Young children's use of unaccusative intransitives in novel verb experiments

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1. Introduction

According to the usage-based approaches, language develops in relation to the communicative contexts in which it unfolds. Usage-based theorists start from the assumption that children experience language as part of social interactions and that constructions are the basic units of language. This means that children learn language in the form of sentence level constructions embedded in communicative contexts, not as separate words or as abstract grammatical rules (see Budwig, 1995; Tomasello, 2003). Constructions are collections of meaning that designate basic patterns of experience. For example, Goldberg (1998) illustrates that the meaning of the verb "sneeze" differs in the following two constructions:

a) She sneezed.
b) She sneezed the tissue off the table.

In sentence a), the SV ergative intransitive construction, the meaning of the verb *sneeze* focuses on the nature of the action (sneezing), while in sentence b), the SVO transitive construction gives additional causal meaning to the verb *sneeze*: that someone is causing something to move. The general overall form and meaning of a sentence is not simply determined by the meaning of the main verb plus the meaning of the arguments, but rather meaning is added by the verb argument constructions, which designate a basic pattern of experience (Goldberg, 1998).

Most usage-based theorists propose that early on, children learn constructions on an item by item basis, so that children's syntactic understanding starts in a lexically specific manner and gradually congeals into abstract and systematic rules. Language development is considered a gradual, piecemeal process and linguistic input plays a crucial role. For example, focusing on the way children learn to use new verbs, Tomasello (2003) proposes that the majority of children before the age of 3 can only produce a verb in a sentence frame in which they have heard it before. If young children have only heard "the door opens" and no other constructions with this verb, they cannot go on to produce "I open the door" before the age of 3. As children's vocabulary size increases, the type frequency of construction usage increases as well, and overgeneralization errors, such as "*I disappeared my orange juice,*" emerge, indicating productivity of a transitive schema. Younger children tend to be conservative and use new verbs by repeating the constructions in which they have heard these verbs. Researchers have suggested that only after 3 years of age can children generalize new verbs to syntactic constructions in which they have not heard the verbs modeled. Young children's approach to language seems to shift from a concrete, item-based one to an abstract, rule-based one between the ages 2 and 4 as a result of the increase in their vocabulary and the type frequency of construction use (e.g., Tomasello, 2000; 2003).

Input influences the way such transitions happen, and children's communicative needs and cognitive capacity may make some construction schemas more readily

available and generalizable than others. There are some indications that children are more likely to make transitive overgeneralization errors when using intransitive verbs such as disappear, rather than make intransitive overgeneralization errors using transitive verbs such as *remove* (e.g., *It's removing*.). An experiment in which children were primed to use familiar and unfamiliar English verbs of fixed transitivity indicates a steady decrease in intransitive overgeneralization errors, while transitive overgeneralization persisted up to age 8 (Brooks, Tomasello, Dodson, & Lewis, 1999). Children also seem to have particular difficulties assimilating unaccusative intransitive construction schemas into newly learned verbs, whereas they are more prepared to assimilate transitive or passive constructions (Brooks & Tomasello, 1999). English speakers' preference to use canonical SVO transitive constructions over SV intransitive constructions in child directed speech (Cameron-Faulkner, Lieven, & Tomasello, 2003) may contribute to the paucity of intransitive overgeneralization by children, as well as their difficulties with assimilating unaccusative intransitive constructions.

It has also been suggested that for English speakers, canonical SVO transitive constructions may place fewer cognitive demands than SV unaccusative intransitive constructions despite containing more arguments. Unlike ergative intransitive constructions such as "*I sneezed*" or SVO transitive constructions such as "*I opened the door*," unaccusative intransitive constructions such as "*the door opened*" do not have an actor or an agent in subject position. Instead, the object or the theme of canonical SVO transitive constructions (e.g., the door) is in subject position. Unaccusative intransitive constructions in English demand additional cognitive processing because of this switching of an actor/agent with the theme/object in subject position (c.f., Bastiaanse & van Zonneveld, 2005).

