

'GROUND RULES': LOCATIVE VERBS IN FIRST LANGUAGE ACQUISITION

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Abstract

The objective of this study is to investigate the knowledge and developmental processes that underlie native speakers' acquisition of a particular syntactic alternation pattern: the *spray / load* alternation. An experiment was designed to test the predictions of semantic structure theory against those of conventional theta-theory (modifying techniques employed by Gropen et al., 1991). Novel verbs were coined and taught to 2 groups of 12 children (aged 2;10 – 4;11 and 5;3 – 6;11) as well as an adult control group. In accordance with the predictions of semantic structure theory, the meaning of the verbs determined the appropriate argument structure, so that the change-of-state verb selected a ground rather than a figure as its direct object. The results count as evidence in favour of the hypothesis that the lexical semantic representations of predicates play a crucial role in the realization of syntactic argument structure. It is argued that the discovery of such structures not only furnishes us with an explanation of just what is being acquired in the *spray / load* alternation and how it may be acquired, but provides us with a window on the architecture of meaning in natural language.¹

1. Introduction

The lexicon has played an increasingly important role in generative syntactic theory over the last fifteen years as significant correlations between the lexical semantics and syntactic behaviour of verbal predicates have come to light. The fact that certain semantic classes of verbs predictably appear in particular syntactic configurations has inspired a broad-ranging research programme whose goals include: a) the reclassification of verbs in accordance with shared semantic components and shared syntactic behaviour; b) the development of a descriptively adequate representational schema for the lexical semantic entries of predicates; c) a detailed explanatory theory of the interface between lexical semantics and syntax. The possible implications of this research programme are far-reaching, and the more renowned studies (e.g. Jackendoff, 1983, 1987, 1990; Levin, 1993; Levin and Rappaport Hovav, 1991, 1995; Pinker, 1989; Rappaport and Levin, 1988) have stirred up heated debate with regard to the relationship between meaning and grammar. Language acquisition studies have played a pivotal role in refining theoretical investigations, as any theory of linguistic representation worth its salt must meet learnability requirements. Children demonstrate a remarkable ability to make subtle semantic distinctions, and reliably map thematic structures of newly-acquired verbs onto appropriate syntactic structures in their native language (L1). The occasional errors children make in the course of acquisition are most revealing as they highlight the syntactic consequences if the meaning of a verb is not

¹ This paper presents a brief outline of semantic structure theory and a summary of an experiment, both discussed in full in Stringer (1998).

fully grasped. Acquisition theory must also hypothesize a learning mechanism that accounts for the ‘unlearning’ problem: incorrect semantic representations must be abandoned as correct verb meaning is acquired, enabling productive use in appropriate syntactic contexts. The purpose of the present study is to investigate the acquisition of linguistic knowledge that underlies a particular syntactic phenomenon in English, often referred to as the *spray / load* alternation.

2. The *spray / load* alternation as an acquisition conundrum

Despite being unaware of how they arrive at many of such judgements, native speakers display a capacity for making extremely subtle distinctions regarding the possible and impossible combinations of arguments as the verb surfaces in various syntactic environments. Consider the following sentence pairs (from Stringer, 1998: 3-4):

- (1) (a) She sprayed champagne onto her friends.
(b) She sprayed her friends with champagne.
- (2) (a) She poured champagne into a glass.
(b) *She poured a glass with champagne.
- (3) (a) She filled a glass with champagne.
(b) *She filled champagne into a glass.

The verbs *spray*, *pour* and *fill* are all usually used to describe events that involve things or substances being put into containers or onto surfaces. The moving object or substance and the surface or receptacle may be respectively distinguished by use of the terms *figure* and *ground* (Talmy, 1975, 1978). In these examples, ‘champagne’ plays the role of figure, whilst ‘her friends’ and ‘a glass’ constitute the ground.

