Resumptive pronouns as a last resort when movement is impaired: Relative clauses in hearing impairment

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This study tested 14 school-age orally-trained children with hearing impairment who have a deficit in A-bar movement, manifested in an impaired comprehension of object relatives and topicalization structures. When they produce a grammatical object relative clause, they typically produce it with a resumptive pronoun, unlike their age-matched controls, who tend to produce object relatives with a gap. They also produce resumptive pronouns where only a gap is licit, in the highest embedded subject position in subject relatives. We interpret these results as supporting the claim that resumptive pronouns are a last resort when movement is blocked, not only because of islands in intact syntax, but also due to impairment. The participants also doubled the relative head in both subject- and object-relatives, producing ungrammatical sentences. The bearing of these errors on the copy theory of movement is discussed.

Introduction

Children with hearing impairment who are orally trained and do not receive sufficient exposure to language, either sign language, or spoken language with the aid of early fitted hearing aids, have a deficit in sentences that are derived by A-bar movement. This study explored whether resumptive pronouns, which are considered a "last resort" in sentences that do not allow movement, would be used also when movement is impaired.

Restrictive relative clauses are predicates that modify a nominal head. As such, they must contain a syntactic element which is interpreted as a bound variable, and is located in a thematic position within the relative clause. The most cross-linguistically pervasive strategy for achieving this involves movement of an operator (overt or phonetically-null) out of the clause-internal thematic position,

and into the periphery of the relative clause. The original position of the operator receives the interpretation of a variable, which is bound by the operator in its new position.

(1) I saw [the duck [which$_1$ [Dudu drew t$_1$]]]

However, some languages employ a different strategy, instead of or alongside the movement-based strategy. This strategy is known as *resumption*: a pronominal element, a resumptive pronoun, is generated in the clause-internal thematic position, does not move, and is bound by a co-indexed operator. Presumably, this operator can be base-generated at the periphery of the relative clause.

(2) Ra'iti   et   ha-barvaz Se-Dudu ciyeroto
    saw.1st.sg ACC the-duck that-Dudu   drewhim
    'I saw the duck that Dudu drew.'

Hebrew allows both strategies in different syntactic contexts. The distribution of the two strategies in Hebrew is as follows:

	Highest subject position	Other subject positions	Direct objects	Complements of P^0	NP-internal elements
Movement	+	+	+	–	–
Resumption	–	+	+	+	+

Linguistic literature has dealt extensively with relative clauses that include resumption, and how they are derived. Researchers agree that when movement is blocked, only the resumption strategy is available. This is most evident within syntactic constructions known as Strong Islands (Chomsky, 1986; Ross, 1967), out of which movement is never possible. The only option available in these cases, in any language, is resumption.

(3) ze ha-yeledSe-Dani mexabev et   ha-'iSa   Se-ciyra oto
     this the-child   that-Dani likes ACC   the-woman that-drew him
     'This is the child that Dani likes the woman who drew him.'

However, researchers disagree on whether or not *any* phonetically realized element which receives a bound variable interpretation in a relative clause is indeed a true resumptive pronoun (cf. true resumption vs. apparent resumption; Aoun, Choueiri, & Hornstein, 2001). Some argue that such elements are always resumptive pronouns, even when they appear in contexts which appear to allow movement (Borer, 1984; Grolla, 2005; McKee & McDaniel, 2001; Shlonsky, 1992). Others claim that in contexts that allow movement, the phonetically realized element is in fact the residue of movement, and only in contexts where movement is blocked, is it a true resumptive pronoun (Aoun & Choueiri, 1996; Aoun, Choueiri, & Hornstein, 2001; Varlokosta & Armon-Lotem, 1998).

Crucially for the current study, Hebrew resumptive pronouns in the embedded object position (e.g. the relative pronoun *oto* 'him' in (2)) do not behave as if they are the residue of movement. This can be demonstrated using reconstruction, a diagnostic used by Aoun, Choueiri and Hornstein (2001) to tease apart true resumption and apparent resumption. A-bar movement in Hebrew gives rise to reconstruction effects, as can be seen below:

(4) a. [et   ha-ben Sela$_i$]   kol ima$_i$ haxi   ohevet
       ACC the-son her   every mother the-most loves
       'Every mother$_i$ loves her$_i$ son the most.'

   b. [eize ca'acu'a   Selo$_i$]   kol   yeled   tamid   me'abed?
       which toy   his   every   child   always loses?
       'Which toy of his$_i$ does every child always lose?'

Topicalization (4a) and A-bar movement (4b) allow a pronoun to be bound by a universal quantifier that c-commands its base position and does not c-command its surface position.

However, Hebrew relative clauses with resumptive pronouns show no such effects:

(5) a. * hine ha-mamtakim Selo$_i$Se-kol   yeled$_i$ kibel otam ba-gan
          here the-candies   his   that-everychild got them in-the-
          preschool

   b. * asafti   et   ha-bxinot Selo$_i$Se-kol   more$_i$
          collected ACC   the-exams his   that-everyteacher
          badak   otan bi-mhirut
          checked   them quickly

One can therefore conclude that the resumptive pronoun in Hebrew object relative clauses does not represent the residue of movement. Note that (5a-b) represent sentences that would be grammatical if the bound-variable reading were not forced upon the pronoun.[2]

As argued by Shlonsky (1992), movement is the unmarked option for relativization, and as a result, relative clauses will be derived by movement whenever possible. In this sense, resumption serves as a last resort mechanism, salvaging derivations which are illicit due to the impossibility of movement (cf. Strong Islands). This raises the question of how the grammar implements this mechanism.

