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The Acquisition of Semantic Relations in English Nominal Compounds: A Pilot Study

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THE ACQUISITION OF SEMANTIC RELATIONS IN ENGLISH NOMINAL COMPOUNDS: A PILOT STUDY

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ABSTRACT

Children acquire different linguistic constructions in approximately the same order and near the same time. Nominal (noun + noun) compounds, like "football," are more complex than simple nominals, like "ball," and are produced and comprehended later. Previous literature (Berko 1958, Berman 1987, Clark 1981, Clark et al 1985, Krott et al 2009, Nicoladis 2003) investigated how children understand the complexity of compounds, yet questions remain regarding children's early abilities to produce novel compounds. The present study focused on the ability of one English acquisitionist, "Sam," to form novel compounds encoding four types of semantic relations (HAS, MADE OF, LOCATED ON, and ABOUT). The tests were elicited production tasks, with one round at 2;6 and a second at 2;9. Sam was prompted to produce five novel compounds of each type. The materials in each round were distinct to ensure that the target is novel. For example, "water flamingo" was used at 2;6 and "soup zebra" at 2;9. At 2;6. Sam was only able to produce compounds in the HAS form, while he flawlessly formed each type at 2;9. These results suggest that HAS is the first strategy acquired, while MADE OF, LOCATED ON, and ABOUT are acquired later. However, it is uncertain whether these three types of compounds were acquired simultaneously or in a certain order. This experiment provides insight towards the abilities of young children to create novel compounds. The results support previous research showing that children begin to learn, understand, and even produce compounds at a young age. Yet, this research is new in showing that the production of novel compounds of different types need not begin simultaneously, and that, for English acquisitionists, it likely begins before the age of 2:6.

Keywords: First Language Acquisition, Child Language, Novel Compounds, Nominal Compounds, Semantic Relations.

1.0 Introduction

Through a pilot study investigating the order of nominal compound production in a young child, the results and conclusions formed from this paper will inform future research on early novel compound formation in English acquisitionists. The study focused on the ability of one English acquisitionist, "Sam," to form novel compounds that encode four types of semantic relations. Using elicited production tasks, with one round at 2;6 and a second at 2;9, Sam was prompted to produce five novel compounds of each type. In general, nominal compounds have a higher level of morphological and semantic complexity than simple nominals. Therefore, they are expected to be acquired later. Numerous studies have been conducted to learn more about when children understand the duplexity of compounds. Yet, more questions remain regarding children's early abilities to produce their own compounds. This paper reviews earlier research on novel compound formation by young children and how the topic has been addressed experimentally, then explains design and results of the pilot study at hand.

1.1 Literature Review

For children to be able to understand a novel compound, they must understand the type of head-modifier relationship the compound has. A nominal compound is a compound with at least two nouns, one acting as the head and the other as the modifier. This definition excludes

compounds with at least one adjective or other part of speech and at least one noun (i.e. *blackbird*), though these are nominal compounds as well. In English, the head is after the modifier(s). For example, in the compound *apple juice*, *juice* is the head and *apple* is the modifier. This is a transparent compound because it follows the head-modifier model. However, this does not always hold true, as in the case of opaque compounds. An example is *jailbird*, because it is not a type of bird. The studies in this paper, including the pilot study itself, focus on transparent compounds because children are more likely to understand them. Thematic relations also come into play: the many possible relations make novel compounds difficult for children to understand. For example, the novel compound *apple wall* could mean a wall made of apples, a wall on which to put apples, or something else entirely. Furthermore, there are no morphological markers that indicate how the modifier and head interact (Krott et al., 2009). For instance, the word *bird* does not contribute to the meaning of *jailbird* as one who is or has been imprisoned.

It has been found that the acquisition of linguistic constructions, including compounds, is affected by the frequency of a child's exposure to them (Krott et al., 2009). Since compounds are relatively common in English, these studies suggest that children being raised in English-speaking environments will learn compounds earlier than speakers of languages without frequent compounding, like French and Hebrew. However, even English acquisitionists initially learn and understand compounds as single linguistic units, and this incorrect understanding can last until age 7;0 or older (Berko, 1958). For example, a child can understand the meaning of the word *football* as well as both *foot* and *ball* without understanding that *football* refers to a ball that can be kicked with the foot or to a game played with this type of ball.

