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Knowledge of the OV parameter setting at 19 months: Evidence from Hindi–Urdu

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Abstract

Although there is extensive evidence for early parameter setting in the syntactic productions of young children, much less is known about parameter setting before production starts. Franck et al. (2011) showed, for the first time, sensitivity to the VO/OV parameter at 19 months of age in children exposed to French, a VO language. Their experiment resorted to the combination of the preferential looking paradigm with pseudo-verbs and the weird word order paradigm. Here we report a closely resembling experiment with an OV language, Hindi–Urdu. We tested 20 children aged 19 months and the results show that children can parse the SOV sequences (and consequently show a looking preference for a transitive action) that generated random behaviour in the French experiment, while non-target sequences grant only random gazing behaviour.

Keywords: Acquisition; Word order; Preferential looking paradigm; VO/OV; Early development; Parameter setting

1. Introduction

Hirsh-Pasek and Golinkoff (1996) initiated the research on sensitivity to word order in infants by resorting to the preferential looking paradigm. They showed that 17-month old children comprehend active sentences such as *Big Bird is washing Cookie Monster* even though they are reversible, i.e. children are capable of identifying Agent and Theme on the sole basis of word order. Gertner et al. (2006) achieved the same result with 21-month old children for transitive sentences with a pseudo-verb, e.g. *The girl is gorping the boy*, when shown an action depicting a girl as Agent and a boy as Theme and the reverse action. Nevertheless, in and of themselves these results do not demonstrate that children are aware that in a language like English objects follow the verb. To address this issue, Franck et al. (2011) designed an experiment testing awareness of the VO/OV contrast by children exposed to a VO language: French. They combined the preferential looking paradigm with the use of pseudo-verbs to preclude the possibility that children were able to understand sentences by simply having memorized similar verbal templates as suggested by Dittmar et al. (2008) in their critique of Gertner et al. (2006). They also resorted to the weird word order paradigm (Akhtar, 1999), in which children are

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confronted with grammatical and ungrammatical sequences: nineteen 19-month old children natively exposed to French heard sentences such as (1a), a well-formed SVO sentence of French, and (1b), SOV, ill-formed.

(1) a. Le lion poune le cheval.
the lion pseudo-verb the horse
b. La vache le lion dase.
the cow the lion pseudo-verb

Two synchronized videos were shown to the children; in one of the screens, a causative action was portrayed (a character performing an action on the other character), in the other screen the same action was performed reflexively (each character performed it on himself). By hypothesis, children able to parse (1a) as a transitive SVO sentence would look at the causative action longer than at the non-causative. In line with this prediction, the results indicate that children prefer the causative action over the non-causative one. Crucially, this preference was only found when hearing the grammatical transitive sentence (1a), while no preference was found when hearing the ungrammatical sentence (1b). Hence, the preference observed when hearing a transitive sentence cannot be attributed to a general preference for causative actions. So the conclusion of these eye-tracking measures is that children of 19 months exposed to French have set the parameter that determines the VO/OV alternation according to the adult setting. Franck et al. (2011) go on to show that alternative hypotheses on early development are inconsistent with the findings; in particular, children cannot be solely guided by a principle mapping the first argument to the Agent and the second to the Theme (Lidz et al., 2001), as that would predict the same gazing behaviour with SVO and SOV. Nor are the results expected under the contention that infants lack general knowledge of syntax (Dittmar et al., 2008), as their performance is consistent with the adult grammar in the absence of previous lexical knowledge of the verbs.

Our goal is to run an experiment resembling as closely as possible that in French in a language with another parametric choice, an OV language. We hypothesize that, as in French, children at 19 months will have set the parameter according to the target grammar and thus will show a preference for the causative representation when hearing an SOV sentence.

The paper proceeds as follows. In section 2 we provide the necessary background on the language investigated, Hindi–Urdu. In section 3 we detail the experimental design. In section 4 we present the results and in section 5 we discuss them by reference to the background outlined.

2. Background

As illustrated in (2), the basic word order of Hindi–Urdu is SOV (in fact the language is quite consistently head-final, with postpositions outnumbering prepositions and T following VP, albeit some Cs are initial, see Bayer, 1999), and argument DPs bear case (*ne* in *raam-ne* for Ergative, *ko* in *raavan-ko* for Accusative).