Hornstein (2001) suggests an intriguing possibility with respect to resumptive pronouns (and in fact pronouns in general). He suggests that pronouns are not, as is widely assumed, part of the array of lexical elements selected at the beginning of each syntactic derivation. Rather, they are inserted by the syntactic component during the course of the computation, to save derivations that would otherwise crash. Relativization into a Strong Island would presumably require movement which is syntactically impossible (even for unimpaired speakers). In such cases, the computational system would recognize that the derivation in its present form would be illicit, and insert a pronoun in place of the launching-site of movement, within the Strong Island. The derivation would no longer violate

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[2] In that case, they would mean 'Here is his$_k$ candy that every child$_i$ received in preschool', and 'I collected his$_k$ exams that every teacher graded carelessly', respectively.

the conditions on movement, and the computational system could continue.

In other words, when movement is blocked in sentence production of unimpaired speakers, resumptive pronouns are recruited. The current study looked at another way in which movement can be blocked: in the context of language impairment. We tested whether Hebrew-speaking school-age orally-trained children with hearing impairment, who have a deficit in the comprehension of sentences that are derived by phrasal movement, use resumptive pronouns when trying to produce sentences that are normally derived by movement.

Many studies indicated that the syntactic abilities of children with hearing impairment who are orally trained are different from those of hearing children. In the realm of speech production, studies showed that children with hearing impairment produce ungrammatical sentences (Friedmann & Szterman, 2006; Geers & Moog, 1978; Pressnell, 1973). Passives, Wh questions and relative clauses were found to be specifically impaired in the comprehension and speech production of children with hearing impairment (Berent, 1988; de Villiers, 1988; de Villiers, de Villiers, & Hoban, 1994; Friedmann & Szterman, 2006; Geers & Moog, 1978; Quigley, Smith, & Wilbur, 1974; Quigley, Wilbur & Montanelli, 1974; Power & Quigley, 1973; Szterman & Friedmann, 2003; Wilbur, Goodhart, & Montandon, 1983).

Given the deficit children with hearing impairment have in structures that are derived by movement of phrases, it is especially interesting to see how they would produce relative clauses, and whether they use resumptive pronouns as a last resort, salvaging them from the inability to produce relative clauses that are derived by movement, or from production of ungrammatical sentences. A further question is whether resumption is also used in this population in contexts that do *not* allow for resumptive pronouns in unimpaired speech, such as highest subject position in subject relatives.

Such overuse of resumptive pronouns instead of gaps both in licit and illicit contexts of relative clauses has been reported for young children who are at the process of acquiring relative clauses. It has been reported for several languages such as English (de Villiers, 1988; Pérez-Leroux, 1995), Greek (Varlokosta & Armon-Lotem, 1998), French (Ferreiro et al., 1976; Labelle, 1990), Spanish (Ferreiro et al., 1976; Pérez-Leroux, 1995), and Hebrew (Günzberg-Kerbel, Shvimer, & Friedmann, in press; Varlokosta & Armon-Lotem, 1998). Is this overuse of resumptive pronoun characteristic of older children with an impairment in syntactic movement?

Experimental investigation

Participants

The hearing impaired participants were 14 Hebrew-speaking children, 9 girls and 5 boys. Their age range was 7;7-11;3 years (M = 9;7). They had moderate to severe hearing loss, 10 of the children used binaural hearing aids, and 4 children used a cochlear implant. The age hearing aids were first fitted to them ranged between 6 months and 6 years. The subjects' files included no other disabilities, and in all cases neither parent was deaf. All subjects came from monolingual Hebrew-speaking families. All children were trained orally, without sign language, attended language intervention programs in kindergarten at least weekly, and were considered to have good achievements in oral language acquisition. At the time of testing, they were studying in primary schools in hearing classes with inclusive schooling using oral education, with additional classes given by teachers of the deaf. All the participants constantly wore a hearing aid, and with the hearing aid passed a screening test for hearing the experimenter sentences.

The children in the control group for the comprehension study of the SVO and topicalization sentences were 20 first graders without language impairment (taken from Friedmann & Szterman, 2006). For the study of relative clause comprehension we had two control groups: one was a group of 10 first graders

(from Friedmann & Novogrodsky, 2004); the other was an age-matched group of 27 fourth graders. The control group for the production study included 28 children without language impairment. They were 7;5-11;0 years old (M = 9;0), and their age distribution was similar to that of the experimental group.

Comprehension of sentences that are derived by phrasal movement

Our earlier study (Friedmann & Szterman, 2006) indicated that orally-trained Hebrew-speaking children with hearing impairment have significant difficulties in the comprehension of sentences derived in A-bar movement. In order to establish whether the 14 children with hearing impairment who participated in the current study had a deficit in the comprehension of sentences derived by A-bar movement, we used a sentence-picture matching task with relative clauses and topicalization structures. The participant heard a semantically reversible sentence read by a native speaker of Hebrew, and saw two pictures on the same page, one above the other. In one picture the roles matched the sentence; in the other picture the roles were reversed (Figure 1). The participant was then asked to point to the picture that correctly described the sentence. There was no time limit and no limit on the number of repetitions of each sentence.

