the telegraphic condition, for an average of 0.14. P2 and P5 never produced a function word in the telegraphic condition but produced an average of 1.86 and 4.43 times in the grammatical condition, respectively. The other two children, P3 and P4, did not produce a function word in either condition. It may be that these children were not at the developmental level necessary to fully respond to the grammatically complete prompts. In their study on children's readiness to move from single words to two-word semantic relations, Bain and Olswang (1995) determined that children's potential for immediate change can best be described by observing their responsiveness to adult prompts. Children who are ready for immediate change will respond to less supportive prompts while those who are less ready will need more support. An elicitive prompt is highly supportive and yet these two children were unable to imitate a function word. Under Bain and Olswang's (1995) dynamic assessment, the production of function words was outside of these

children's zone of proximal development (Vygotsky, 1978; Olswang, Bain, & Johnson, 1992).

For the three children who did imitate function words, the pattern is clear. Including function words in the elicitive prompt encouraged these children to produce them along with a semantic relation, demonstrating a level of language processing and, perhaps, ability that was not part of their spontaneous language. Excluding function words in the elicitive prompt stripped the model of grammatical features and significantly reduced the probability that the children would process and use a function word in their response to the elicitive stimulus.

Does Telegraphic Input Facilitate Production?

Proponents of telegraphic elicitive prompts make the assumption that this simplified input facilitates production by making targets easier to imitate and, ultimately, easier to produce. No such advantage for telegraphic prompts was found in this study. Children imitated semantic relations that they had not yet mastered at similar levels across both conditions. Therefore, grammatical prompts were just as facilitative as telegraphic prompts in getting children to imitate semantic relations. Further, the telegraphic prompts had a negative effect on the inclusion of function words. Children who imitated function words when they were a part of the elicitive prompt were less likely to produce them when they were not included in the elicitive prompt. In terms of function words then, the grammatical prompts were more facilitative than the telegraphic prompts. The results of this study offer strong evidence that elicitive prompts do not need to be telegraphic to be facilitative and that

grammatical prompts offer an advantage for children who are developmentally ready to include function words.

Statistical Power

Because no differences were found between the two conditions for the number of responses containing a semantic relation, it is reasonable to ask if the study had enough power to detect a difference if there was one. Recall that the power of a randomization test is directly proportional to the number of sessions; the greater the number of sessions, the greater the power. Further, this increase in power escalates quickly because the number of ways to randomize two or more conditions is factorial. For example, in the current study, 14 sessions evenly split between two conditions yielded 3,432 possible random orders. The restriction that no more than three sessions of the same condition occur consecutively reduced this number to 1,972. If just two more sessions had been added, for a total of 16 sessions evenly split between two conditions, the total number of possible random orders would be 12,870 [$16!/8!8! = 12,870$]. The same restriction would have left 6,344 possible orders. This is over a three-fold increase in power and yet, given the pattern of observed scores, it is unlikely that two more sessions would have yielded different results. Fourteen sessions, split between two conditions, was sufficient to detect a significant difference for the inclusion of function words indicating that the lack of an effect for responses to elicitive prompts between conditions was not due to a lack of power.

Clinical Implications

The results of this study provide convincing evidence that using elicitive prompts that are devoid of function words, does not give children an advantage in repeating imitative prompts and thus, are not likely to be more facilitative than grammatical prompts. Children just as readily imitate (and, may learn) a semantic relation when given a longer, grammatically complete elicitive prompt. Further, including function words encourages children, who are developmentally ready, to imitate them. Importantly, including function words does not hinder those children who are not developmentally ready to produce them. The two children who never included a function word in either condition were still able to imitate as many semantic relations when given grammatically complete elicitive prompts as when given telegraphic elicitive prompts. Including a function word for these two children did not result in fewer imitations of semantic relations, or in a difference in the number of no responses between conditions.

None of the children in this study produced a function word in an utterance that also contained a semantic relation during their spontaneous language sample. It would seem that relying on a child's expressive language ability to decide whether to include function words in adult models and elicitive prompts is contraindicated. As noted above, children are able to perceive function words long before they are able to produce them. It is therefore recommended that when reducing utterances to more closely match that of a child's, clinicians should not reduce their utterances to the point of being ungrammatical, even if the child is not yet using function words. Other

researchers have made similar recommendations to include function words (e.g., Fey, 1986; Fey, 2008; Van Kleeck et al., 2010). Rice et al. (2000) recommended that clinicians include determiners when teaching vocabulary to young children to help them distinguish between noun categories such as count versus mass nouns.