(2) raam-ne raavan-ko dekhaa. S O V
Ram-ERG Ravan-ACC see.PFV
'Ram saw Ravan.'

However, when the object is a finite embedded clause, it follows the verb systematically, as in (3) (example taken from Manetta, 2012) (see Davison, 1999).

(3) a. siita-ne kahaa thaa [ki mohan aayaa thaa]. S V T CP
Sita-ERG say-PFV AUX.PST that Mohan come.PFV AUX.PST
'Sita said that Mohan had come.'
b. *siita-ne [ki mohan aayaa thaa] kahaa thaa. S CP V T

The DP object in (2) may also appear postverbally, and then is interpreted as old information (4a). Other word order alternations of (2) are possible, as shown in (4b–d).

(4) a. raam-ne dekhaa raavan-ko. S V O
b. raavan-ko dekhaa raam-ne. O V S
c. dekhaa raavan-ko raam-ne. V O S
d. dekhaa raam-ne raavan-ko. V S O

For discussion of these departures from the basic word order due to topicalisation and focus, see Mahajan (1990, 1997), Kidwai (2000), and Manetta (2012).

Table 1
Raw counts and percentages (in brackets) of different word orders in adult spontaneous speech of, Hindi–Urdu. *Abbreviations*: S = subject; V = verb; O = object; O_{CP} = sentential object; IO = indirect object; Adv = adverbial.

Word order	Counts (Percentages)
S O V	2264 (43.5)
O V	566 (10.9)
S V	449 (8.6)
O S V	313 (6)
S V O	286 (5.5)
O V S	180 (3.5)
S V O_{CP}	124 (2.4)
V O	120 (2.3)
S O V IO	108 (2.1)
Adv V	102 (2)
O S V IO	89 (1.7)
NV: No Verb	79 (1.5)
O IO S V	74 (1.4)
V	74 (1.4)
O V IO	67 (1.3)
V S	53 (1.2)
O IO V	52 (1)
V O S	50 (1)
V S O	50 (1)
O S IO V	40 (0.8)
V S O_{CP}	17 (0.3)
V O_{CP}	15 (0.3)
IO O V	12 (0.2)
IO S V O_{CP}	9 (0.2)
IO V O	7 (0.1)

In order to establish the distribution of the basic word order DP DP V in spoken Hindi–Urdu, a corpus study was carried out. We considered the transcriptions of spoken language taken from dialogues recorded in the *NavBharat Times*. A total of 5200 sentences were transcribed and analyzed. All main declarative and interrogative clauses were included in the recount; vocatives and adjuncts were excluded. The results are reported in Table 1.

These results indicate that adult spontaneous production in Hindi–Urdu displays a large array of word orders, consistent with the literature, but the verb appears predominantly in final position (73.6% of the total). Sentences with an overt object represent 85% of the total. Of these, the sentences in which there is direct evidence for the OV order (S O V, IO O V, OV, S O V IO, O V IO, O V S) represent 72% (61.5% of the total number of sentences), while those with the VO sequence (S V O, S V O_{CP}, V O, V O S, V O_{CP}, IO V O, IO S V O_{CP}) constitute only 13.8% (11.8% of the total number of sentences). Thus, more than 70% of the sentences containing an object display OV order. So, in spite of the occurrence of scrambling and generalized pro-drop in Hindi–Urdu (see Prasad and Strube, 2000, and Neeleman and Szendröi, 2008 for the general case), the child seems to have consistent input to establish the OV parameter.[1] In other OV languages, e.g. Malayalam, the input is less consistently verb-final, due to further options of scrambling.

3. Materials and methods

3.1. Participants

The participants in our experiment were twenty children of 19 months (age range: 1;7,2–1;7,7, mean age: 1;7,4). They were recruited in the metropolitan area of Barcelona. Their families were Urdu-speaking and the children had had minimal exposure to Catalan and Spanish, and none of them were attending a kindergarten. None of the children had a family history

[1] There is no open corpus of children interacting with adults for Hindi–Urdu (Narasimhan, 2005 refers to one, compiled by herself and collaborators, but this has not been made available to the community), and therefore we could not analyze child-directed speech. A preliminary analysis was conducted on a small sample of child-directed speech extracted from the web, and the presence of the different word orders did not differ substantially from that reported in the text (verb-final sentences represented 68% of the total, OV was attested in 55% of them).

of language delay, language impairment or cognitive impairment. No children's performance was excluded from the final analysis.