SVO
ha-yeled menadned et ha-kelev
The-boy swings acc the-dog

Subject relative
tar'ee li et ha-yeled she-menadned et ha-kelev
show me acc the-boy that-swings acc the-dog

Object relative
tar'ee li et ha-kelev she-ha-yeled menadned
show me acc the-dog that-the-boy swings

Topicalization
et ha-kelev ha-ze ha-yeled menadned
acc the-dog the-this the-boy swings

Figure 1. An example of a picture pair used in the sentence-picture matching task and sentences of the various types that match the upper picture

A total of 100 reversible Hebrew sentences were presented to each participant. These sentences were presented in two tests, one test included 20 simple SVO sentences, 20 right branching subject relatives (with a gap, as is obligatory in Hebrew), 20 right branching object relatives without a resumptive pronoun. The other test included 20 SVO sentences and 20 OVS topicalization sentences (see Figure 1 for examples for each sentence type). All verbs were agentive transitives. In order to preclude an agreement cue on the verb (Hebrew verbs agree with the subject in gender number and person), the figures in every picture were always of the same gender and number (a female nurse and a female soldier, a little boy and a grandfather, etc.) so the verb inflection agreed with both the subject and the object. The sentences and the matching pictures were randomly ordered.

Results

The results of the comprehension test are summarized in Table 1. The main finding was that the children with hearing impairment had a severe difficulty in the comprehension of sentences derived by A-bar movement, as indicated by their poor performance in object relatives and OVS topicalization sentences. They performed well on the simple SVO sentences, and on the subject relative sentences in which the canonical order of thematic roles is preserved. Whereas all the children performed at a level above chance on the SVO and subject relatives, seven of the children with hearing impairment were at chance level on the object relatives, and nine were at chance on the topicalization sentences.

Table 1
Performance in a sentence-picture matching test

	SVO	Subject relative	Object relative	SVO	OVS
Hearing impaired	97%	95%	69%	99%	59%
Control – 1st grade	99%	95%	86%	100%	93%
Control – 4th grade	98%	99%	94%		

The performance of the hearing impaired participants on object relatives was significantly poorer than on subject relatives, t(13) = 5.74, *p* < .0001, and significantly poorer than on simple SVO sentences, t(13) = 6.20, *p* < .0001. The comprehension of OVS sentences was significantly poorer than that of SVO, t(13) = 4.87, *p* < .0001. The performance on subject relatives and simple SVO sentences did not differ significantly.

The performance of the children with hearing impairment on object relatives and OVS topicalization sentences was significantly poorer than that of the control participants who were two and a half years younger, t(22) = 2.49, *p* = .02, t(32) = 4.79, *p* < .0001, respectively. The object relatives were also tested in a control group of fourth graders, and there, too, the children with hearing impairment performed significantly worse, t(39) = 6.99, *p* < .0001. No differences were found between the hearing impaired children and the two control groups in the comprehension of sentences that did not include A-bar movement (SVO). The comprehension of subject relatives, which do include movement but preserve the canonical order of constituents, did not differ between the children with hearing impairment and the first graders, but it was significantly poorer than the comprehension of subject relatives in the fourth grader control group, t(39) = 3.01, *p* = .005.

These results of the comprehension of object relatives (without a resumptive pronoun) and of topicalization structures indicate a severe difficulty in the comprehension of sentences that are derived by A-bar movement (in case they do not preserve the canonical order of arguments). How would these children produce such sentences? Would resumptive pronouns be recruited as a last resort? The next experiments focused on the elicitation of object- and subject-relatives in children with hearing impairment, compared to typically developing children.

Production of relative clauses

Two types of tasks were used to elicit relative clauses in children with hearing impairment: a preference task, and a picture description task.

Elicitation of relative clauses in a preference task

In this experiment relative clauses were elicited using a preference question. The children were presented with two options and had to choose which one they prefer. The task was constructed in such a way that the choice would have to be formed as a relative clause. There were 12 questions per participant, 6 eliciting subject relatives and 6 eliciting object relatives. The order of the subject and object relative target sentences was randomized. The questions that targeted subject relatives described two children (two boys for a male participant, two girls for a female participant), performing two actions (6); the questions that targeted object relatives described two children who are the themes of two actions performed by two different figures (7).

(6)   Elicitation of subject relative:

There are two children. One child gives a present, the other child receives a present. Which child would you rather be? Start with "I would rather be…" or "The child …"

Target answer: (Hayiti ma'adif lihiot) ha-yeled Se-mekabel matana

　　　　　　　(Was-1sg prefer to-be) the- child that-receives present

　　　　　　　　'(I would rather be) the child who receives a present.'

(7)   Elicitation of object relative:

There are two children. The father wakes up one child, the alarm clock wakes up another child. Which child would you rather be?

Start with "I would rather be…" or "The child …"

Target answer: (Hayiti   ma'adif lihiot) ha-yeled Se-aba me'ir

　　　　　　　(Was-1sg prefer to-be) the- child that-father wakes-up

　　　　　　　　'(I would rather be) the child who the father wakes up.'

Results

Object relatives. This task showed that the children with hearing impairment had difficulties producing object relatives; as shown in Table 2, in many cases they either produced an object relative clause with a resumptive pronoun, refrained from producing an object relative, or tried to produce an object relative but ended up with ungrammatical sentences.

