Nativist Accounts of Verb Argument Acquisition Reevaluated

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1. Introduction

Various proposals have been made to account for the acquisition of Verb Argument Structure (VAS). These include **Input-based accounts** of various orientations like Bowerman (1973, 1982), Braine & Brooks (1995), Clark (1993), Ingram & Thompson (1996), Schlesinger (1988), and Tomasello (1992), on the one hand, and **Nativist accounts** like Grimshaw (1981, 1990) and Gleitman (1990), on the other hand.

One of the most elaborate Nativist accounts is Pinker's (1984, 1989) semantic bootstrapping account. According to Pinker, early acquisition of verb-argument structure is regulated by a "canonical mapping" scheme; that is, a default mapping between thematic roles and syntactic functions such that most AGENT roles are initially assigned to the Subject, most THEME/PATIENT roles to the Direct Object, and most LOCATION/GOAL/SOURCE roles to the Oblique Object, as shown in Figure 1 below.

AGENT	THEME/PATIENT	LOCATION/GOAL/SOURCE
SUBJECT	DIRECT OBJECT	OBLIQUE OBJECT

Figure 1: Pinker's Canonical Mapping Scheme

In this account, children are assumed to apply the "canonical mapping scheme" to new predicate-argument sequences as follows. Children first check whether the predicate they analyze has an AGENT argument (the first role on the thematic hierarchy). If it does, this role is assigned to the first function on the syntactic hierarchy – Subject. If not, children look for the next available role on the thematic hierarchy and assign it to Subject. Once "Subject" is linked, children move along the thematic hierarchy to the next role associated with the predicate and assign it to the next available syntactic function. The proposed mapping scheme is assumed be universal, and to reflect properties of children's innate capacity for language acquisition.

Against this background, one of the major predictions of Nativist accounts is that children will learn the syntactic treatment of prototypical AGENT-PATIENT verbs, i.e., verbs that adhere to the canonical mapping scheme, earlier and faster than non-prototypical verbs.

The present paper uses evidence from child Hebrew to re-evaluate Nativist accounts of VAS acquisition. Specifically, I argue that a canonical mapping scheme of the sort proposed by Pinker may not, in fact, facilitate VAS

acquisition, and moreover, that even when children show evidence for applying this sort of mapping mechanism, it does not suffice to acquire VAS in Hebrew.

2. Method

2.1 Subjects and Database

To test my claims, I used naturalistic longitudinal data collected on a bi-weekly basis from two Hebrew-speaking girls, Smadar and Lior, between ages 1;5 – 2;9. Recording intervals were sufficiently short not to miss significant developmental changes in the girls' language yet extended enough to allow such changes to take place. These data were collected as part of the Crosslinguistic Language Acquisition Project conducted by Berman and Weissenborn (1991).

The two girls were audio-recorded at home during interactions with their parents and siblings. Each recording was approximately one hour long, and covered a variety of situations. The girls were recorded by their mothers, who were graduate students of linguistics at Tel Aviv University during the period of data collection. Information concerning the girls and analyzed data is summarized in Table 1.

Table 1 Subjects and Database

Child's Name	Age Range	MLU Range	Number of Transcripts	Mean No. of Utterances per Transcript
Lior	1;5-2;9	1-3.5	32	168
Smadar[1]	1;6-2;4	1.5-4.5	15	230

The girls' linguistic age was calculated using Mean Length of Utterance (MLU). A Table showing the age – MLU correspondences for each one of the girls is provided in Appendix I. During the study period, their MLU values increased from 1 to 4.5, marking a transition from the single word stage to multiple word combinations.

2.2 Coding and Analysis

The data were coded and analyzed using CHILDES (MacWhinney 1995) with adaptations to Hebrew. A total of 8743 utterances were analyzed (Smadar, N = 3367; Lior, N = 5376). These included all utterances that contained a lexical verb. Excluded were copular, existential and possessive constructions, and unclear verb forms.

All overt arguments were coded for their thematic roles, based on thematic categories proposed by Bowerman (1996), Cowper (1992), Dowty (1991), Jackendoff (1972), Radford (1997), and Van Valin (1990). In line with

1. For Smadar, the girl with the most precocious language development of the two, recordings were cut short for extrinsic reasons before age 3.