In a 1981 study about how children create new words, Clark delved into the various methods young children may use to create lexical innovations. She asked monolingual English-speaking children between the ages of 3;0 and 6;0 for innovative names by means of a word game using a deck of cards. She would hold up a card without showing it to the child, describe what she saw on the card, and ask the child to give a word for the description. The child would respond with a compound, a verb ending in *er*, a suppletive, or none of these. For example, the experimenter would prompt the child by saying, *"a person who gives things,"* and the child would respond with *"give-man"* (compound), *"giver"* (verb ending in *er*), *"someone who gives"* (suppletive), or none of these. Clark found that the younger children produced more nominal compounds than were older children. Older children more commonly added *er* to verbs than younger children. These results are shown below in Figure 1.

Age	V + er	Compound	Suppletive	No Response
3;0-3;8	56	23	3	18
3;9-4;5	90	6	1	3
4;6-5;2	76	8	5	11
5;3-6;0	93	3	2	2

Figure 1. Percentage of each agent form elicited by age (from Clark, 1981, pg. 18).

In another study, Clark presented monolingual English-speaking children with a set of four pictures and asked the child to point to the picture that best described the given compound. For example, she would present a child with four images: a hat decorated with a mouse, a mouse with a hat on, a hat, and a mouse. Then she would say, "Show me the mouse hat" and the child would choose. This study found that half of the children tested between the ages of 2;0 and 2;9 chose the correct picture, showing an understanding of nominal compounds. The other half had the ability to identify the head of the compound presented to them but did not seem to understand the word as a compound. By age three, 80% of children chose the correct picture, and nearly 100% by age four (Clark, 1981).

Other studies have shown that some children can begin constructing novel compounds from the age of 2;0. A 1985 study done by Clark, Gelman, and Lane found that children as young as 2;6 can use novel compounds to name several different semantic relations. This study involved 60 monolingual English children aged 2;3 to 4;4 and had three parts: the first two parts were focused on comprehension of novel compounds, and the third part involved the production of novel compounds as well as comprehension. In the third part, named "contrast task," children were shown 10 pages, one at a time, with each page having three ink-drawn pictures on it. One picture showed a target novel nominal compound (e.g. a picture of a horse in a truck for the target *horse truck*), another picture showed the same target head, but with a contrasting modifier (e.g. a bicycle in a truck for the target *bicycle truck*), and a last picture showed a referent of the target modifier with some other namable item (e.g. a man riding a horse). First, the experimenter asked the child for the target novel compound by saying, in the case of the present example, "Can you show me the horse truck?" This part tested comprehension. Then, the experimenter asked the child to name the other two pictures, potentially eliciting novel compound production. The results show that children between the ages of 2;0 and 3;0 use compounds to label related or semi-related objects significantly less often that children between 3;0 and 4;0 or adults (Clark et al., 1985), suggesting that while children younger than 3;0 can use compounds, a correct understanding of these compounds develops later. Nicoladis (2003) delved into these ideas further and found that more development in production of novel compounds happens between the ages of 3;0 and 4;0 years.

Previous experimentation and research delves into how children of varying ages interpret presented novel compounds. The studies have found that correct interpretations of novel compounds can begin as early as 2;0, and drastically improve in accuracy after ages 3;0, 4;0, and 5;0. One study on the production of novel compounds found that children as young as 2;6 can produce them, though infrequently and inconsistently (Clark et al, 1985). The pilot study undertaken in this paper digs deeper into the acquisition of nominal novel compound formation and into children's understanding of the role of the semantic relationship between the head and the modifier.

1.2 Pilot Study

In meetings with Sam (2;6), an English acquisitionist, I observed spontaneous productions of novel nominal compounds. His ease in forming compounds alerted me to the more interesting task of investigating the early development of this skill and raised the question of whether English speaking children have a default strategy in forming novel compounds. This question has not been explicitly addressed in previous studies. I considered the four types of head-modifier relationships as categorized previously by Krott, et. al, (2009), as listed below:

1. HAS: a muffin that has chocolate = chocolate muffin
2. MADE OF: a box made of cardboard = cardboard box
3. LOCATED ON: a bird living on the mountain = mountain bird
4. ABOUT: a magazine about mountains = mountain magazine

This study is designed to discover the order in which these different types of compounds are acquired. Focusing on children between the ages of 2;0 and 3;0 is ideal because this is when compound production begins (Clark, 1981). This study has a narrow focus; it focuses completely on the *production* of novel compounds, rather than discussing comprehension. The results provide helpful insight into the earliest methods by which English acquisitionists produce novel compounds.