The transition from concrete to abstract seems to be a flexible, gradual, and piecemeal process, and children may take a variety of paths to acquire different construction schemas. Young children often seem to be working with something in between an item-based verb-by-verb strategy and abstract rule level. From early on, children actively organize what they hear into something systematic, which may not necessarily go along with the rules adults follow (Budwig, 1995; Budwig, Stein, & O'Brien, 2001). Based on a developmental functionalist approach, it has been suggested that children are constantly constructing meaning clusters that are interim solutions en route to more adult like constructions wherein they link forms with functions that meet their specific communicative needs (Budwig et al., 2001; Budwig, Narasimhan, & Srivastava, in press). For example, children used a canonical SVO transitive construction to talk about self as an agent that brings about a causal change, whereas SV unaccusative intransitive constructions were used to report instances of goal blocking as in 'the door won't open' (Budwig et al., 2001; Budwig et al., in press). The nature of these solutions by children is influenced by the specific properties of the input language, such as verb morphology and argument frames.

There are two major methodological approaches to substantiate claims made by the developmental functionalists. Naturalistic observation has suggested that much of English-speaking children's early speech (e.g., Clark, 1974; Tomasello, 1992), as well as their caretakers' child directed speech (Cameron-Faulkner et al., 2003), can be analyzed in terms of specific linguistic items and phrases with open slots. A number of factors, including the type and token frequencies of the construction together with its functional

salience for the child, seem to influence the extent to which constructions are acquired and free of lexical specificity (Lieven, Behrens, Speares, & Tomasello, 2003).

While naturalistic observation provides some information about the way children acquire language, it does not clarify whether their limited use of language indicates lack of underlying abstract structure. Experiments that control the amount and the form of input with specific lexical items and then test for the capacity to generalize and modify grammatical structure have demonstrated that the abstract structures that are free from lexical specificity develop around the age of 3 (e.g., Abbot-Smith, Lieven, & Tomasello, 2001; Tomasello, Akhtar, Dodson, & Rekau, 1997).

A recent novel verb experiment sheds light on the way input plays an important role in young children's productivities in novel verb usage. When trained to use a verb in alternating transitivity—for example, to use a bi-transitive verb in SVO transitive and SV unaccusative intransitive construction, such as in "I open the door" and "the door opens"—children as young as 2.5 years of age, much like 3-year-olds, were able to use a novel verb in a creative manner (Abbot-Smith, Lieven, & Tomasello, 2004). An exposure to a verb in alternating transitivity seems to strengthen the initially fragile transitive schema in young children at 2;6.

Naturalistic observation is valuable when exploring the way children and their caretakers use verbs in daily conversation, whereas the advantage of an experimental study over naturalistic observation is that the experimenter can control the amount and forms of the input. However, the input given in experimental conditions is unlikely to reflect the way children are exposed to a new verb in their daily life, and it is also the case that some children are resistant to using the verbs that are primed in experimental settings (Brooks et al., 1999). Given the limitations and the advantages of both approaches, there has been an attempt to modify current experimental procedure to reflect some aspects of naturalistic language use (Smith, 2006; Smith & Budwig, 2005).

In the current study, we investigated the nature of the relationship between input and the way children learn to use new verbs, particularly focusing on the relationship between children's capacity to generalize unaccusative intransitive constructions and input frequencies. One of the main purposes of the present study is to see how children learn a new verb in an experimental procedure, which simulates everyday social interactions where young children learn new verbs. The study makes use of a novel verb paradigm with some modifications to reflect aspects of naturalistic observations. Smith and Budwig (2005) designed a novel verb experiment, which involved the child, his/her caretaker, and the researcher. In their experiment, adults modeled novel verbs in SVO transitive constructions, and all the participants took turns to perform the novel verb actions. Recent experiments make use of toy objects to enact the novel verb action in order to remove contextual cues (i.e., an animate agent is acting upon an inanimate object) and place demands on children to describe these objects. However, in spontaneous speech, young children are more likely to talk about their own actions rather than describing what is happening with others (e.g., Bartsch & Wellman, 1995). It is also the case with most of the recent novel verb experiments that non-SVO constructions (e.g., passive or intransitive constructions) are provided as models in order to examine children's ability to grasp the SVO transitive constructions. However, naturalistic observation informs us that children hear more SVO transitive constructions than SV intransitive constructions (Cameron-Faulkner et al., 2003).