Bowerman (1990), the following verbs were included in the 'prototypical AGENT-PATIENT' category: (1) Verbs expressing the causation by an agent of a change-of-state or location, e.g., *open, close, break, fix, put away, throw away, pick up*; and (2) kinetic verbs expressing events in which the AGENT acts on the PATIENT in a physically obvious way, e.g., *push, wash, bite, eat, tickle, spank, get (=take).* Consistent occurrence of self-initiated, correctly ordered arguments served as a measure of proper mapping of syntactic functions to thematic roles.

3. Findings

Several kinds of evidence are used to argue against an *a priori* canonical mapping mechanism. The first kind shows that canonical mapping leads to incorrect predictions (section 3.1). The second kind shows that canonical mapping is insufficient to account for acquisition of VAS in Hebrew, and relates to overextension errors (section 3.2). The third kind shows that VAS acquisition is initially affected by parental input, and proceeds on the basis of experience with individual verbs, as suggested by the order of argument acquisition in three-argument verbs (section 3.3).

3.1 Canonical Mapping Leads to Incorrect Predictions

This section includes evidence relating to the distribution of thematic roles across overt subjects (3.1.1), to the order of occurrence of prototypical and non-prototypical AGENT-PATIENT verbs (3.1.2), and to default mapping errors (3.1.3).

3.1.1 Distribution of Thematic Roles Across Subjects

The canonical mapping scheme assumes a default paring between AGENT and Subject. As a result, verbs with AGENT subjects are expected to be acquired earlier than verbs with non-AGENT subjects. To test this hypothesis, I examined the distribution of AGENT versus non-AGENT subjects across all overt subjects (Smadar, N = 257; Lior, N = 600) in the early word-combinations of the two girls (MLU 1.5 – 2.5), as shown in Figure 2.

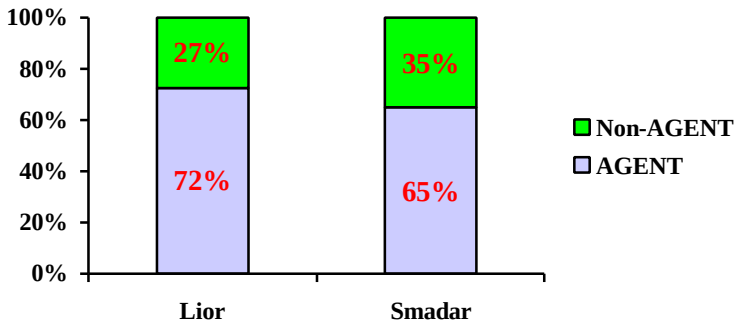

Figure 2 Distribution of Agent versus Non-Agent Subjects

Figure 2 reveals that about a third of the girls' early utterances contain a non-AGENT overt subject.

Examples of early utterances with non-AGENT subjects are given in (1).[2]

(1) a. *moceci* ***nafal***
pacifier fall-3SG-MS-PT
'(The) pacifier fell down'

b. *ze* ***nishpax***
it spill-3SG-MS-PT
'it spilt-INTR'

c. *ha-buba* ***roca*** *moceci*
the doll want-SG-FM-PR pacifier-DIM
'The doll wants a pacifier'

d. *ha-pil* ***xole***
the elephant sick-SG-MS-PR
'The elephant is sick'

The examples reveal that non-AGENT subjects occurred in the girls' data with unaccusative, change-of-state verbs like *nafal* 'fell down' and *nishpax* 'spilt', which take PATIENT subjects, and with stative verbs like *roca* 'want', and *xole* 'sick', which take EXPERIENCER subjects.

Consider next, the distribution of AGENT subjects by transitivity in the girls' data (Smadar, N = 167; Lior, N = 444) between MLU 1.5 – 2.5, as shown in Figure 3.