Despite any similarity they may exhibit, it is clear from syntactic distributional evidence that the above verbs do not form a homogenous class. The verb *spray* is one of a number of verbs that participate in what is often referred to as the *spray / load* alternation. This is one form of the locative alternation, whereby either the figure or the ground can be expressed as the direct object of the verb. Verbs like *pour* must express the figure as direct object, whilst verbs like *fill* select the ground for this position. I shall refer to *spray*-type verbs as ‘alternators’, *pour*-type verbs as ‘figure-oriented’, and *fill*-type verbs as ‘ground-oriented’. As can be seen from examples (1), (2) and (3), the properties which allow *spray* to appear in both configurations are apparently absent from the examples with *pour* and *fill*. Despite the fact that (2b) and (3b) are cognitively interpretable, they are ruled out as syntactically ill-formed.

In addition to having clear-cut intuitions of syntactic acceptability, native speakers can also reliably distinguish subtle differences in meaning between different ways of

expressing the arguments of locative verbs. As shown by the (b) examples below (from Stringer, 1998: 5), when an alternating locative verb selects the container or surface as the direct object, a sense of completeness is incorporated into the meaning.

(4) (a) The builder loaded bricks onto the truck.

(b) The builder loaded the truck with bricks.

(5) (a) The farmer planted seeds in the field.

(b) The farmer planted the field with seeds.

Native speakers somehow know that (4a) and (5a) are true regardless of how full the truck or how cultivated the field, but that (4b) and (5b) imply that the truck is now full and the whole field is now cultivated. As pointed out by Anderson (1971) and Chomsky (1972), this difference in meaning renders unlikely a simple syntactic movement strategy as an explanation for the alternation. This so-called ‘holistic-partitive effect’ appears to be characteristic of all forms of the locative alternation.

Where does our knowledge of the (un)grammaticality of the syntactic alternations exemplified in examples (1)–(3) come from? As noted by Bowerman (1982, 1990) and Pinker (1989), evidence abounds that children overextend syntactic alternation rules in productive fashion to lexical items, and must learn to constrain such productivity. Errors with the locative alternation may persist until about 7 years of age. Children’s overextension of the principles governing the *spray / load* alternation can be seen in the following examples from Melissa Bowerman’s daughters, Christy (C) and Eva (E), as reported in Bowerman (1981, 1982):

(6) GROUND-ORIENTED VERBS

E – 4;1: I didn’t fill water up to drink it; I filled it up for the flowers to drink it [= filled the watering can up with water].

E – 4;5: I’m going to cover a screen over me.

(7) FIGURE-ORIENTED VERBS

E – 2;11: Pour, pour, pour. Mommy, I poured you. [Waving empty container near M. M: You poured me?] Yeah, with water.

E – 4;11: I don’t want it because I spilled it of orange juice [= spilled orange juice on her toast].

If it could be shown that children reliably receive some form of correction whenever they overextend the locative alternation, then there would be no puzzle to solve. By paying

attention to corrective feedback following utterances such as **I covered the blanket onto the bed*, or **She spat the table with orange juice*, children would be able to eliminate the inappropriate lexical entries, quickly converging on adult-like representations for location-oriented *cover* and locatum-oriented *spit*. However, the obvious point needs to be made that all children converge on the adult grammar irrespective of the differences in parental feedback, and empirical research into first language acquisition has produced convincing evidence that children do not make use of what little feedback is sometimes made available (see e.g. Brown and Hanlon, 1970; Cromer, 1987; Grimshaw and Pinker, 1989; Pinker, 1989; Marcus, 1993; Morgan, Bonamo and Travis, 1995).

If children's willingness to overextend productive rules is combined with the fact that there is no reliable, utilized source of corrective feedback, then we have the mystery at the heart of our acquisition conundrum. On having generated a grammar which is a superset of the more constrained adult grammar, what are the learning mechanisms by which children can then retreat to the appropriate subset grammar in the absence of negative evidence?

A third aspect of the problem is discussed by Pinker (1989): rules of alternation seemingly apply in arbitrary fashion to some verbs but not other apparently similar ones so that, for example, *squirt* may locativize but *spit* may not, and *load* may locativize but *dump* may not. However, the fact that children converge on the adult grammar without explicit instruction and with no negative evidence suggests that there must be principles underlying *non-arbitrary* productive rules: herein lies the solution to the acquisition problem. Something must be there in the input enabling speakers to categorize verbs in ways which either do or do not license the alternation.