In previous interactions with Sam, I noticed that he liked to create novel compounds of the HAS type. For example, he called his fuzzy wool jacket his "lamb coat" and a plastic apple in his toy camper "apple camper." These are just a few of many spontaneous novel nominal compounds observed. Because of this, I hypothesized that HAS-type compounds are acquired first. Krott et al., (2009) suggest that HAS-type and LOCATED ON-type are especially concrete relations that children likely prefer, though my observations of Sam do not extend to the LOCATED ON category.

2.0 Methods

This study took place over a three-month period; Experiment 1 took place when Sam was 2;6, and Experiment 2 was conducted with Sam at age 2;9. As previously mentioned, the four categories of nominal compounds given by Krott et al. 2009 were chosen. A separate test was created for each category; all are elicited production tasks. Experiment 2 included one practice trial for each category, while Experiment 1 did not include any practice trials. The tests were presented to Sam as games, and he eagerly participated in every trial.

2.1 Experiment 1

The tests were administered by me, a native speaker of English. As part of my First Language Acquisition class at Carleton College, I had been meeting with Sam once a week for 8 weeks before I began this experiment. I gave the tests individually, and over two different days. On the first day of the test, the HAS and ABOUT tests were given using physical objects. A week later, Sam went through the MADE OF and LOCATED ON tests on a computer. The reasoning for having two tests on the computer and two using physical objects was ease of presentation. It would have been a challenge to obtain the specific items needed to present MADE OF and LOCATED ON to Sam. The tests took place in Sam's home. Each category took between 3 and 7 minutes to complete, and no feedback was given after each trial. The HAS test involved physical objects: a combination of Sam's toys and household objects. To begin each trial, it was confirmed that Sam knew what both objects were. The objects were then combined, and Sam was asked to name the resulting object. Each trial adopted the format:

For the target utterance "box camper":
Experimenter: *holding up a box* "Sam, this is a box."
Experimenter: *pointing to the toy camper* "And this is a camper."
Experimenter: *places the box on the camper* "So what is this?"

The ABOUT test also used physical objects. I brought the books so Sam would not recognize them from his home. I presented Sam with the book, told him the topic of the book, and asked him to tell me what the book is called. Each trial adopted the format:

> For the target utterance "fire book":
> Experimenter: *holding up a book* "Sam, this is a book, and it's all about fire, so what is it called?"

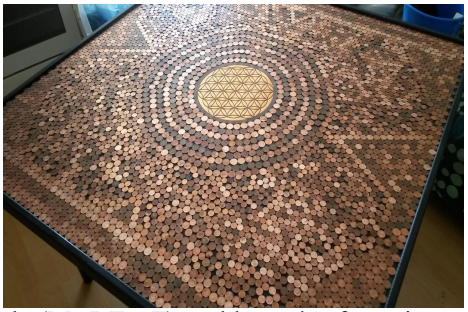
The MADE OF and LOCATED ON tests were presented to Sam using images on a computer screen. I showed Sam the images, gave the relevant information, and asked Sam to name the objects in the pictures. The MADE OF and LOCATED ON tests adopted the following two formats, respectively:

> For the target utterance "apple wall":
> Experimenter: *pointing to a picture on the screen* "Sam, this is a wall, and it's made of apples, so what is it called?"
> For the target utterance "water flamingo":
> Experimenter: *pointing to a picture on the screen* "Sam, this is a flamingo, and it's always in the water, so what is it called?"

2.2 Experiment 2

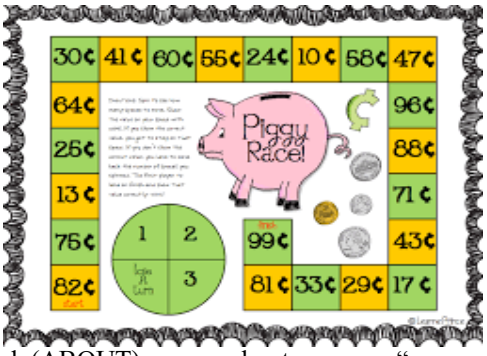
Experiment 2 followed the same procedure as Experiment 1 with a number of improvements. To begin, all four categories were presented to Sam on the same day, and I randomized the order of delivery. I also presented Sam with one practice trial for each category at the beginning of the experiment, then five additional trials for each. Furthermore, the HAS and ABOUT trials were altered to be more varied. For example, instead of having five different kinds of books, I presented Sam with a book, a movie, a poster, a game, etc. I also altered the LOCATED ON category to be more novel. For instance, "soup flamingo" is arguably a more novel concept than "water flamingo" and may help separate what children may know about flamingos from the production of a novel compound. Examples of materials used in Experiment 2 are shown in Figure 2.