The current study adds a standardized measure of children's ability for receptive vocabulary and draws on Smith and Budwig (2005) with some further modifications that allow us to investigate how caregivers introduce a novel verb to their children. In this study, caregivers are allowed to use novel verbs at their own discretion, so that there is a considerable variation in the amount and the forms of caregivers' novel verb usage. Using the novel verb paradigm with these modifications allow us to ascertain that children have never heard the new verbs introduced and to observe what the caretakers do when introducing a new verb to their children. Although a past finding seems to indicate that it is more difficult for children to generalize unaccusative intransitive constructions than transitive constructions (Brooks & Tomasello, 1999), simulating everyday social interactions may increase the level of engagement on the children's part and their productivity to reflect their full linguistic capacity.

The present study explores the influence of adults' input on children's productivity with novel verbs. In particular, it addresses following questions:

1. In which constructions do children and adults use novel verbs?
2. Are there any characteristics that distinguish children who produce creative SV unaccusative intransitive constructions from those who don't?
3. How much input do children need to produce a novel verb?
4. Do children use novel verbs spontaneously or in response to elicitation questions?

2. Method

2.1. Participants

A total of 13 children with a mean age of 3;0 (range 2;6-3;6) and their caretakers participated in the study. The children were all monolingual American English speakers, and there were 6 girls and 7 boys. All but one caretaker was the child's mother; one father participated. The participants were recruited through day care centers and informal play groups in a mid-size industrial city in New England. An additional 3 children participated but were excluded from analysis due to equipment failure and procedural mistakes.

2.2. Materials

A measure of receptive vocabulary, the Peabody Picture Vocabulary Test (third edition, PPVT-3) (Dunn & Dunn, 1997) was administered to children. The PPVT correlates highly with full-scale verbal intelligence measures such as the Wechsler Preschool and Primary Scales of Intelligence (revised, WPPSI-R) (Carvajal, Parks, Logan, & Page, 1992) and the verbal subscale of the Stanford–Binet IV (Hodapp, 1993). The experimenter states a word and children select the picture that best illustrates it out of four choices. Testing continues until children miss 8 out of a set of 12 words.

The participants played four novel verb games (*ping, lem, dax, gav*). To *ping*, they used a magnet to move small metal objects, such as nails or paper clips, in a plastic container. To *lem*, they used an aspirator to move light objects, such as feather and tissue paper, by blowing air on these items. To *dax*, they tapped on precolored figures with a

color changing marker. And to *gav*, they poured colored baking soda in vinegar to cause a fizzing reaction.

2.3. Procedure

The participants took part in two 45-minute sessions over a one-week period. The sessions began with approximately 20 minutes of free play involving the child and the caretaker. The experimental sessions took approximately 25 minutes. The PPVT-3 was administered at the end of the first session. One child took the PPVT at the end of the second session.

At the beginning of the first experimental session, the researcher introduced a sock puppet as a curious monster and children were told to be ready to tell the puppet what was going on while they played games. The guidelines for the adult input followed prior studies (e.g., Abbot-Smith et al., 2004; Brooks & Tomasello, 1999) with variation in tense morpheme and the use of pronoun/noun phrase in subject and object position. The researcher modeled the novel verbs in SVO transitive constructions, as in "Look, I am going to *ping* the nails," and in questions, as in "Can you *ping* them?" The caregivers were given a total of four index cards—one card for each verb—and they were invited to use the novel verbs to make a request and to describe what the child did in SVO transitive constructions. For example, they read: "*Now it's [child's name]'s turn. Can you PING these? You are PINGING them. [Child's name] can PING the nails.*" After they read the card, they were left to use the novel verbs as they wished while engaging with their children.