3. Semantic conflation and semantic structures

Semantic structure theories involve a much more fine-grained analysis than that found in the kind of syntax-semantics linking theories pioneered by Gruber (1965), Fillmore (1968) and Jackendoff (1972), and developed in the Government and Binding tradition of theta-theory. Theta-theory posits a set of primitive 'thematic roles' (or 'theta-roles'), each of which expresses the semantic function of a syntactic argument in relation to the event or state described by the predicate, e.g. AGENT, PATIENT, GOAL. These theta-roles must necessarily be linked in some systematic way to syntactic positions such as subject, direct object and oblique object, and various schemes of canonical mapping have been proposed. However, a number of fundamental problems seem to be inherent in the idea that there is a simple hierarchy of semantic primitives; the *spray / load* alternation provides us with an illuminating example. Conventional theta-theory predicts that all verbs describing a type of event with a certain set of participants should canonically link the theta-roles to arguments in the same way. In a locative motion event, the figure should be assigned the theta-role THEME and linked to direct object, whilst the ground should be interpreted as a GOAL and linked to oblique object. As we have seen, figure-oriented verbs such as *pour* follow this 'standard' mapping, but ground-oriented verbs such as *fill* select the GOAL as direct object, and alternators such as *spray* permit both THEME and GOAL in this position. Another problem with the conventional assumption is that the postulation of a straightforward hierarchical mapping between primitive theta-roles and syntactic categories sheds no light on semantic

distinctions between alternative argument structures, such as the 'holistic / partitive effect' in the *spray / load* alternation.

Productive rule application by children casts two more doubts on standard assumptions. Firstly, children seem to acquire figure- and ground-oriented verbs at the same time and with equal ease (Bowerman, 1990; Pinker, 1989), which calls into question the conjecture that one form is canonical and the other somehow 'marked'. Secondly, when children overapply rules they invariably recover from such overgeneralizations, yet the way in which they recover from alternation errors with *fill*, whilst retaining alternation patterns with *load*, surely cannot be explained by recourse to a theory wherein theta-roles are semantic primitives: the conventional theta-roles selected by these two verbs are identical.

By couching the conundrum in terms of the lexical semantics shared by the predicates, it is possible to shed light on the acquisition problem. Many of the more interesting forays into the nature of predicates have taken the form of a search for grammatically relevant semantic components across verbs which exhibit shared syntactic behaviour, amassing evidence not only from single-language studies but from cross-linguistic surveys. The work of Talmy (e.g. 1975, 1978, 1983, 1985, 1988) has proven deeply influential. Key universal semantic components proposed by Talmy in his investigations into how human language encodes events and states in physical space include FIGURE, GROUND, PATH, LOCATION, MANNER, MOTION and CAUSE (for a selective inventory, see Talmy 1985: 127-138). Central to Talmy's work is the notion of semantic 'conflation', whereby a universal semantic primitive such as PATH is incorporated into the meaning structure of a verbal or prepositional predicate. Another complementary approach to semantic decomposition has been pursued by Levin (1993) in her detailed analysis of English verbs. Such research stems from the observation that verbs that share an identical range of legitimate syntactic environments also appear to share certain aspects of their meaning (e.g. whether the MANNER of motion is described, whether there is CONTACT between participants in the event, whether one of the participants undergoes a CHANGE-OF-STATE). As a child formulates a semantic representation of a verbal predicate, the presence or absence of one single, subtle, semantic component in relation to other such components may be enough for the child to categorize (or later *recategorize*) the verb as a member of a narrow 'conflation class', thus licensing productive application to the verb of lexical rules permitted by that class.