Table 2

Distribution of responses for target object relatives in the preference elicitation task

Participants		Object relative without RP	Object relative with RP	Grammatical subject relative	Ungrammatical relative clause	Sentential complement
Hearing impaired	14 participants 84 sentences	19% (16)	42% (35)	6% (5)	24% (20)	10% (8)
Control	28 participants 168 sentences	64% (108)	30% (50)	5% (9)	1% (1)	0% (0)

RP = resumptive pronoun

Out of the 84 target object relatives, the hearing impaired participants produced 60% (51) grammatical object relative sentences, with or without resumptive pronouns. Of these grammatical object relative clauses, 69% (35/51) were produced with a resumptive pronoun in object position. Although resumptive pronouns in object position in object relatives are grammatical in Hebrew, they are characteristic of the production of much younger children (Günzberg-Kerbel, Shvimer, & Friedmann, in press; Varlokosta & Armon-Lotem, 1998). The children in the control group produced 94% grammatical object relatives (158 out of the total 168 target sentences). Of these grammatical object relative clauses, only 32% (50/158) were produced with a resumptive pronoun. This difference between the number of sentences with and without resumptive pronouns (number of object relatives with RP minus number of object relatives without RP) was significantly larger in the hearing impairment group than in the control group, $t(40) = 3.39$, $p = .0008$.

In 20 responses the participants attempted to produce a relative clause, but ended up with an ungrammatical sentence. Some sentences included more than one error type. The main error types were head omission which happened in 9 responses (example (8)), 5 of them with a full NP object (example (9)); use of the wrong resumptive pronoun – a first person singular resumptive that refers to the speaker rather than to the relative head (4 responses, example (10)); complementizer omission (3 responses); 4 ungrammatical subject relatives that included a change of the head of the relative clause (example (11)); 6 utterances that were completely ungrammatical and resulted from using the requested beginning of a sentence (*I would rather be…*) and a continuation that does not match this beginning. The children with hearing impairment produced significantly more ungrammatical responses than the control group, $t(40) = 5.10$, $p = .0001$.

The participants exhibited two main ways of avoiding the production of object relatives: they either produced a grammatical subject relative instead, created by a change in the predicate (5 responses), or produced a sentence with a sentential complement - either a CP with "that" (see example (12)) or an infinitival phrase such as "I would like to go…" (8 responses). The participants in the control group did not produce any such non-relative clause sentence in response to this task, and the difference in production of non-relative clauses between the hearing impaired group and the control group was significant, $t(40) = 2.39$, $p = .01$. Examples of error types:

(8)   Head omission

        Hayiti roce lihiot Se-saba ma'axil oto

        Would-1sg-past want to-be that-grandpa feeds him

        '*I would like to be that grandpa feeds him.*'

(9)   Relative without head and with a full NP object

        Hayiti roce lihiot Se-ha-kelev melakek et ha-yeled

        Would-1sg-past want to-be that-the-dog licks ACC the-child

        '*I would like to be that the dog licks the child.*'

(10) Wrong resumptive pronoun

Ani raciti lihiot yeled Se-ha-kelev melakek oti

I wanted to-be child that-the-dog licks me

'*I wanted to be a child that the dog licks me.*'

Examples for avoidance:

(11) Use of subject relative instead of object relative – change of head

Target: I want to be the girl that grandma dresses

Response: ani raciti lihiot safta Se-malbisha oti

I wanted to-be grandma that-dresses me

'*I wanted to be grandma that dresses me.*'

(12) No relative clause

Target: I would rather be the boy that grandma hugs

Response: hayiti roce Se-safta texabek yeled exad

Would-1sg-past want that-grandma hug-future boy one

'*I would want that grandma will hug one boy.*'

Subject relatives. The production of subject relative sentences was better than that of the object relatives, but still showed significant difficulty. As seen in Table 3, the participants produced only 67/84 (79.8%) correct subject relatives. Six subject relatives were ungrammatical (4 of them due to the omission of the complementizer), and in 11 of the target subject relatives the participants avoided relatives, producing a sentential complement instead (*I would like to swim* instead of *I would like to be the boy that swims*). The participants in the control group produced all subject relatives correctly, except for one response in which one participant produced a resumptive pronoun in subject position, and two responses in which they produced a simple sentence instead of the relative clause.

Table 3
Distribution of responses for target subject relatives in the preference elicitation task

Participants		Grammatical subject relative	Ungrammatical subject relative	Sentential complement
Hearing impaired	14 participants 84 sentences	80% (67)	7% (6)	13% (11)
Control	28 participants 168 sentences	98% (165)	1% (1)	1% (2)

Elicitation of relative clauses in a picture description task

An additional elicitation task we used in order to elicit subject and object relative clauses was a description of picture pairs. Each of the two pictures included two figures. One picture described one figure performing an action on the other, in the second picture the roles were reversed, similarly to the pictures in Figure 1. The experimenter described the two pictures using simple sentences, and then asked about one of the figures and its role in each of the pictures (13). There were 10 picture pairs, each eliciting one subject relative clause and one object relative clause, with a total of 10 subject relatives and 10 object relatives. The order of the subject and object relatives was randomized among the pictures.

(13) Here are two girls. In one picture the girl draws the woman, in the other picture the woman draws the girl. Which girl is this (pointing to the girl in the first picture)? Start with "This is the girl…". And now, which girl is this? (pointing to the girl in the second picture).

(14) Target response – subject relative : zo ha-yalda Se-mecayeret et ha-iSa

This the-girl that-draws ACC the-woman

'*This is the girl that draws the woman.*'

(15) Target response – object relative : zo ha-yalda Se-ha-iSa mecayeret

This the-girl that-the-woman draws

'*This is the girl that the woman draws.*'

One important difference between this task and the preference task relates to the optionality of an overt subject. In the preference task, the object relative clauses had to include a subject (I would rather be the boy that *the father* combs), because the participants had to choose between two possible agents for an action. In the current task, however, there is only one possible agent for the action in the relative clause. This is because the two figures that were involved in the sentence were given, and the sentence had to focus on the agent-theme relations between the figures (*This is the girl that draws the woman*, vs. *This is the girl that the woman draws*).