To examine the role of input on language development, Hadley, Rispoli, Fitzgerald, and Bahnsen (2011) considered the construct *input informativeness*, defined as the proportion of unambiguous evidence for tense in the input, as a predictor of morpho-syntactic growth in typically developing children. In this model, learning is the result of a probabilistic algorithm that punishes or rewards competing grammars; either a grammar with obligatory tense marking such as English (+Tense), or a grammar without tense marking, such as Mandarin (–Tense). Sentences with overt tense will reward the +Tense grammar, while sentences lacking tense will punish it and instead reward the –Tense grammar. Hadley et al. (2011) predicted that input containing lots of ambiguous evidence would slow down the learning of a +Tense grammar. Ambiguous evidence in English would include grammatical sentences such as *Go to sleep* which do not have overt tense marking. Telegraphic utterances such as those used in this study for the agent-action semantic relation (e.g., *duck walking*) also lack overt tense marking and would be expected to have the same deleterious effect.

The results of the Hadley et al. (2011) study revealed that the frequency of parents' ambiguous tense marking was related to slower child morpho-syntactic growth over a 9-month period. Specifically, the extent of –Tense verb forms in the

parent input was a significant unique predictor of typically developing children's morpho-syntactic skills at 30 months of age. They concluded that reducing the proportion of ambiguous verb forms during the early stages of morpho-syntactic learning is even more important than increasing the use of overt marking. The use of telegraphic speech during intervention for children who are having difficulty learning language would run counter to this conclusion.

Hadley et al. (2011) assume that the child's learning is constrained by principles of universal grammar, in particular, that children have knowledge of clause structure. As such, they do not consider distinctly nonfinite forms like the small clause *him dancing* in the sentence *We see him dancing* to be problematic because the child recognizes that tense does not have scope over the small clause. In other words, the child understands that the small clause is nonfinite. Other researchers, operating under a usage-based theory or construction grammar, assume that children misinterpret these nonfinite small clauses as full clauses that can stand alone and therefore, are problematic for the child. That is, a child who does not recognize clause structure may think the nonfinite sequence *him dancing* is perfectly acceptable without the matrix clause *We see*. Leonard and Deevy (2011) tested the hypothesis that nonfinite subject-verb sequences in the input would influence children's tendency to use utterances that were also nonfinite. They presented novel verbs in nonfinite contexts (e.g., *We saw the dog pagging*) and novel verbs in finite contexts (e.g., *Just now, the horse was channing*) to children with SLI and typically developing peers. They then prompted the children to use the novel verbs in a sentence structure that

obligated the use of auxiliary *is*. The results showed that the children with SLI were significantly influenced by the input. When novel verbs were heard in nonfinite subject-verb sequences, these children were more likely to produce these novel verbs without an auxiliary. Alternatively, when the novel verb was heard with an auxiliary these children were more likely to include an auxiliary. The typically developing children were not similarly influenced by how the novel verbs were presented. Finneran and Leonard (2010) considered the role of input for learning the third person singular –s (3S) with young typically developing children. They presented novel verbs to children age 30 to 36 months in either a 3S context (e.g., *The tiger heens*) or a nonfinite context (e.g., *Will the tiger heen?*). Children were then prompted to use the novel verbs in contexts requiring 3S and in contexts requiring the infinitive. The results of this study revealed that novel verbs heard only in the 3S context were more likely to be marked correctly for 3S in obligatory contexts and were more likely to be marked incorrectly with 3S in infinitive contexts than novel verbs heard only in a nonfinite context. As with the Leonard and Deevy (2011) study, how children experienced words in the input affected how they learned these new words.

Despite the different theoretical frameworks, both groups of researchers concluded that input that is devoid of overt tense and agreement marking leads children to consider forms that incorrectly lack tense and agreement as acceptable. Because telegraphic elicitive models and telegraphic input in general lack tense and agreement, this type of input would also lead children to the same erroneous conclusion. The implicit assumption, made by proponents of telegraphic input, that

this type of input is not detrimental to a child who has difficulty learning language is not supported by these studies.

Study Limitations

The primary researcher of this study also served as the examiner who delivered the elicitive prompts to the participants. Because of this, it may be that the children were more likely to respond in one condition because of the examiner's reaction to the child's response. To limit the chances for the results to be influenced by bias, the examiner was careful to react to children's responses in the same manner across conditions. Furthermore, careful reliability studies were undertaken involving a listener who was blind to the study questions and hypotheses. Despite these cautionary steps, it is impossible to eliminate all possibility that the data could be biased in some way. Employing a trained clinician who was unaware of the purpose of the study to deliver the elicitive prompts would have strengthened the implementation of this study.