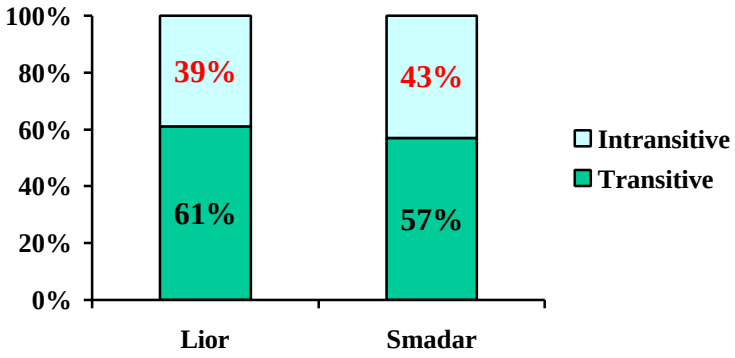

Figure 3 Distribution of Agent Subjects by Transitivity

2. In these examples, and throughout the text, arguments are underlined and verbs written in bold face.

Figure 3 reveals that about 40% of the utterances that contain an AGENT subject are intransitive. These consist mainly of motion verbs (e.g., *higia* 'arrived', *yavo* 'will come', *halax* 'went', *omed* 'stands'), as illustrated by the examples in (2).

(2) a. *Abale* ***higia***
Daddy arrive-3SG-MS-PT
'Daddy arrived'

b. *Yotam* ***yavo***
Yotam come-3SG-MS-FUT
'Yotam will come'

c. *Gaga* ***halax***
Gaga go-3SG-MS-PT
'Gaga went (away)'

d. *Kushi* ***omed*** *kaxa*
Kushi stand-SG-MS-PR thus
'Kushi (a puppet) stands like this'

According to Pinker's mapping scheme, subjects are initially mapped onto the AGENT role. However, the data presented above reveal that: (1) Hebrew-speaking children use verbs with non-AGENT subjects successfully, despite an apparent violation of the canonical mapping scheme. (2) Verbs with AGENT subjects seem to belong to particular semantic groups (e.g., motion verbs), which may themselves trigger acquisition of particular verb argument structures, rather than canonical mapping.

3.1.2 Prototypical versus Non-Prototypical AGENT-PATIENT Verbs

Consider next, the girls' use of transitive verbs with AGENT subjects. On the assumption that children are helped by an innate canonical mapping scheme, prototypical AGENT-PATIENT verbs should be acquired **earlier** than non-prototypical verbs, i.e., verbs with THEME, or LOCATION/SOURCE/GOAL subjects, transitive stative verbs, or verbs denoting events in which the AGENT is static (Bowerman 1990). The reason is that for prototypical AGENT-PATIENT verbs there is a match between the input about the syntax of the verb's arguments and the child's innate linking rules. This hypothesis was tested with developmental data from Smadar, the most linguistically precocious of the two girls, between ages 1;7 to 2;4.

Table 2 shows the order of acquisition of prototypical and non-prototypical AGENT-PATIENT verb types in Smadar's data by age (see Appendix II for a detailed list of verb types by age).

Table 2 Distribution of Prototypical Agent-Patient Verb Types in Smadar's Data by Age

Age	Prototypical AGENT-PATIENT verbs	Non-Prototypical AGENT-PATIENT verbs
1;7		1
1;8	1	
1;10	1	
1;11	2	2
2;0	6	1
2;1	6	9
2;2	5	6
2;3	3	3
2;4	1	3
Total	**25**	**24**

want

Two major findings emerge from Table 2: (1) Non-prototypical AGENT-PATIENT verbs are acquired before prototypical AGENT-PATIENT verbs. In fact, the first transitive verb in Smadar's data was *rcy1* 'want' as in *ha-buba* ***roca*** *moceci* 'The doll wants a pacifier' [1;7], which is non-prototypical (see, also, Ninio 1999).[3] (2) There is no meaningful difference in the number of prototypical and non-prototypical verb types acquired by Smadar.

Table 3 shows the distribution of prototypical and non-prototypical AGENT-PATIENT verb types by age and word order.