Correctly determining and defining semantic components is clearly crucial, but in order to formulate a theory of how children acquire complex lexical rules such as those governing the *spray / load* alternation, one must also develop a theory of how semantic components relate to one another. Pinker (1989) attempts to synthesize research into semantic conflation with Jackendoff's (1983, 1987) investigations into the combinatorial system of semantic structure to forge an image of the mental scaffolding needed to support the complex acquisition of alternation patterns. The semantic structures I assume for the purposes of this experiment correspond to those proposed in Pinker (1989: 228-239), who argues that children may create a structured semantic representation for a new verb based on observational evidence (refined by means of cross-situational evidence and attention to the associated syntactic structures in the input). The perceived meaning of the new verb plays a crucial role in determining the appropriate argument structure.

In the case of figure-oriented verbs specifying a manner of motion, such as *pour*, *push*, or *roll*, both theta-theory and semantic structure theory predict a mapping of THEME onto direct object and GOAL onto oblique object. However, in the case of ground-oriented verbs specifying a change of state without a specific manner of motion, such as *fill*, *cover* or *stain*, the predictions differ. The list-of-primitives approach predicts that as the THEME is canonically mapped onto the direct object, the required mapping of GOAL onto direct object is somehow ‘marked’; therefore acquisition of these verbs should be more problematic, resulting in initial selection of the theme as direct object. In contrast, semantic structure theory maintains that in the case of such verbs, the change of state is specified as the main EVENT in the predicate’s semantic representation, with the motion of the figure specified in a subsidiary ‘means’ structure. The linking rules are sensitive to the whole of the semantic representation, thus the ground specified in the main EVENT should be mapped canonically onto the direct object. This is in accordance with the principle of ‘object affectedness’ (Gropen et al, 1991), which states that the object perceived as principally affected by the event described by the verb will surface as the direct object.²

4. An Acquisition Experiment

An experiment was conducted with a view to (i) testing the divergent predictions of the two theoretical approaches outlined above; (ii) reaffirming the productivity inherent in lexical rules; and (iii) observing any developmental differences in sensitivity to proposed linking rules, by comparing test results from three age groups.³ In conducting this experiment, I adopted the overall methodological framework of Gropen et al (1991), with younger test subjects and several adjustments as discussed below. Novel verbs were created and presented to test subjects in the context of the events they were meant to represent.

Test Subjects. Group A consisted of 12 children aged between 2;10 and 4;11 (mean: 4;2); Group B consisted of 12 children aged between 5;3 and 6;11 (mean: 6;4); and Group C consisted of 12 adult control subjects. All children were visited at their homes, where experimental conditions were made possible with the understanding and generosity of their parents. All children performed successfully, although one or two required a break involving playful persuasion between two successive recording sessions. All subjects were tested in isolation, and all Group A and Group B sessions were recorded on tape so that the noting down of responses did not disturb or distract the children during the course of the experiment. Group C responses were more immediate, and the subjects more confident, so response types were checked off *in situ*.

² In conventional terms: either the THEME or the GOAL may be interpreted principally as a PATIENT, so that if a girl sprays champagne onto her friends (as in (1a)), she acts principally on the champagne, but if she sprays her friends with champagne (as in 1b)), she acts principally on her friends. In terms of semantic structure theory: the second argument of an ACT-function is linked to the direct object position. If an ACT-function takes a ground argument thus representing a change-of-state event, whilst the figure is represented in a ‘means’ substructure describing the subsidiary motion event, the ground will be canonically linked to the direct object.

³ The experiment reported here was the second of two experiments, the first of which contained a methodological flaw that skewed results. Both are discussed in greater detail in Stringer (1998).