3.2. Materials

The materials used were those designed by Franck et al. (2011) for their experiment on French. They involve videos depicting causative and non-causative actions[2] and two types of linguistic input: in the case of Hindi–Urdu, well formed transitive DP DP V sentences and highly dispreferred V DP DP sentences (i.e. degraded with the associated intonation). The choice of the VSO order deserves some explanation. This order was chosen (instead of SVO as in the French experiment) because of its infrequency in adult spontaneous production: SVO was found in our recounts in 5.5% of the sentences, VSO in only 1%. Given the array of possible word orders in Hindi–Urdu, much larger than that of French, it seemed that choosing a very infrequent word order was necessary to replicate the contrast in the original experiment between French SVO and SOV – SOV is never well formed in French with a full DP object. VSO critically maintains the SO order and, in that respect, even though it differs from the SVO condition in French, is formally similar to it in that the two conditions (grammatical and ungrammatical) keep the order of the two arguments constant: the only variation is the order of O with respect to V.[3] This has the consequence that we did not replicate the original SVO/SOV word orders, although comparison between the performance of French and Hindi–Urdu children is still direct for SOV, ungrammatical in the first, grammatical in the second.[4]

The characters in the video included a subset of those in the French video (a dog, a donkey, a horse, a lion, a sheep and a cow), to make the video culturally appropriate. The sentences were pre-recorded by an Urdu native speaker female from Peshwar, Pakistan.

A list of commonly occurring verbs in Hindi–Urdu was compiled and two pseudo-verbs were formed combining the most common syllables: the bisyllabic verb *chonna* (third person: *choona*) and the trisyllabic verb *khalaanaa* (third person: *khalaayaa*). A group of 20 adult Hindi native speakers were asked to judge if each verb sounded familiar and whether they knew its meaning; all speakers said the verbs sounded familiar, but could not attach any meaning to them. The pseudo-verbs used therefore followed the phonological pattern of Hindi–Urdu verbs. The meanings assigned to the pseudo-verbs correspond to actions non-lexicalised in Hindi–Urdu: *choona* to 'put someone's head under a net' and *khalaayaa* to 'put a crown on someone's head'. An anonymous reviewer drew our attention to the fact that a long *–a* is one of the Hindi–Urdu morphological causative morphemes that renders a verbal stem into a causative verb; our verb *khalaayaa* could have been derived in that way, in which case the pseudo-verb would be inherently causative (and therefore could have helped the child select a causative action by virtue of its morphophonological shape). The pseudo-verb *khalaayaa* could indeed be interpreted as a so-called direct causative (Bhatt and Embick, 2003), but so could *choona*, which also presents a long vowel and exemplifies another means of deriving a causative verb. So the two pseudo-verbs used in the experiment bias children in the same way, if they do. More importantly, the choice the child is faced with in our experiment is an agentive action performed on another character and a reflexive action, and there are verbs in Hindi–Urdu with the same shape as *khalaayaa* (i.e. with a causative morpheme) which allow for a reflexive interpretation and can take a reflexive pronoun: *nahaayaa* 'bathed', *bulaayaa* 'called', and so on. The reviewer also observes that *–na* may be an infinitival morpheme, and therefore a sentence with the verb *choona* be anomalous for lack of a finite verb; but, again, we find finite verbs in Hindi–Urdu much alike our pseudo-verb: *chiina* 'snatched', *maana* 'accepted', *ginaa* 'counted', *taana* 'flung'. We contend that, in both cases, the pseudo-verbs in our experiment allow for a reflexive and non-reflexive interpretation, which correspond to the two actions in the videos, and therefore do not drive the child to a particular interpretation by their morphophonological profile.

The following sentences correspond to the grammatical condition (5) and the ungrammatical condition (6).[5]

(5) a. kuthe-ne gadhe-ko khalaayaa.
dog-ERG donkey-ACC V-PFV

[2] We have kept the denomination 'causative' for consistency with Franck et al. (2011) although it may be the source of some confusion, especially when discussing Hindi–Urdu, where causativity is morphologically marked (see Saksena, 1982). What we designate with causative is an agentive action performed transitively, non-reflexively.