Results

Object relatives. This task, too, indicated a deficit in the production of object relatives; when the children with hearing impairment did produce object relatives, they tended to produce them with resumptive pronouns. In other cases they either produced an ungrammatical relative clause, or refrained from producing them by producing a simple or conjoined sentence, or a subject relative instead of an object relative. The rate of each response type is presented in Table 4. One child refused to participate in this test, so there were 13 participants with hearing impairment in this experiment.

Table 4

Distribution of responses in the picture description task, target object relatives

Participants		Grammatical object relative			Subject relative	Ungrammatical relative		
		object relative without RP	object relative with RP	empty subject and RP	instead of object relative	subject relative	doubling	other
Hearing impaired	13 participants 130 sentences	17% (22)	58% (76)	6% (8)	7% (9)	2% (2)	7% (9)	3% (4)
Control	28 participants 280 sentences	60% (169)	34% (95)	4% (10)	2% (5)	0% (0)	0% (1)	0% (0)

RP = resumptive pronoun

Out of the 130 target object relatives, only 22 grammatical object relatives were produced without resumptive pronouns; 79% of the grammatical object relatives (84/106) included a resumptive pronoun (almost 4 times more object relatives

with a resumptive pronoun than object relatives without resumptive pronouns). This pattern was completely different from the pattern observed in the control group, who produced only 38% (105/274) of the grammatical object relatives with a resumptive pronoun. The children with hearing impairment produced significantly more grammatical object relatives with a resumptive pronoun than the children in the control group, $t(39) = 2.15$, $p = .02$. This difference was also apparent in the comparison of the difference between the number of grammatical object relatives with and without resumptive pronouns in the two groups, $t(39) = 2.79$, $p = .004$.

Eight object relatives were produced with an arbitrary pro subject (i.e., without an overt embedded subject) and an object resumptive pronoun (see example (16)), a grammatically and pragmatically accepted option, which was also used by 3 of the participants in the control group. In this respect, the comparison between the two elicitation tasks yields an interesting result. The different pragmatic nature of the two tasks made the children use empty subjects only in the picture task, but not in the preference task. This can be taken to indicate something beyond syntactic abilities: it suggests that the linguistic-pragmatic ability of the participants is intact, because they omitted the embedded subject only when it was pragmatically licit, i.e., in the picture description experiment, but not in the preference task.

Eleven responses included subject relatives instead of object relatives (grammatical and ungrammatical), mostly with a change of the predicate to a predicate that was close to the intended meaning but did not match it exactly (example (17)). These had several versions: a subject relative that includes a change of the predicate to a reflexive (example (18)) or a PP or another verb (8 responses), or the formation of two coordinated sentences, the first a subject relative, the second completing the meaning with a simple sentence and a pronoun (3 instances, examples (18) and (19)).

(16) Use of an empty (arbitrary pro) embedded subject

Zo ha-yalda Se-mexabkim ota

This the-girl that-hugging-3pl her-ACC

'*This is the girl that is hugged.*'

(17) Use of a subject relative instead of an object relative – change of

predicate

Target: this is the girl that the nurse photographs

Response: Zo ha-yalda Se-mistakelet al ha-maclema

This the-girl that-looks at the-camera

'*This is the girl that looks at the camera.*'

(18) Use of a subject relative with a reflexivized verb

Target: this is the boy that the father washes

Ze ha-yeled Se-mitkale'ax ve-aba menake oto

This the-boy that-showers-REFL and-dad cleans him

'*This is the boy that showers and dad cleans him.*'

(19) Use of a subject relative and a sentence with a coreferential

pronoun

Target: this is the mother that the girl dries

Response: Zo ha-ima Se-yoSevet ve-ha-yalda menagevet ota

This the-mother that-sits and-the-girl dries her

'*This is the mother that sits and the girl dries her off.*'

(20) Object doubling

Zo ha-yalda Se-ha-safta mesareket et ha-yalda

This the-girl that-the-grandma combs ACC the-girl

'*This is <u>the girl</u> that grandma combs <u>the girl</u>.*'

There were 12 ungrammatical relative clauses: 9 included doubling of the relative head (example (20)), and 2 of the subject relatives that were produced instead of an object relative were ungrammatical – one included a resumptive pronoun in subject position, the other included doubling of the relative head in subject position. The children with hearing impairment produced significantly

more ungrammatical responses compared to the control group, who produced only a single ungrammatical relative clause out of 280, $t(39) = 5.10$, $p < .0001$.

Subject relatives. The production of subject relative clauses was better than that of the object relatives, but still not without errors. Out of 130 target subject relatives, 113 were produced correctly, and 17 (13%) were ungrammatical (see Table 5). The main error types in subject relatives were 10 sentences with a resumptive pronoun in embedded subject position (recall, that resumptive pronouns are illicit in Hebrew in the highest embedded subject position, Shlonsky, 1992), and 3 doublings of the head (which together formed 7% of the responses when subject relatives were targeted). The control participants produced less than 2% of their subject relatives with a resumptive pronoun (5/280), and did not make any doubling errors. One subject relative was produced as a grammatical reduced relative.