Table 3 Distribution of Prototypical Agent-Patient Verb Types by Word Order and Age in Smadar's Data

Age	Prototypical AGENT-PATIENT verbs		Non-Prototypical AGENT-PATIENT verbs	
	SVO	NON-SVO	SVO	NON-SVO
1;7			1	
1;8	1			
1;10	1			
1;11	1	1	2	
2;0	5	1	1	
2;1	4	2	8	1
2;2	5		5	1
2;3	3		3	
2;4	1		3	
Total	**21**	**4**	**22**	**2**

3. The verb *rcy1* and throughout the text, verbs are listed as *lexemes*, i.e., combinations of a consonantal root + verb-pattern, e.g., *rcy1* 'want' is made up of the root *r-c-y* 'come' and the number 1, which stands for the P1 pattern – *pa'al.*

Table 3 shows that more word order errors occur with prototypical than with non-prototypical AGENT-PATIENT verbs. Examples of errors with prototypical AGENT-PATIENT verbs + one argument are given in (3). In these examples, the direct object, which bears the THEME or PATIENT role, is placed before the verb, in subject position.

(3) a. *naxash od* ***asit*** [Lior 1;10]
snake another (you) make-2SG-FM-PT
'you made another snake'

b. *od meyxal* ***lisgor*** [Lior 1;11]
another container to close
'to close another container'

c. *et ze* ***lefocec*** [Lior 1;11]
this to blow up
'blow this up'

Following are examples of word order errors with two-argument verbs. These examples show that the THEME or PATIENT direct object is placed before the AGENT subject, counter canonical mapping.

(4) a. *gam Rolf ani* ***lokaxat*** [Smadar 1;11]
too, Rolf I take-SG-FM-PR
'I'm taking Rolf, too'

b. *oti hu* ***medagdeg*** [Smadar 2;0]
me he tickle-SG-MS-PR
'he tickles me'

c. *axshav et ha-sha'on ani* ***orid*** [Smadar 2;1]
now the watch I take-off-1SG-FUT
'now I will take off the watch'

The two girls use certain non-prototypical verbs with an overt subject in both pre- and post-verbal position, as allowed in Hebrew, despite violation of the canonical mapping scheme. For example, they often use the subject of the unaccusative verb *npl1* 'fall', in pre- and post-verbal position, as shown in (5/a) and (5/b), respectively.

(5) a. *domino* ***nafal*** [Smadar 1;7]
dominoes fall-3SG-MS-PT
'(the) dominoes fell'

b. ***nafal*** *domino*
fall-3SG-MS-PT dominoes
'fell (the) dominoes'

3.1.2 Default Mapping Errors

If children rely on an innate set of linking rules between thematic roles and syntactic functions, they should exhibit "default mapping errors", i.e., errors such as reversing the order of the subject and direct object in verbs that take a GOAL or LOCATION subject, to adhere to the canonical mapping scheme. To illustrate this type of error, contrast sentences (6/a) and (6/b).

(6) a. I got this from grandma Matilda

b. *This got I from grandma Matilda

In (6/a), the subject 'I' which bears the GOAL role precedes the direct object 'this' which bears the THEME role. However, THEME is higher on the thematic hierarchy than GOAL (see section 1). Thus, children should reverse the order of the subject 'I' and direct object 'this', as shown in sentence (6/b), to adhere to the thematic hierarchy. This results in an ungrammatical sentence, or a "default mapping error".

Examination of all early occurrences of the verb *qbl3* 'get, receive' in Lior and Smadar's data (N = 15) reveals that the girls used this verb without making any word-order errors, thus not bearing out the prediction above.

3.2 Canonical Mapping is Insufficient to Account for VAS Acquisition

What happens when children do use prototypical AGENT-PATIENT verbs? Smadar's attempts to enforce canonical AGENT-PATIENT mapping on certain intransitive verbs result in overextension, as shown in example (7).

(7) **ani* ***rokedet*** *oto* [Smadar 2;2]
I dance-SG-FM-PR him
'I am dancing him'

In this example, the root *r-k-d* 'dance' is initially used in the intransitive P1 pattern rather than in the P5 pattern which encodes causative meaning (cf. *ani* ***markida*** *oto* 'I'm making him dance'). Additional examples of overextension errors are shown in (8) and (9).