In addition, this study focused on one aspect of a broader intervention technique; namely, elicitive prompts to imitate, the most supportive prompt in a hierarchy of prompts in milieu teaching. The outcome of interest was children's imitative responses to these prompts and not evidence of learning. As such, this study cannot directly address the impact of telegraphic input on children's spontaneous language production. Elicitive prompts are an effective language intervention technique that lead to productive use (Hancock & Kaiser, 2006), but a direct measure of the effect of telegraphic input on children's morpho-syntactic development would

require an examination of children's expressive language following a full intervention regimen.

Direction for Future Research

Previous research has shown that telegraphic models do not aid comprehension (Duchan & Erickson, 1976; Fraser, 1972; Jones, 1978; Larson, 1974; Page & Horn, 1987; Petretic & Tweeney, 1977) and intervention studies have shown that telegraphic models and/or elicitive prompts can be effective in changing a child's language ability (Kaiser citations; Loeb & Armstrong, 2001; Willer, 1974). To the author's knowledge, this study offers the first evidence that adult telegraphic speech is not necessary for children to successfully respond to a fundamental intervention technique, however. While telegraphic input may not be more helpful than grammatical input, might it be harmful? That is, would omission of function words during intervention slow the morpho-syntactic growth trajectory of children who are having difficulty learning language. Loeb & Armstrong (2001) raise a similar question regarding the role of this type of input. Studies discussed above of ambiguous and nonfinite input indicate that this type of input may be the source of children's errors during development. Telegraphic input may have the same impact. Future research is needed to determine the long term effects of adult telegraphic speech on children who are language delayed.

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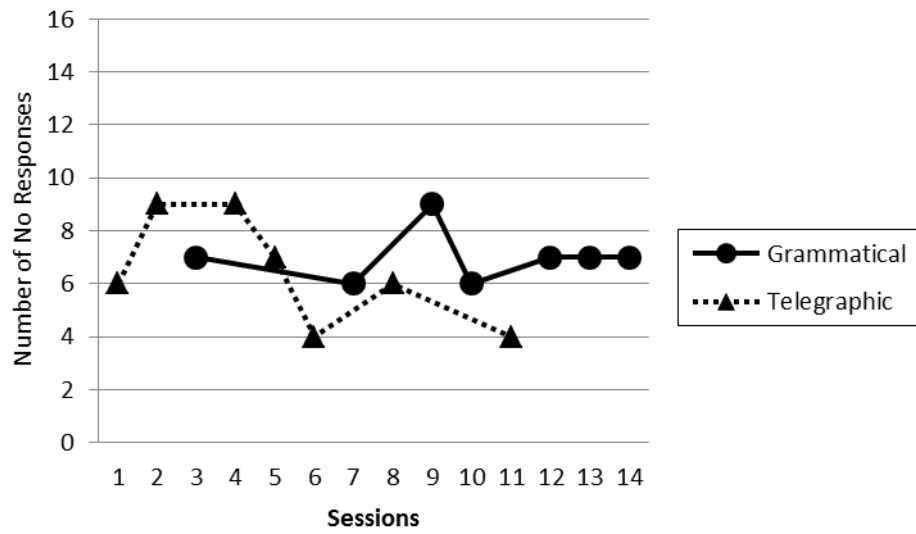
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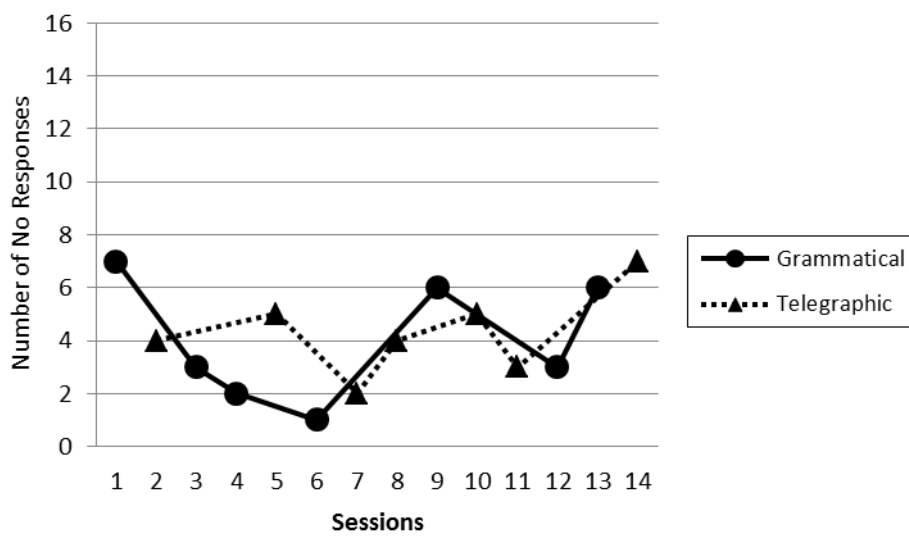
Appendix A