Table 5
Distribution of responses in the picture description task, target subject relatives

Participants		Grammatical	Ungrammatical		
		subject relative	subject relative with RP	doubling	other
Hearing impaired	13 participants 130 sentences	87% (113)	7% (10)	2% (3)	3% (4)
Control	28 participants 280 sentences	89% (275)	2% (5)		

RP = resumptive pronoun

Doubling errors and ungrammatical resumptive pronouns

When examining doubling errors and resumptive pronouns in subject position, combining the subject relatives that were produced when the target was a subject relative, and when the target was an object relative, a clear and important pattern emerges. As seen in Figure 2, unlike the control participants who hardly ever produced a resumptive pronoun in subject position, and did not produce any doubling of the relative head in subject position, the children with hearing impairment produced doubling in 3% of their responses, and resumptive pronouns in subject position in 8% of their responses.

Similarly, the children with hearing impairment produced doubling errors in object position in 8% of the object relatives they produced (or tried to produce), whereas the control participants produced only a single doubling error (out of 275 object relatives).
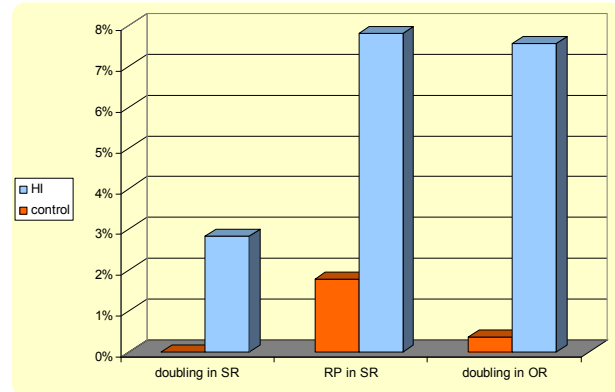

Figure 2. Ungrammatical resumptive pronouns and doubling in subject position in subject relatives, and doubling in object position in object relatives.

The use of resumptive pronouns in object relatives in the two elicitation tasks

The two elicitation methods yielded similar results. In both of them the children with hearing impairment showed difficulty in the production of object relatives, which was evinced in three ways: production of object relatives with a resumptive pronoun, avoiding the production of object relatives, and production of ungrammatical sentences.

In both experiments the children with hearing impairment differed significantly from the control group with respect to the use of resumptive pronouns: while the children with hearing impairment produced mainly object relatives with resumptive pronouns in both elicitation tasks, most of the object relatives produced by the control group were without resumptive pronouns, as can be seen in Figure 3.
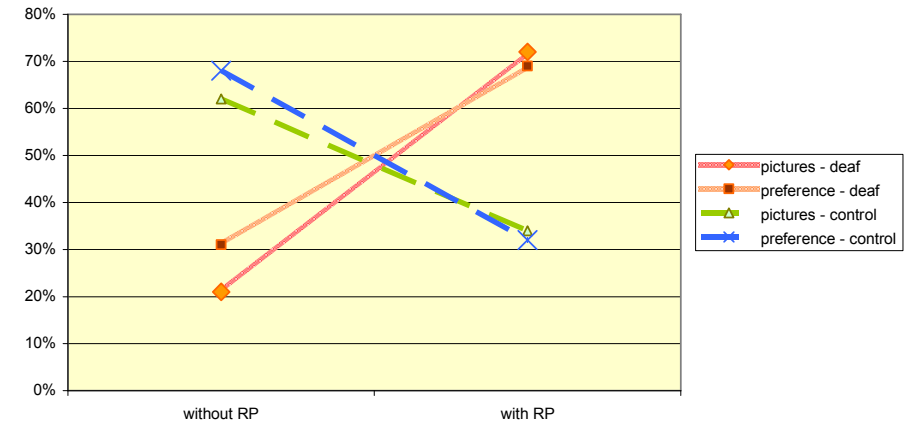
Figure 3. Percent production of grammatical object relatives with and without resumptive pronouns in the two relative clause elicitation tasks.

Comprehension of object relatives with a resumptive pronoun

The results of the production tasks thus show that resumptive pronouns function as last resort for the production of relative clauses. Do resumptive pronouns function as last resort in comprehension? Some preliminary data suggest that they do. For eight of the participants, we ran an additional test in which we compared the comprehension of object relatives with and without resumptive pronouns in sentence-picture matching task. The addition of a resumptive pronoun in object position in object relative clauses significantly improved their comprehension, $t(7) = 3.52$, $p = .01$. Whereas these children with hearing impairment were only 73% correct on object relatives without a resumptive pronoun, they were 94% correct when the object relative included a resumptive pronoun in object position. All but one of the eight participants performed between 95% and 100% correct on the object relatives when they appeared with a resumptive pronoun in object position.

Discussion

Resumptive pronouns have been claimed to occur when movement is blocked (Aoun & Choueiri, 1996; Aoun, Choueiri & Hornstein, 2001; Borer, 1984; Grolla, 2005; McKee & McDaniel, 2001; Shlonsky, 1992; Varlokosta & Armon-Lotem, 1998). This has been suggested with respect to intact syntax, in syntactic contexts that disallow movement. The main result of the current study is that resumptive pronouns are used as a last resort when movement is blocked for other reasons as well – namely, when movement is impaired. In the current study, individuals who are impaired in A-bar movement as a result of their hearing impairment, which prevented them from the necessary exposure to language at the critical period, were shown to rely heavily on the use of resumptive pronouns in the production of object relatives. Their use of resumptive pronouns in production is far more prevalent than that of healthy speakers of the same age (and similarly to 3-5 year olds, Günzberg-Kerbel, Shvimer, & Friedmann, in press; Varlokosta & Armon-Lotem, 1998). Moreover, their considerable difficulties in comprehension of relative clauses were substantially reduced when they were presented with object relatives that included a resumptive pronoun in object position.