Pretest. All subjects were given a pretest, in which full sentences with the figure-oriented form of *stick* and ground-oriented form of *decorate* were elicited. Subjects were introduced to the materials: a collection of colourful, shiny tropical-fish stickers and a blank page. Whilst I placed the fish onto the page, subjects were asked, 'Using the word *sticking*, can you tell me what I'm doing?' Occasional prompting was necessary, and took the form of 'sticking...' or 'sticking the...'. The target response was 'You're sticking the fish onto the page', and was often elicited first time. Other initial responses included 'You're sticking them on' (PB), 'sticking fishes on the book' (AMO) and 'sticking the fish' (DT). If a response did not include both a direct and an oblique object, the subjects were asked to repeat the target response. I then continued placing fish onto the page, and subjects were asked, 'Using the word *decorating*, can you tell me what I'm doing?' The target response was 'You're decorating the page with fish', and again was often elicited with no further ado (even the youngest Group A subject - AM (2;10) - replied in this form with no prompting). Other answers included 'decorating the book with fish stickers' (SL), 'decorating the piece of paper' (JBR), and 'decorating the whole page with the fish' (AL). Three Group A subjects initially used a figure object, thus making the *fill*-type error discussed previously (see Section 2). These responses were 'decorating fishes on' (AW), and [Prompt: *decorating...*] 'the fishes' (PH and HP). As before, when necessary, correct, complete forms were modelled and then elicited without difficulty.

Two novel verbs. The new verbs were both taught in the context of a figure being moved to a ground. The figure-oriented verb *pook* was intended to specify a manner of motion. Test subjects were shown a small plastic figure in the form of an amiable-looking, slightly dishevelled, bespectacled professor, introduced to them as 'my friend, Dr. Doodle' (several Group A subjects said 'hello'). Inside the lower part of the figure, above the plastic base, was a round magnet. Dr. Doodle acted as the AGENT, whilst the locatum took the form of a round magnetic counter (introduced as 'a wheel' to Group A). The poles of the magnets were oriented so as to repel each other (one north-side-up, one north-side-down); in this way the professor appeared to cause the counter to move without touching it. The ground was provided by a hole cut into the cardboard surface of the upturned box on which the event took place, and the target response was, 'He's pooking the counter into the hole'. The intended meaning of the novel figure-oriented verb was thus a manner of motion, and whether interpreted as something paraphraseable as 'cause to move without touching' or 'cause to move magnetically' or even 'cause to move magically' the manner of motion was intended to be the salient characteristic.

The materials used to teach the novel ground-oriented change-of-state verb included another toy character, named Charlie, and a 'magic' hat. Charlie's body was painted onto a small, upturned polystyrene cup, the narrow end of which was cut and lined with glue to accommodate the head. Charlie's head took the form of a table-tennis ball with a painted face, inside of which was an electrical circuit involving a miniature alarm system comprising a bulb, an oscillating bell and a battery. The circuit was broken, with the positive and negative terminals situated close together on the surface of the table-tennis ball (the back of Charlie's head). The terminals remained unseen by test subjects during the experiment. When the terminals were connected with a conductor (e.g. a finger), Charlie's head behaved with the characteristics of a miniature alarm, flashing red and beeping. The novel verb *zike* was coined to describe the causing of Charlie to enter such a state. The hat was made from a piece

of egg carton cut to fit the head. It was covered inside and out with a layer of aluminium foil, and then decorated with shiny stickers. The foil acted as a conductor, so that it was possible to 'zike' Charlie by placing the hat on his head, thus connecting the circuit. The target response was, 'You're ziking Charlie / his head with the hat' (compare the real change-of-state verb *cover*: You're covering his head with the hat / *You're covering the hat onto his head).