[3] The clause-initial position of the verb might be derived by an additional instance of verb movement, just as French SOV would involve object raising, but in both cases what was aimed at was a sequence that would be excluded in the target grammar, as VSO with its associated intonation is here.

[4] In addition, as pointed out to us by M. Baker, our choice of distractor preserves one of the properties of the French distractor, namely the SO(V) sequence in French might have been mistakenly taken to be a coordinate structure in the French experiment, just like the (V)SO sequence in the Hindi/Urdu experiment.

[5] In Hindi–Urdu, aspectual and temporal information is often expressed through free morphemes (as illustrated in (3); see Butt and Rizvi, 2010); the past tense, however, is an affix (as in (2) above) and, in order to avoid further differences with French, it was chosen for our experiment.

b. sher-ne ghode-ko khalaayaa.
lion-ERG horse-ACC V-PFV
c. gaay-ne bakri-ko khalaayaa.
cow-ERG sheep-ACC V-PFV

(6) a. choona gaay-ne sher-ko.
V-PFV cow-ERG lion-ACC
b. choona gadhe-ne kuthe-ko.
V-PFV donkey-ERG dog-ACC
c. choona bakri-ne ghode-ko.
V-PFV sheep-ERG horse-ACC

For each sentence, the child saw two videos on the screen, one video showing a causative action enacted by two of the puppets (e.g. for (5a) a dog putting a crown on a donkey's head). The second video illustrated the same action performed reflexively by the two characters involved (e.g. in (5a) a dog and a donkey putting on a crown). The position of the causative and the non-causative, reflexive action were counterbalanced as to their position to the left or the right of the screen. The items in (5)–(6) were presented in pseudo-random order. There was no exposure to transitive sentences with existing verbs in the training, so that no learning could take place while the experiment was carried out (as this was a potential problem with Gertner et al.'s 2006 experiment, according to Dittmar et al., 2008).

As already pointed out, the word order in (6) is grammatical (with the verb in a focus position), but then it bears a specific intonation. Hindi is categorized as an edge-prominence language, in which only boundary tones can change to convey pragmatic focus (Patil et al., 2008, Féry, 2010). In an SOV declarative sentence the intonational contour is that in (7a). In VSO sentences (and sentences with focus in general) the focused constituent retains the falling contour, but the post-focal elements are lowered. So the intonation contour is as described in (7b).

(7) a. [[L*H] [L*H] [H*L]]
b. [[H*L] [L*H] [L*H]]

In our experiment we used an unfocused declarative intonation contour (7a) for the verb initial sentence, highly dispreferred in Hindi–Urdu.

3.3. Procedure

The experiment took place in the lab of the Departament de Psicologia Bàsica of the Universitat de Barcelona. The machine used was a Tobii T 120. The child sat on his/her mother's lap, at around 65 cm from the 17-inch screen. The procedure matched that used by Franck et al. (2011). First, infant eye calibration took place, and then the training session started. The child was familiarized with the puppets; the puppets were presented once and the recorded speaker named the animal (e.g. *Look! a horse!*). Next, the child was introduced to the simultaneous videos, which showed different animals on the screens and the audio asked the child to find one of them (*Look! do you see the lion? where is the lion?*). Finally, the child was introduced to the actions designated by the pseudo-verbs, both in causative and non-causative form, although the pseudo-verbs were not given at this point and the audio only asked *What is happening?*

After the training session and a short transition cartoon accompanied by a song, the experimental session started. It involved the six pairs of experimental videos corresponding to the sentences in (5)–(6). Each pair lasted 20 s and the actions were played loopwise on the screen for the whole span. The video started by drawing the children's attention (*Look! What is happening here?*), then the sentence associated with the video was played three times, after 6 s, after 10 s and after 16 s. Each pair of videos included four 4-second windows (presentation of the baseline sentence *Look! What is this?* at 2–6 s, first presentation of the target sentence at 6–10 s, second presentation of the target sentence at 10–14 s, third presentation of the target sentence at 16–20 s). Transitions between the experimental pairs consisted in a blank screen followed by the cartoon. For some children, some time was given between the experimental items, as the experimenter wanted to make sure that they did not waver away from the calibrated position, and that they kept their attention to the screen. The whole session lasted around 15 min.