In a given session, each novel verb was enacted eight times, and the researcher ensured to provide a minimum of 18 models per verb. Two of the eight enactments were accompanied by elicitation attempts. During the fifth and eighth enactments, the puppet asked the child a set of questions. The first question was always a neutral question, such as "*What's going on?*" Then, a patient-focused question such as "*What's happening to the nails?*" was asked to bring the child's attention to the object or the theme. And finally, an agent- focused question such as "*What are you doing?*" was asked so that children had a chance to use the SVO transitive constructions, such as "*I'm PINGING the nails.*"

2.4. Coding

All uses of novel verbs by the adults and the children were transcribed and coded for frequency and construction type, following prior studies (e.g., Cameron-Faulkner et al. 2003; Tomasello, 2003). The current analysis combined the novel verb use of the caretaker and the researcher because it investigates the relationship between the child's productivity and the amount and variety of the input for a particular novel verb. Construction types are coded as: SVO transitive (e.g., I'm *pinging* them), SV ergative intransitive (e.g., I'm *pinging*), SV unaccusative intransitive (e.g., the nails are *pinging*), questions (e.g., can you *ping* them?), other (e.g., this one is to *ping*), and fragment (e.g., *pinging*).

When a child produced novel verbs, each verb type (e.g., *ping, lem, dax, gav*) produced by that child was coded to isolate the presence of SV unaccusative intransitive construction. For example, if a child produced *ping* in SVO transitive constructions, fragments and SV ergative intransitive constructions (e.g., "*I'm pinging them,*"

"pinging," and *"I'm pinging"),* that verb type was coded as being in the presence of "any other constructions" while another verb, *lem*, was coded as being in the presence of "SV unaccusative intransitive" because the child produced *lem* in SVO transitive constructions and SV unaccusative intransitive constructions (e.g., *"I'm lemming it*," and *"It lems!")*

Each novel verb use by children was coded for elicitation attempts. Every time a child used a novel verb, the adults' utterance immediately prior to the child's novel verb use was coded. When adults said nothing immediately before the child's novel verb use, the child's novel verb use was coded as "spontaneous usage." When a yes or no question by the adult, such as "are you *pinging* them?" preceded the child's novel verb use, it was coded as "yes or no question." When an agent-focused question, such as "What are you doing?" preceded the child's use, it was coded as "agent-focused question." The child's use preceded by a question such as "What is happening to the nails?" was coded as "patient-focused question," and the one preceded by a question such as "what's going on?" was coded as "neutral question." "Other" included unrelated utterances and encouragement such as "tell me" when the child stayed silent after being questioned.

3 Results

Analysis of the children's and adults' novel verb usage revealed that adults produced an average of 67 tokens for each verb type (range = 32-140) and the child produced an average of 5 tokens (range = 0-23) in a given triad consisting of the child, the caretaker, and the researcher. PPVT scores indicated that receptive vocabulary abilities of all children fell within normal range (mean standard score = 104.3, SD = 11.0). Twelve of 13 children (92%) produced at least two novel verb types in any construction, including fragments. Six (46%) produced at least one SV unaccusative intransitive construction, even though it was not modeled. All four novel verb types were produced in SV unaccusative constructions by at least one child. There was a great deal of individual variation in novel verb usage with regard to both frequency and construction types. No significant correlation was found between children's novel verb production (in terms of frequency or number of construction types by the child) and age or the PPVT score.

Overall, adults did not deviate from the experimental protocol and mostly used questions and SVO transitive constructions, while children produced novel verbs in various constructions, including fragments and SV unaccusative intransitive constructions, that were not modeled by the adults.

Table 1 shows a comparison between children who produced at least one SV unaccusative intransitive construction and those who did not. An independent t-test indicated that children who produced at least one SV unaccusative construction used novel verbs more frequently than those who did not (mean difference = 17.3, t = 2.3, p < .05). There was no significant difference in the number of novel verb construction types they produced, their age, the PPVT score, and mean amount of input prior to their first novel verb use in any construction (including fragment).

Table 1: Comparison between children who produced SV unaccusative intransitive constructions and those who did not

	Children who produced SV unaccusative (n = 6)	Children who did not produce SV unaccusative (n = 7)
	Mean ± SD	Mean ± SD
Novel verb tokens	36.3 ± 30.2	9.6 ± 6.6 *
# of novel verb construction types	3.7 ± 0.5	2.6 ± 1.3
Age	36.7 ± 5.0	35.6 ± 5.5
PPVT	100.3 ± 10.6	107.7 ± 10.8
Input prior to the first use	22.6 ± 21.9	31.5 ± 24.4 †

* Mean difference significant at p = .05.

† One child who produced no novel verb was excluded (n = 6).