Teaching procedure. In each case, the verbs were introduced in the gerund form, so that when test subjects used them for the first time they had had no exposure to associated argument structure, excluding the possibility of syntactic cueing of verb meaning; this also ensured that the resultant argument structure was derived from productive rule application. Subjects were asked, 'Can you say *pooking*?...Say *pooking*...', after which they were told, 'Now I'm going to show you what *pooking* is'. They were then shown Dr. Doodle pooking the counter (or wheel) into the hole, with no further commentary. Gropen et al (1991) included additional descriptions, such as 'when I do this and it ends up over there, it's called...' (for the manner verb), and 'when I do this and it ends up like that, it's called...' (for the endstate verb), which they do justify (op.cit: 169, fn. 7), but one of my objectives was to reduce the number of potential cues for argument structure (whether syntactic or semantic). Subjects were then shown Dr. Doodle kicking the counter into the hole and told, 'This is not *pooking*', as an experimental means of reproducing the effect of cross-situational evidence (N.B. this does not constitute negative linguistic evidence). They were then asked, 'So now do you know what *pooking* is? Can you show me?' All 36 test subjects 'pooked' the counter into the hole (even if the younger ones had to stretch), indicating that the ground was indeed considered a participant in the event described by the predicate. After they had demonstrated the event, they were asked to practice the new word by responding to some questions, while the event was repeated. The first question was invariably 'What am I doing?'; in this way, there was no bias from the input towards a figure or a ground surfacing as the direct object. Gropen et al (1991) used this form in their pretest but not when testing the novel verbs. The following two questions corresponded to Gropen et al's (1991) figure-bias and ground-bias questions. After a pause, subjects were asked, 'Now, using the word *pooking*, and can you tell me what I'm doing with the counter?', which introduced a pragmatic bias for the figure to surface as direct object. I shall refer to this as the figure-question type. Then after another pause, they were asked, 'Now, again using the word *pooking*, can you tell me what I'm doing with the hole?', which of course introduced a pragmatic bias for the ground as direct object. This will be referred to as the ground-question type. The order of these two questions was counterbalanced across subjects, alternating for each successive test subject. When subjects replied in the bare gerund form, or if they hesitated for ten seconds or more, a prompting strategy was adopted. The first prompt was e.g., 'pooking...'; the second was 'pooking the...'; and the third was 'pooking what?'

As regards the form and order of the questions, exactly the same procedure was followed for the verb intended to specify an endstate. Test subjects were introduced to Charlie and asked if they could point out his feet and his hands, before pointing to his head. It was necessary to focus on the predicate as something to do with the head and the hat, not just Charlie and the hat, as the latter scenario may have complicated the prompting strategy. The third prompt, 'ziking what?' could be seen as a syntactic cue that the hat should be mapped onto direct object, whilst 'ziking who?' would indicate that Charlie should be the direct

object. In the actual experiment, the prompt ‘ziking what?’ was used only two or three times and could refer to either the figure or ground. As an example of something that was not *ziking*, a second hat was used. It was made from the same egg carton and took the same form as the ‘magic’ hat. It was decorated in the same way, but was painted red rather than being covered in aluminium foil, so that it could not connect the circuit. After pointing out Charlie’s head, subjects were asked to point out which of the hats they thought was magic, so as not to focus attention solely on the ground before testing. The ground-oriented verb *zike* was introduced in the same fashion as the figure-oriented *pook*. The results are shown in Table 1.

5. Results

Table 1. Experimental Results:
Response percentages indicating the selection of figure or ground as the direct object of manner and endstate verbs

Age Group:	A (2;10 – 4;11)		B (5;3 – 6;11)		C (Adult)		Mean (across groups)	
Object Argument:	FIGURE	GROUND	FIGURE	GROUND	FIGURE	GROUND	FIGURE	GROUND
Manner verb								
Open								
Question:	100	8.33*	100	0	100	0	100	2.77*
FIGURE								
Question:	100	0	100	0	100	0	100	0
GROUND								
Question:	91.66	8.33	100	0	100	0	97.22	2.77
Mean (across question types):	97.22	5.55*	100	0	100	0	99.07	1.85*
Endstate verb								
Open								
Question:	8.33	91.66	25	75	0	100	11.11	88.88
FIGURE								
Question:	8.33	91.66	25	75	0	100	11.11	88.88
GROUND								
question:	0	100	16.66	83.33	0	100	5.55	94.44
Mean (across question types):	5.55	97.22	22.22	77.77	0	100	9.25	91.66

*Figures marked by an asterisk are those which when combined with the locatum figures do not add up to 100%. This is due to certain dual responses in which both the figure and the ground surfaced as direct objects (e.g. PH, as discussed above). Both forms of response were included in the calculations.