Hornstein's (2001) proposal states that pronouns in general are always last-resort elements, inserted by the computational system when a derivation would otherwise crash. Let us examine the consequences of such a proposal for individuals who have a deficit in movement. Suppose that in the course of the derivation of a relative clause, the grammar of these speakers is supposed to perform syntactic movement, but cannot do so. Under Hornstein's account, the computational system would recognize that the derivation is about to crash, and insert a pronoun in place of the launching-site of movement. One important aspect of this approach is that derivations with and without resumptive pronouns begin with the same numeration (i.e. the same set of lexical items). Since pronouns are inserted in the course of the derivation, they are never present in

the initial lexical array. This is crucial, since such an approach does not require the speaker to know "in advance" that syntactic movement is going to fail, and preselect a resumptive pronoun from the lexicon. Rather, the derivation begins as any movement-based derivation of a relative clause would, and the subsequent failure of movement triggers the insertion of the pronoun.

Under this assumption, the preference of the individuals with movement impairment to produce object relatives with a pronoun in object position supports the idea that such pronouns are true resumptives in Hebrew. Unlike the analysis for Greek, which was also assumed for Hebrew by Varlokosta and Armon-Lotem (1998), object relatives with a resumptive pronoun are not derived by movement, but rather represent cases of true resumption.

Crucially, the insertion of resumptive pronouns occurred not only in object position, where it is licit, but also in subject positions, where a gap is required in intact syntax (Shlonsky, 1992). This constitutes perhaps even stronger evidence that it is the blocking of movement, due to the impairment, that causes the insertion of resumptive pronouns and licenses it. The production of a subject relative with a resumptive pronoun in embedded subject position is not grammatical, and is not included in the linguistic input that these children encounter (it is not a sentential environment in which movement is ruled out by syntax, and therefore it is not a context in which resumptive pronoun are normally used). However, a deficit that relates to A-bar movement blocks movement in this environment too, and yields the insertion of a resumptive pronoun.

This finding also bears on some discussion in linguistics which concerned the question of whether subject relative clauses and subject Wh questions indeed include movement (Agbayani, 2000; Chomsky, 1986; Clements, McCloskey, Maling, & Zaenen, 1983). The production of resumptive pronouns in embedded subject position in subject relative clauses by the participants in this study supports the idea of vacuous movement in subject relatives: namely, that even

subject relatives include movement, from subject position (see Friedmann, 2002 for a similar argument in support of movement in subject Wh questions from agrammatic aphasia, and Varlokosta & Armon-Lotem, 1998, for findings from acquisition regarding resumptive pronouns in subject position in subject relatives). This is also supported by the occurrence of doubling errors in embedded subject position.

Doubling errors occurred in the speech of the children with hearing impairment in both subject position and in embedded object position (this has also been reported for object relatives written by individuals with hearing impairment, Geis, 1973). Seen within recent development in syntactic theory, the existence of doubling errors of objects and subjects in relative clauses might be taken as a surprising source of support for the Copy Theory of Movement. This recent idea, promoted by Chomsky (1995, 2000, 2001; Hornstein & Nunes, 2002; Nunes, 2001), suggests that movement operations should be understood a little differently than before: rather than displacement, the Copy Theory considers movement as a creation of a copy (or a chain of identical copies) of the displaced constituent. Its identification as "movement" in the history of linguistic theory is a result of phonological restrictions that (usually) cause only the upper (i.e. leftmost) copy to be pronounced. We usually do not see evidence for these copies in unimpaired adult speech (but see Bošković & Nunes, 2002); however, the speech of children with hearing impairment in this study provides a rare look into this mechanism when it fails and produces instances of sentences in which the lower copies are not deleted, and more than one copy is pronounced. Within the new framework, these errors can be interpreted as a creation of a copy without subsequently deleting a lower copy.

This view of syntax suggests an interesting way to look at the deficit of children with hearing impairment. Under the assumption that syntax passes the chain to PF without privileging any members of the chain for pronunciation, it is PF alone that is responsible for whether the lowest, relative-clause internal copy in the chain will be phonologically overt (i.e., a pronoun or a doubled NP) or null

(i.e., a "pure" trace). One could conjecture that it is exactly this component, PF, that is impaired in children with hearing impairment.[3]

The results reported by McKee and McDaniel (2001) may provide further evidence pointing in this direction. In the experiment they conducted, English-speaking children of ages 3;5-8;11 sometimes produced such copies of the nominal head in bound variable position. However, statistical analysis proved that this phenomenon was significantly more widespread in positions which allowed movement than in positions which did not. In the latter case, the children resorted almost exclusively to gaps or pronouns. This supports the view that these copies are in fact pronunciations of the bottom link of a chain, since they were largely restricted to cases where such a chain would be licit (e.g. not within Strong Islands).