4. Results

Analyses were conducted on the four 4-second windows, defined on the basis of the timing of the linguistic input: Baseline (2–6 s), first presentation of the sentence (6–10 s), second presentation of the sentence (10–14 s), third presentation of the sentence (16–20 s). Mean looking times for the two videos in the two experimental conditions are reported in Table 2.

Table 2
Mean looking times (in ms, standard deviations in parentheses) towards the causative and noncausative videos in the grammatical and ungrammatical conditions across the four time windows. Significant differences between the causative and noncausative videos are in bold.

	Grammatical		Ungrammatical	
	Causative	Non-causative	Causative	Non-causative
Baseline (2–6 s)	2250 (787)	1754 (744)	1951 (590)	1791 (598)
Sentence 1 (6–10 s)	**2372*** (1018)	**1536*** (766)	1514 (564)	2072 (1083)
Sentence 2 (10–14 s)	**2560*** (1034)	**1152*** (772)	1785 (823)	1728 (985)
Sentence 3 (16–20 s)	**2021*** (1140)	**1139*** (768)	1665 (884)	1814 (1086)

* $p < .05$.

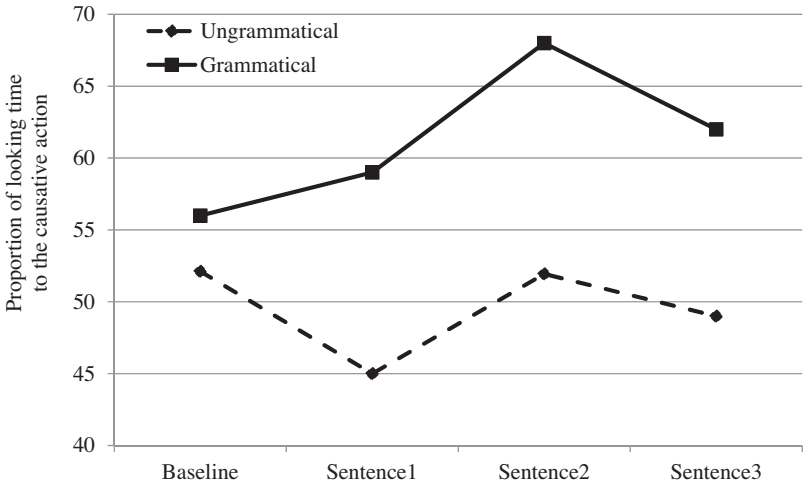

Fig. 1. Proportion of looking time to the causative action in the four critical windows.

Pairwise comparisons using Student *t*-tests were conducted on mean looking times. Infants looked significantly longer to the causative video than to the non-causative video only in the grammatical condition, during the first presentation of the sentence ($t(19) = -2.549$, $p = .020$), the second presentation of the sentence ($t(19) = -4.009$, $p = .001$), and the third presentation of the sentence ($t(19) = -2.396$, $p = .027$). No significant difference was found in the baseline window of the grammatical condition, nor in any of the windows of the ungrammatical condition.

The proportion of looking time to the causative video (calculated over total looking times to the causative and non-causative videos) in the four critical windows is reported in Fig. 1.

Analyses were conducted on these proportions using the Wilcoxon signed-rank test. The analysis against chance level (defined as 50%) showed above chance performance in the grammatical condition during the second presentation of the sentence window (Median proportion = 72.21; $Z = -2.987$, $p = .003$) as well as during the third presentation of the sentence window (Median proportion = 60.93; $Z = -2.128$, $p = .033$). None of the other windows showed above chance performance. The comparative analysis of proportions to the causative video in the grammatical and ungrammatical sentences showed significantly higher proportions in the grammatical condition than in the ungrammatical condition during the second presentation of the sentence (Medians: 72.21 and 52.53 respectively; $Z = -1.979$, $p = .048$). No significant difference was found in the baseline window and during the first and third presentations of the sentence.