The results for the figure-oriented ‘manner’ verb bear out the predictions of both theories, as expected. The figure surfaced as direct object in 100% of responses to all three question types by Groups B and C. Group A had an almost identical response pattern, with

figure responses to the open question reaching 100%, to the figure question also reaching 100%, and to the ground question reaching 91.66%. Two Group A subjects selected the ground as direct object in one out of three responses. SL did so in response to a ground question, perhaps indicating pragmatic bias: [Ground Question: ‘...can you tell me what he’s doing with the hole? Prompt: pooking...] ‘pooking the hole’ (SL). PH responded in confused fashion to the first, open question: [Third prompt: pooking what?] ‘the hole and the wheel’ (PH). However, he selected the figure as direct object in his next two responses, despite the ground bias in the final question ([Figure Question: ...can you tell me what he’s doing with the wheel?] ‘He’s pooking it in the hole’ (PH); [Ground Question: ...can you tell me what he’s doing with the hole?] ‘He’s pooking the wheel into it’ (PH)). The ground question did make some subjects hesitate, but as noted the selection of figure as direct object proved resilient.

In using the novel verb *zike*, test subjects appeared to have little difficulty mapping the ground onto the direct object. Of Group A subjects, only two mapped the figure onto the direct object, and each did so in only one out of three responses (AL after the open question: ‘You’re ziking the hat onto him’; and HP after the location question: ‘You’re ziking it on his head’). The overwhelming preference in Group A was to interpret the verb as a non-alternating change-of-state predicate, hence the selection of the ground as direct object in 91.66% of responses to both open and figure questions, and in 100% of responses to ground questions. Typical responses include: ‘You’re ziking the head’ (KM); and ‘You’re ziking Charlie’ (DM). Group B responses were slightly less uniform, but the ground still surfaced as direct object in 75% of responses to open and figure questions and in 83.33% of responses to ground questions. Two subjects (JBR and JW) consistently encoded the verb as figure-oriented in all three responses, thus possibly categorizing the verb as a non-alternating figure-oriented verb. A third subject (AMO) responded in similar fashion to the open and figure questions, but perhaps responded to pragmatic bias following the ground question: ‘ziking it...you’re ziking the head’ (AMO). The performance of these three Group B subjects may well reflect the purported bias of this age group to attend to figures and manners of motion, rather than grounds and endstates, as observed by Gentner (1978), Bowerman (1981, 1982, 1990) and Gropen et al (1991). The adult control group performed as predicted, selecting the ground as direct object in 100% of responses to all question types.

The mean response preferences of Groups A, B and C for the ground as direct object following the endstate verb across question types were 97.22%, 77.77%, and 100% respectively, indicating a presumably canonical mapping of the ground (which plays the conventional theta-role GOAL) onto the direct object.

6. Conclusions

The findings reported here corroborate the conclusions drawn by Gropen et al (1991), and the percentages indicating response preferences are just as clear-cut. Both the 4-to-5-year-olds and the adults in Gropen et al’s (1991) Experiment 2 expressed the location as direct object 100% of the time (across all question types), and both the 3-to-4-year-olds and 6-to-8-year-olds showed a strong predilection for the same mapping pattern (respectively selecting mean averages of 78% and 84% ground-objects). These results and their replication

in my own experiment with younger test subjects lend weight to the following theoretical assertions. Firstly, as children canonically map ground to direct object when using change-of state verbs, theta-roles are not semantic primitives mapped onto syntactic arguments according to their priority in a hierarchically-arranged list. Secondly, the predictions of Pinker's (1989) semantic structure theory are borne out. Whilst the ground does play the conventional role of GOAL in an event described by a ground-oriented verb, this role falls out of its position in an 'effect' substructure containing a locational EVENT; its projection into syntax is determined by its interpretation as a PATIENT, which falls out of its position as the second THING in the main EVENT structure containing the ACT function. In other words, if a verb describes a change of state, the AGENT 'acts' primarily on the thing that changes state. Thirdly, observational evidence can in principle be sufficient to allow children acquiring their first language to classify new verbs in semantic conflation classes, membership of which determines what constitutes an appropriate syntactic argument structure for a particular verb. This is not to say that verb meanings cannot be refined by children's attention to the syntax associated with the verb in the input, but it does mean that observation-driven lexical semantic representations are in principle sufficient to determine predicate argument structure.

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