(8) **Aba herim oti ve* ***ala*** *oti* [Smadar 2;2]
Daddy pick-up-3SG-MS-PT me and go-up-3SG-MS-PT me
'Daddy picked me up and went up (=lifted) me'

(9) **Miryam* ***overt*** *et kol ha-dapim* [Smadar 2;3]
Miryam cross-SG-FM-PR all the pages
'Miryam crosses (=turns over) all the pages'

In example (8), Smadar uses the intransitive verb *ala* 'go up' in the P1 pattern instead of the corresponding causative verb *he'ela* 'lift' in the P5 pattern.

Similarly, in example (9), she uses the intransitive verb *overet* 'cross' in the P1 pattern instead of the corresponding causative verb *ma'avira* 'turn over' in the P5 pattern. Thus, even when there appears to be evidence for use of canonical mapping (subject - AGENT, object - PATIENT), it alone may not suffice to direct children into acquisition of VAS in their language. Thus, to complete the acquisition of VAS, Hebrew-speaking children also need to acquire the morphological means for marking argument structure alternations in their language, i.e., a shift in *binyan* assignment.

3.3 The Role of Input in VAS Acquisition

By the canonical mapping scheme, the argument bearing the THEME role should be acquired prior to the one bearing the GOAL role, since THEME is higher on the thematic hierarchy than GOAL (see sections 1, 3.1). Hebrew forms a particularly interesting test-case for this hypothesis, since it allows a relatively free ordering of the indirect (dative) object in relation to the direct object, as illustrated by examples (10/a) and (10/b). In (10/a) the direct object (THEME) precedes the indirect object (GOAL), while in (10/b) the order is reversed.

(10) a. *ima* ***natna*** *[et ha-buba] [le-Ruti]*
Mommy give-3SG-FM-PT ACC the-doll to-Ruti
'Mommy gave the doll to Ruti'

b. *ima* ***natna*** *[le-Ruti] [et ha-buba]*
Mommy give-3SG-FM-PT to-Ruti ACC the-doll
'Mommy gave Ruti the doll'

Three-argument verbs like *ntn1* 'give' and *bwa5* 'bring' have both a THEME and a GOAL role. Consider next the distribution of early argument configurations for these two verbs in input to Lior, and in the girl's production data between MLU 1.5 – 2.5 (*ntn1* 'give', N = 22; *bwa5* 'bring', N = 44).[4]

Table 4 Distribution of Early Arguments for *ntn1* 'give' and *bwa5* 'bring' in Input to Lior, and in Lior's Production Data

Verb	Initial Arg. Str.	Thematic Role	Child	Adult
ntn1 'give'	V Direct Object	Theme	25%	14%
	V Indirect Object	Goal	75%	86%
bwa5 'bring'	V Direct Object	Theme	40%	65%
	V Indirect Object	Goal	20%	23%

4. The percentages in Table 4 do not add up to 100%, since both Lior and her mother used a certain amount of bare verbs, i.e., verbs with no overt arguments.

Several findings emerge from Table 4: (1) Initially, each verb was acquired with a different first argument: *bring* was acquired with an overt direct object (40%), e.g., *tavii sefer* 'bring-2SG-FM-IMP (a) book', while *give* was initially acquired with an indirect object (75%), e.g., *tni li* 'gimme', even though the two verbs have the same argument structure (Subject, Direct Object, Indirect Object). (2) A comparison of the child and adult columns reveals that the acquisition patterns of *bring* and *give* match parental input for the two verbs. This finding can be accounted for by resorting to the pragmatic notions of background as opposed to new or more dominant information (Erteschick 1979, Hopper & Thompson 1980), as follows. The verb *give* is usually used when the child and caretaker interact, and one is holding an object that the other wants. Since both child and caretaker usually see the requested object, it is most likely that the recipient of the object will constitute new information. In Hebrew, the RECIPIENT of a bitransitive verb is marked by the indirect object. Therefore, it is most likely that *give* would be initially used with the indirect object. With *bring*, the object to be transferred is out of sight, and therefore, it is most likely to constitute new information. Since the transferred object (or THEME), is usually marked in Hebrew by the direct object, this argument will be the first to occur with *bring*.