Another important theoretical issue relates to the finding that the hearing impaired children produced copies of the nominal head itself. If these are cases of pronunciation of the bottom link in a syntactic chain, this pertains to a long-standing debate in linguistic theory, regarding the derivation of relative constructions. Under the conventional view (Chomsky, 1965, 1977), the relative clause is an adjunct which attaches to the nominal head. Though syntactic movement is involved, it is *movement of an operator* (overt or phonetically-null) from within the clause to the periphery of the relative clause. The alternative analysis, following Vergnaud (1974) and Kayne (1994) (see Sauerland 2000 for a discussion), takes the relative head of the relative clause itself to have moved out of a thematic position within the relative clause. The finding that the

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[3] Additional possible corroboration for the phonological underpinnings for the deficit comes from time-frame considerations. Friedmann and Szterman (2006) found that only children who had hearing aids fitted before the age of eight months show normal comprehension of relative clauses, even of object relatives without a resumptive pronoun. This suggests that there is a critical period involved in the reported deficit. Interestingly, this critical period coincides with another phonological phenomenon that occurs in the same time frame: the decline in the ability to discriminate non-native speech contrasts as a function of specific language experience and the establishing of native phonetic distinctions on the basis of language experience (Eilers, Gavin, & Wilson, 1979; Werker & Tees, 2002). Is this critical period phonological, rather than syntactic in nature? Is it possible that the lack of exposure to language causes a problem in the establishment of the native phonetic distinctions, which, in turn, impairs the PF, an impairment that later causes deficits in copies? This is quite speculative at this point, yet interesting.

participants actually produced a copy of the relative head itself lends support to the relative-head movement analysis of the derivation of relative clauses.

Finally, some interesting differences between the children with hearing impairment reported in this study and another group which has a syntactic deficit, namely individuals with agrammatic aphasia, shed light on the source of both types of impairments and the differences between them. Like individuals with agrammatism, individuals with hearing impairment fail in sentence-picture matching tasks of object relatives and topicalization sentences (see Friedmann & Shapiro, 2003 for comprehension of these structures in Hebrew). However, unlike individuals with agrammatism, who cannot produce any type of embedded clauses (Friedmann 1998, 2006), children with hearing impairment can and do produce both relative clauses and sentences with sentential complements. This suggests that the deficit in each of the two populations stems from a different source. While in agrammatism the upper node in the syntactic tree, CP, which is responsible for the production of embedded sentences, is inaccessible (Tree Pruning Hypothesis, Friedmann, 2001, 2006), children with hearing impairment can access this node; their deficit is probably related to syntactic movement and the non-canonicity of the argument order. This is evinced in the fact that the agrammatic speakers can produce neither subject relatives nor object relatives, whereas the children with hearing impairment show better production of subject relatives. This is also supported by the massive reliance of the hearing impaired on resumptive pronouns, which allows the production of a relative clause without recourse to syntactic movement, though still making use of the upper node CP. Agrammatic aphasics do not produce any type of relative clause and do not use resumptive pronouns because these too require the CP node. A further difference between this group and individuals with agrammatism is that the comprehension of object relatives in Hebrew-speaking individuals with agrammatism does not improve with the addition of a resumptive pronoun (Friedmann, in press). This shows that whereas the syntactic deficit in children with hearing impairment is directly

related to movement, the deficit in agrammatism is related to the CP node (only, or in addition to a deficit in movement): an object relative with a resumptive pronoun also includes an operator in the upper syntactic node, CP, and a relative head above CP (or within it, see Hulsey & Sauerland, in press). This is not a problem for children with hearing impairment, because in sentences with a resumptive pronoun there is no movement, and the operator is base-generated in CP. It is, however, a problem for individuals with agrammatism, because CP is inaccessible to them, and therefore they cannot understand object relatives with resumptive pronouns.

Another interesting difference can be seen when comparing the production of relative clauses of the children with hearing impairment in this study with that of children with syntactic SLI. Both groups demonstrate poor comprehension of object relatives (without resumptive pronouns) and of topicalization structures (Adams, 1990; Friedmann & Novogrodsky, 2004, in press; Håkansson & Hansson, 2000; Levy & Friedmann, in press; Novogrodsky & Friedmann, 2003; Stavrakaki, 2001), and both groups have difficulties in the production of object relatives, but are not impaired in the production of embedded structures without movement (at least at school age, Friedmann & Novogrodsky, 2003; Novogrodsky & Friedmann, 2006). These similarities suggest that both groups suffer a deficit related to A-bar movement, but do not suffer a deficit in the CP node (unlike in agrammatism). However, the exact locus of their deficit in A-bar movement is different: the hearing impaired group cannot construct the structures with movement, as elucidated in their better comprehension of object relatives with resumptive pronouns, in the reliance on production of sentences without movement, including relatives with resumptive pronouns, and in the abundance of ungrammatical structures they produce when they try to construct object relatives; but the children with syntactic SLI *can* construct structures with movement, and probably even a representation of the trace (see Friedmann, Gvion, & Novogrodsky, 2006; Friedmann & Novogrodsky, in press). We believe that what the children with SLI cannot do is transfer thematic roles in

sentences that include A-bar chains. This is manifested in their pattern of production in relative clause elicitation tasks of the type presented in the current study: unlike the children with hearing impairment, the children with S-SLI produce mainly grammatical sentences, but refrain from producing sentences that require the assignment of two thematic roles via chains. They produce less resumptive pronouns in object relatives than the hearing impaired children, and more subject relatives and subject relatives with arbitrary pro subject (Novogrodsky & Friedmann, 2006).

To summarize, the analysis of the speech production of children with hearing impairment who have a deficit in movement sheds light on several key questions in syntactic theory. Firstly, their overuse of resumptive pronouns, both in licit environments (such as object relatives) as well as in illicit environments, suggests that resumptive pronouns can be used when movement is blocked not only by Strong Islands in intact speech but also when movement is blocked due to a deficit in movement. Secondly, the children produced lower copies in relative clauses, supporting recent suggestions regarding the Copy Theory of Movement.

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