Table 2 shows the amount of adults' novel verb use prior to the child's first novel verb use in any construction for each verb type that the child produced. An average of 27 tokens was produced by adults prior to their child's first novel verb use. There were a total of 52 verb types (4 verb types times 13 children), 11 of which were never produced by the children and were excluded from the table. Of the remaining 41 verbs that children produced, 9 were produced in SV unaccusative intransitive constructions at least once and 32 were produced only in other constructions, such as fragments and SVO transitive constructions. An independent t-test indicates a significant difference in the number of verb tokens produced by adults prior to the child's first use between the verbs that were produced in unaccusative intransitive constructions and the verbs that were not (mean difference = 17.3, t = 3.3, p = .002). This implies that if a novel verb was produced in a SV unaccusative intransitive construction, children needed to hear fewer novel verb tokens by adults prior to their very first novel verb use in any construction, compared to the verbs that were not produced in SV unaccusative intransitive construction.

Table 2: Amount of adults' novel verb tokens prior to the child's first novel verb usage in any constructions

Number of verb types produced by children in presence of		Number of verb tokens produced by the adults prior to the child's first novel verb use	
		Mean	Range
SV unaccusative intransitive	9	13.2	2-25
Any other constructions	32	30.5	2-79
Total	41	26.7	2-79

Figure 1 shows the children's response to elicitation questions. In general, more than 40% of the children's novel verb use was spontaneous. As shown in the Figure 1, the children responded to patient-focused questions more frequently, when they produced novel verbs in SV unaccusative intransitive constructions. Twenty-seven percent of the novel verb usage in SV unaccusative intransitive constructions, as opposed to 17 % in any other constructions, was in response to patient-focused questions.

Figure 1: Children's response to elicitation attempts
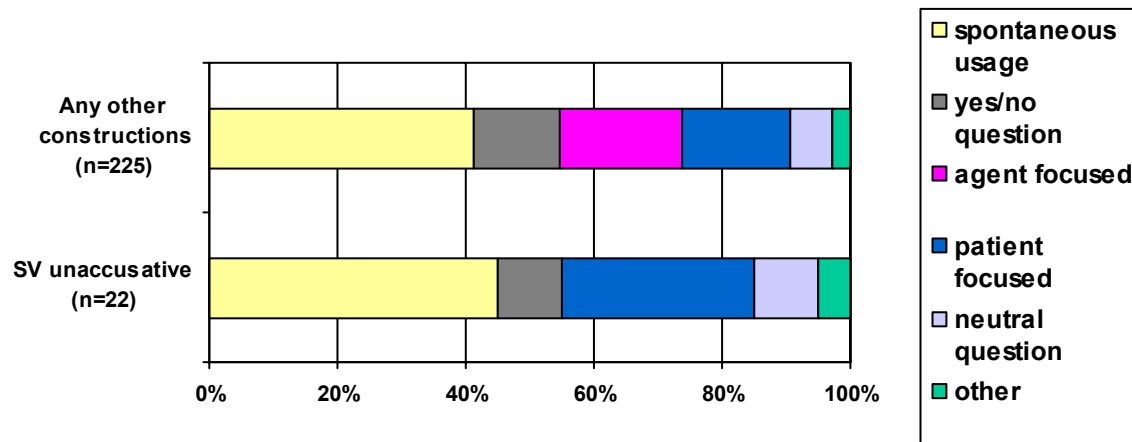
4 Discussion

The current results indicate that most of the children (92%) between the ages of 2;6 and 3;6 produced at least one novel verb, and half of these children produced a creative intransitive construction with a novel verb at least once. Children who produced unaccusative intransitive constructions also produced more novel verb tokens compared to those who didn't. Children needed to hear fewer models prior to their very first novel verb use when that novel verb was produced in at least one SV unaccusative intransitive construction. The current study also supports past findings suggesting that children are sensitive to the discourse demands and more likely to respond to patient-focused questions with unaccusative intransitive constructions (e.g., Brooks & Tomasello, 1999). Surprisingly, the current findings revealed no significant difference between children who produced creative intransitive utterances and children who did not in their age, receptive vocabulary, or the amount of input prior to the first novel verb use.