a. (HAS) a truck with a cup = "cup truck"



b. (MADE OF) a table made of pennies = "penny table"

c. (LOCATED ON) a zebra living in soup = "soup zebra"



d. (ABOUT) a game about money = "money game"

Figure 2. Examples of materials used in Experiment 2

3.0 Results

In Experiment 1, Sam matched the target utterance for 100% of the HAS trials correct (11/11), 0% of the MADE OF (0/5), 0% of the LOCATED ON (0/6), and 0% of the ABOUT (0/4). Sam even demonstrated his ability to form HAS compounds by playfully producing them after the testing had ended. As for the other three trials, the results point to the fact that Sam is not yet able to form these types of compounds extemporaneously. For the MADE OF category, Sam used a consistent format: *"a table made of pennies," "a wall made of apples," "a bed made of candy,"* etc. for the target utterances *"penny table, apple wall, and candy bed,"* respectively. Sam also forged his own structure for the LOCATED ON tasks: *"flamingo in the water," "a parrot on a swing," "the flowers on the mountain,"* etc. for the target utterances *"water flamingo, swing parrot, and mountain flower."* The ABOUT category did not appear to generate a consistent pattern from Sam; his answers ranged from one-word responses to phrases. For example, for the target utterance *"water book,"* Sam said, *"book,"* and for the target utterance *"fire book,"* he said, *"a book with fire."* A detailed list of each trial's target utterances and Sam's responses for Experiment 1 can be found below in Appendix 1.

In Experiment 2, Sam flawlessly produced the target utterances for each of the categories. A detailed list of each trial's target utterances and Sam's responses for Experiment 2 can be found below in Appendix 2. The results for both Experiments 1 and 2 are displayed in Figure 3.

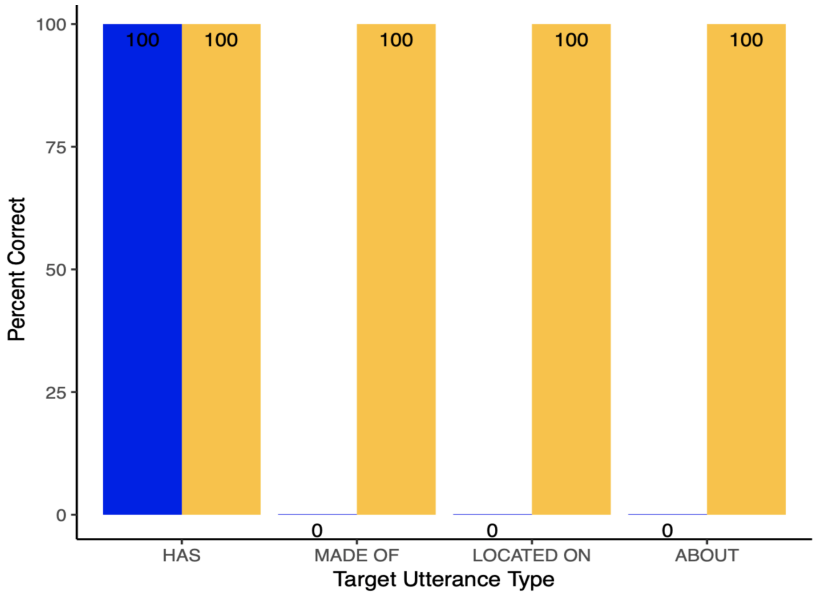


Figure 3. The results of Experiment 1 (blue) and Experiment 2 (yellow)

4.0 Discussions of Experiment 1

The results of Experiment 1 showed that Sam had fluently acquired the ability to create novel HAS compounds, but he had not yet applied compound structures to his production of MADE OF, LOCATED ON, and ABOUT semantic constructions. His ease with spontaneously producing HAS compounds could have been due to his high level of exposure to, and interest in, these compounds. For example, Sam loves different vehicles, and he has learned many of the different types. He frequently talks about the mail truck, and he understands it as a truck that carries mail. This aligns with the observation of Krott et al. that children's understanding of compounds appears to be affected by frequency of exposure, and that HAS is the most frequently used type of compound in English. Another possibility is that the HAS compounds are less semantically complex. Krott et al. suggests that HAS and LOCATED ON have especially concrete semantic relations that children likely prefer.