5. Discussion

The results of our experiment indicate that Hindi–Urdu children are aware at 19 months of age that the language they are exposed to is an OV language, and can use that knowledge to comprehend sentences. Crucially, that knowledge appears to rely on an abstract representation of the directionality parameter, since it was found in sentences involving pseudo-verbs. That is, performance cannot be explained by item-based lexical knowledge as was argued to be the case for children until 3–4 years of age, in studies using the weird word order paradigm in sentence production (e.g. Abbot-Smith et al., 2001; Matthews et al., 2007; but see Franck and Lassotta (2012) for a critical review of these studies). On the other hand, children fail to assign a consistent interpretation to VSO in the same experimental setting; the

source of the difference in performance lies in the ungrammaticality of VSO (although scarcely found in the spontaneous production corpus, 1%, VSO is grammatical but only with an intonational contour not used in the experiment).

Our results are complementary to the previous ones by Franck et al. in which, with an identical experimental design, the French children of 19 months failed to understand the ungrammatical SOV order. As remarked by an anonymous reviewer, there is one difference between French and Hindi–Urdu that cannot be discarded, namely the overt Case marking of Hindi–Urdu arguments, absent in French. Testing nominals without overt Case marking is not an option in Hindi–Urdu, since the only arguments that may appear without overt Case marking are inanimate objects and some Nominatives.[6] Nevertheless, children's consistent preference for the causative action when hearing SOV sentences cannot be attributed to the sole presence of overt case markers since case markers failed to drive their performance in the highly dispreferred VSO condition. If performance was driven by Case marking, we would expect Hindi–Urdu children to perform equally in the VSO and the SOV conditions, contrary to fact. One can nevertheless not exclude the possibility that both case markers and word order played a role in children's understanding of SOV sentences. Dittmar et al. (2008) argued that whereas 2-year-old German children understood sentences containing both word order and case markers, it's only by the age of 5 that they understood sentences on the basis of word order alone (Dittmar et al., 2008).

Comparison between the precise timing of the effects in Hindi–Urdu and French is not really possible given that we did not adopt exactly the same windows for analyses (partly due to the length of the experimental items in Hindi–Urdu): whereas in French the 20-second total lag was split in 5 windows, here we analyzed 4 windows corresponding to when the sentences were presented (baseline and 3 presentations). Nevertheless, some differences seem to emerge, in particular, the effect (in both the proportion and chance analyses) seems to arise earlier in Hindi–Urdu (in the 6–10 s window compared to the 8–12 s window in French) and to persist until the last 16–20 s window (whereas it disappeared in the last window in French). Moreover, although the curves for French and Hindi–Urdu are similar (for example, the gazing times at the causative video decrease in the last presentation of the sentence for both languages, presumably due to tiredness at the same stimulus), the contrast between the grammatical and ungrammatical conditions shows an earlier and longer effect in the Hindi–Urdu results. These differences may potentially be accounted by the presence of additional case markers in Hindi–Urdu, absent in French. Further research is necessary to better understand the role of case marking in young children's sentence comprehension.

In view of the results of Franck et al. our results for Hindi–Urdu would be expected if we assume a directionality parameter that could be set as either head initial (French) or head-final (Hindi–Urdu). If we follow Kayne's (1994) antisymmetry, both French and Hindi–Urdu are underlyingly SVO and the contrast VO/OV follows from object raising in Hindi–Urdu. The implication of the results would then be that the parameter resulting in object raising is correctly set by 19 months. There would have been the possibility that this additional movement had delayed the Hindi–Urdu children with respect to the French, but this is not the case. The result, as it stands, does not provide evidence for or against antisymmetry, and experimental work bearing on this remains for future research. Still we have provided evidence, to our knowledge for the first time, that the parameter responsible for the VO/OV alternation has been set correctly by 19 months in an OV language. This runs contrary to the claim that abstract, though language-specific knowledge of syntax is not reached until ages 3 and 4 (as stated in the constructivist approach to language development), and provides empirical support to the hypothesis of very early parameter setting (Rizzi, 2005; Wexler, 1998).

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[6] It is worth pointing out that in non-past sentences subjects are Nominative and objects can also be Nominative; in that circumstance it is possible to neutralize the effect of Case marking although word order freezing occurs and the first argument is usually interpreted as the subject.

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