Tomasello's verb island hypothesis suggests that children are better able to assimilate a novel verb to construction schemas when they are older and have more vocabulary (Tomasello, 2000; 2003), so it would make sense for children who produced creative SV unaccusative construction to be older and score higher on vocabulary measures. However, the PPVT measures receptive vocabulary and includes nouns and adjectives. Children's construction schemas may be exclusively related to how many verbs children can produce, instead of the general knowledge of to what it is the words refer. The current results suggest that children are better able to assimilate a novel verb to a SV unaccusative construction schema when they are more productive with novel verbs in general (particularly in terms of token frequency).

Although current findings did not reveal an age effect on children's ability to generalize SV unaccusative construction schemas, past findings indicate that older children are more likely to have a verb-general transitive construction schema, which they can apply to a newly learned verbs (Abbot-Smith et al., 2004; Brooks & Tomasello, 1999). The age effect seems to be clearer with transitive schemas than with passive or intransitive constructions, into which children have more difficulties assimilating newly learned verbs (Brooks & Tomasello, 1999). Given a steady decrease in intransitive overgeneralization errors in contrast to transitive overgeneralization errors, which persist

up to age 8 (Brooks et al., 1999), it is possible that there is a different developmental trajectory for the acquisition of transitive and intransitive construction schemas.

Connectionist accounts of word meaning suggest that the meanings of words are not stored as separate entities but are computed afresh taking into account the contexts in which they appear (MacDonald, Pearlmutter, & Seidenberg, 1994). Processing unaccusative intransitive utterances may require a system that is distinct from what is called for in processing transitive utterances and may even be associated with a specific brain part, Broca's area (Bastiaanse & van Zonneveld, 2005). Paucity of unaccusative intransitive constructions in child-directed speech (c.f. Cameron-Faulkner et al., 2003) may contribute to a possibly different trajectory for acquisition of unaccusative intransitive constructions, which coincides with specific brain development and is reflected in distinct patterns of developmental change in the overgeneralization errors.

While the current results do not reveal any effects of age and receptive vocabulary, they suggest that input frequency may play a crucial role in children's ability to generalize the unaccusative intransitive construction schema. Sensitivity to input frequency seems to persist through adulthood. Adults' on-line syntactic decision making is sensitive to the input frequency with which a particular verb occurs in particular constructions that persist through adulthood (MacDonald et al., 1994). The current results confirm the entrenchment hypothesis and the past finding that even 3-year-olds are sensitive to the entrenchment effect; children are more inclined to overgeneralize unfamiliar verbs compared to familiar ones (Brooks et al., 1999). The longer children wait to use a particular novel verb in the experiment, the more familiar they are with that verb in SVO transitive constructions (and questions). Thus, the less inclined they are to use that verb in SV unaccusative constructions that are absent in the adult input. Children who produced unaccusative intransitive constructions were not necessarily quick to learn a novel verb in general compared to those who didn't. With some verbs, they never produced SV unaccusative because they hadn't ventured to produce these verbs before these verb usages had become entrenched in canonical SVO transitive constructions.

Children's communicative needs and internal motivation to use novel verbs seem to play another crucial role. For example, one 3;6 year old girl exclaimed, "Mine *gaved*, too!" while the experimenter was saying, "Look, I'm *gaving* the powder." When children were eager to use the verb in the experiment, they spoke even before they were prompted to describe the event. Given that children already have accumulated enough input to acquire construction schemas, children's urge to use a new verb as soon as they learned it seems to encourage children to freely assimilate the new verb into their construction schemas before they accumulate enough models and evidence for fixed transitivity. There may be a threshold for the amount of input, which then determines young children's judgment of the transitivity of a given verb.

Children must have heard a certain amount of verb use in adults' input so that they acquire construction schemas and are then able to quickly produce the newly learned verb in order to assimilate it to construction schemas. In this study of 2;6 to 3;6 year old children, the ability to generalize unaccusative intransitive construction schemas appeared to be related more to their productive ability rather than to their chronological age or receptive vocabulary.

Novel verb experiments have focused on the use of transitive and passive constructions, and more research is needed to explore the way children acquire

unaccusative intransitive schemas. Investigation into children's communicative needs and functions of their utterances is needed to clarify what motivates them to use unaccusative intransitive constructions in novel verb experiments.

5 Acknowledgements

6 References

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