Further explanations of Sam's results may lie in potential sources of error in Experiment 1. To begin, two tests were with physical objects, and two were presented as images on a computer. The different methods of test administration could have impacted Sam's ability to recognize the nature of the objects. Having the physical objects could have improved Sam's ability to see the relation between the objects, and therefore increased his ability to form a compound. Previous studies, including Clark (1981) and Clark et al. (1985), tend to use pictures, which are comparable to my use of images on a computer screen. In addition, presenting the individual trials to Sam one category at a time instead of randomizing the order could have interfered with his interpretations, although the lack of feedback given by the experimenter mitigates this concern. Another potential source of error lies in the exclusion of practice trials in Experiment 1.

4.1 Discussions of Experiment 2

The results of Experiment 1 show that, for Sam, HAS compounds were acquired before he was 2;6 and were acquired first. Experiment 2's results indicate that the rest of the compound types developed sometime between the ages of 2;6 and 2;9. Again, there are potential sources of error with these results that must be considered. One is the differences between Experiment 1 and

Experiment 2, including the change in presentation materials, the randomization of the order of delivery of each case to Sam, the fact that Experiment 1 took place in one day while Experiment 1 took place over two, the addition of the training phase in Experiment 2, and the possibility that Sam did not understand the task in Experiment 1 and was better able to understand the task in Experiment 2, either due to age, experience, the practice trial, or another factor. Additional experiments with more children will be needed before more firm conclusions can be drawn.

4.2 Going Forward

For future experiments, 120 participants in four age groups (2;3, 2;6, 2;9, and 3;0) with 30 participants in each group will be needed to make the results statistically significant. All participants will be monolingual English speakers. Their caretakers will vouch that they are typical children. Like other studies, I will also run these tests on a group of adults first to gain insight as to the types of responses generated by adult native speakers of English. This will be the control group. Some of the previous studies done on this topic include a production section, while all have a comprehension section. Because of this, I would also broaden the goals of the experiment to include comprehension tasks as well as production tasks.

5.0 Summary

My study focuses on the ability of English acquisitionists to produce novel compounds with the four main structures described by Krott et al. The results suggest that HAS is the strategy that Sam acquired first. The results also confirm previous studies that have indicated that. This experiment provides helpful insights towards the early abilities of children to create novel compounds. Furthermore, they support the view that children's early abilities are confined to specific types of compounds.

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Appendix 1: A list of target utterances and responses given by Sam in Experiment 1

Experiment 1	Target Utterance	Sam's utterance	yes/no
HAS	box camper	"box camper"	yes
	cup camper	"cup camper"	yes
	hat camper	"hat camper"	yes
	banana camper	"banana camper"	yes
	bandana camper	bandana camper	yes
	book camper	"a book camper"	yes
	mug "cup" truck	"cup truck"	yes
	zebra truck	"zebra truck"	yes
	picture truck	"picture truck"	yes
	penguin truck	"penguin truck"	yes
	water truck	"a water truck"	yes
MADE OF	penny table	"a table made of pennies"	no
	truck box	"a firetruck. I do that with my real fire truck"	no
	pretzel alphabet	"alphabet made of pretzels"	no
	candy bed	"a bed made of candy"	no
	blanket house	"that house- that upa in the- in- house, with the green and white blankie"	no
	apple wall	"a wall made of apples"	no

LOCATED ON	swing parrot	"a parrot on a swing"	no
	water flamingo	"flamingo in the water"	no
	mountain flower	"flower- the flowers on the mountain"	no
	tree papaya	"a tree covered with papaya"	no
	grass antelope	"a antelope in the grass"	no
	chocolate bug	"a bug in the chocolate"	no
ABOUT	boat book	"boats"	no
	water book	"book"	no
	car book	"gimme that"	no
	Sam book	"book about Sam"	no
	fire book	"a book with fire"	no

Appendix 2: A list of target utterances and responses given by Sam in Experiment 2

Experiment 2	Target Utterance	Sam's utterance	yes/no
HAS	spoon car	"spoon car"	yes
	carrot box	"carrot box"	yes
	sun towel	"sun towel"	yes
	banana camper	"banana camper"	yes
	bandana camper	bandana camper	yes
MADE OF	bread house	"bread house"	yes
	book chair	"book chair"	yes
	wood bike	"wood bike"	yes
	bottle wall	"bottle wall"	yes
	leaf car	"leaf car"	yes
LOCATED ON	soup zebra	"soup zebra"	yes
	backpack bird	"backpack bird"	yes
	apple worm	"apple worm"	yes
	moon gorilla	"moon gorilla"	yes
	shoe cow	"show cow"	yes
ABOUT	tree book	"tree book"	yes
	puppy movie	"puppy movie"	yes
	sports magazine	"sports magazine"	yes

	money game	“money game”	yes
	elephant show	“elephant show”	yes