P1's Pattern of No Responses to Elicitive Models



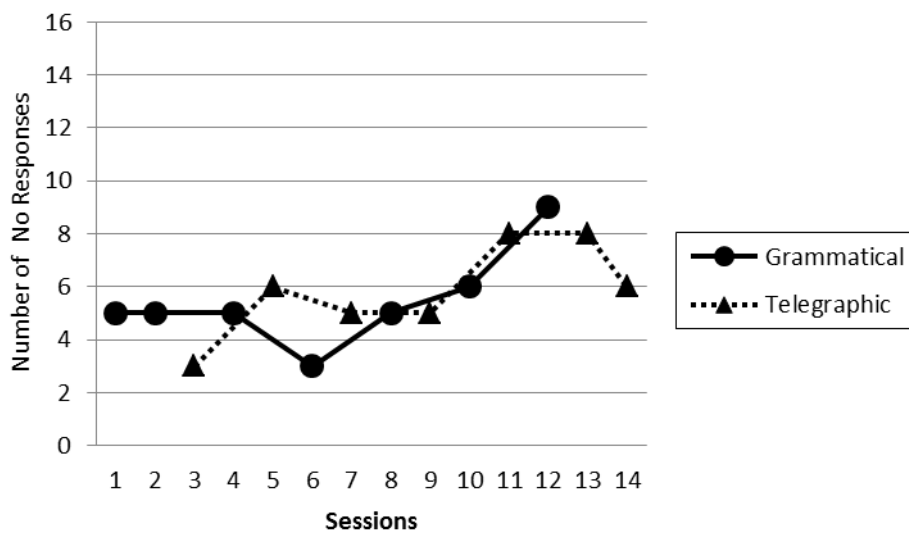
Appendix B

P2's Pattern of No Responses to Elicitive Models



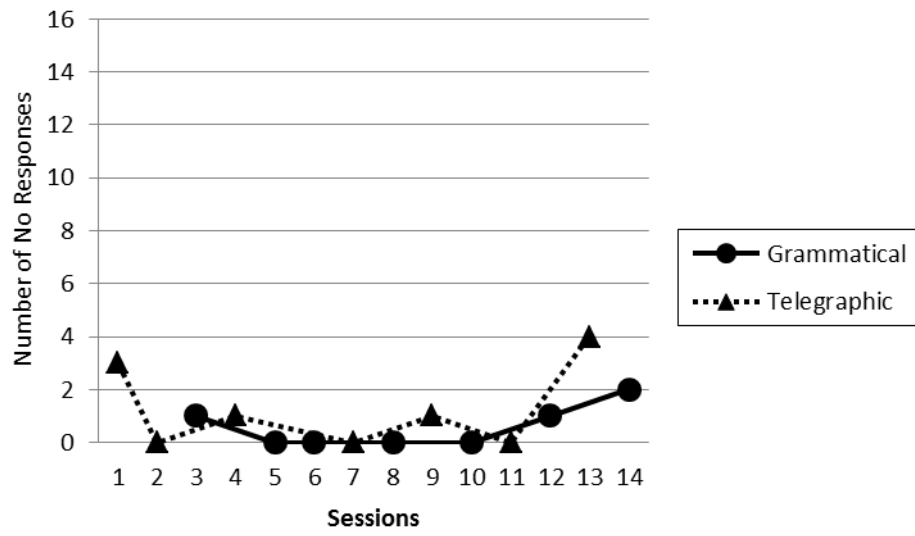
Appendix C

P3's Pattern of No Responses to Elicitive Models



Appendix D

P4's Pattern of No Responses to Elicitive Models



Appendix E

P5's Pattern of No Responses to Elicitive Models