Table 5 shows the distribution of VAS for *spr3* 'tell' in input to Lior and in the girl's production data (MLU 1.5 – 2.5).[5]

Table 5 Distribution of VAS for *spr3* 'tell' in Input to Lior and in Lior's Production Data

Speaker	v	sv	vo	vi	vc	svi	svo	vio	vic	svio	svic	Total
Mother	1	1	1	17	2	3	3	7	6	4	3	48
Lior	0	1	0	6	0	2	1	1	1	0	0	12

Table 5 reveals that the first argument Lior uses with the verb 'tell' is the indirect object which bears the GOAL or BENEFICIARY role, rather than the direct object which bears the THEME role, as would be predicted by the canonical mapping scheme. The table further reveals a similarity between the distribution of particular argument structures in the input and their subsequent use by Lior. This suggests that Lior is attentive to her caretaker's input, and that she processes this input to produce similar patterns.

To sum up, several findings emerge from the Hebrew data: (1) In the early phases of VAS acquisition, children's overt subjects are not limited to AGENTS. (2) Acquisition of prototypical AGENT-PATIENT verbs does not precede acquisition of non-prototypical ones. (3) Initially, more word order errors occurred with prototypical than with non-prototypical AGENT-PATIENT verbs. (4) Overextension errors suggest that canonical mapping is not sufficient to acquire

5. The following abbreviations are used in Table 5: v – verb, s – subject, o – direct object, i – indirect object, c – sentential complement.

argument-structure in Hebrew. (5) When two verbs have a similar meaning and a similar transitivity value (e.g., *give* and *bring*), children initially do not generalize from the argument structure of one verb to that of the other, as would be expected given an innate canonical mapping scheme. Finally, (6) Children acquire certain early argument structure configurations based on parental input despite violation of the canonical mapping scheme.

4. Conclusion

The findings reviewed here suggest that a canonical mapping scheme may not, in fact, facilitate acquisition, and that it may not be sufficient to acquire VAS crosslinguistically. In this case, children must figure out the non-canonical mapping for each verb by observing how adult speakers use it, which, in turn, means that a canonical-mapping scheme, or an *a priori* set of linking rules has no advantage over a verb-by-verb strategy for VAS acquisition. Comparative data from English and Chechen-Ingush (Bowerman 1990, and Nichols 1984 cited there) further support this claim by showing that a universal linking mechanism cannot account in the same way for acquisition of predicate-argument relations in these two languages.

In line with other input-based accounts, I propose, instead, that verb argument structures are initially learned for individual verbs, even when the acquired verbs have the same argument structure (e.g., *give* and *bring*), and that the initial choice of arguments appears to be determined by input and by pragmatic factors like new versus old information. To support this proposal, future research should focus on the role of input on VAS acquisition, and on analysis of additional data, particularly from typologically different languages, as well as evidence elicited by different methodologies (e.g., experiments, computer simulations).

Appendices

Appendix I MLU by Child and Age

MLU Range	Lior	Smadar
1 – 1.5	1;5 – 1;7	—
1.51 – 2.5	1;8 – 2;4	1;6 – 1;8
2.51 – 3.5	2;5 – 2;9	1;10 – 2;0
3.51 – 4.5	—	2;1 – 2;4

Appendix II Order of Occurrence of (Non)Prototypical Agent-Patient Verbs in Smadar's Data by Age, Verb Type, and Word Order

Age	Prototypical AGENT-PATIENT Verbs		Non-Prototypical AGENT-PATIENT Verbs	
	SVO	NON-SVO	SVO	NON-SVO
1;7			want	
1;8	make/do		find	
1;10	clean			
1;11	drive-TR	take	find, look for	
2;0	wear, open, take, take apart, make/do	tickle	read	
2;1	put together, take apart, close, do	take off, put on (a shoe)	pass by, smell, count, buy, want, look for, remember, hold	manage
2;2	water, mix, collect, pick up, do		want, hear, invite, look for, drive-TR	want
2;3	close, sail-TR, slide		find, know, want	
2;4	take		look for, enter, draw	

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