



הפקולטה למדעי הרוח ע"ש לסטר וסאלי אנטין

كلية العلوم الإنسانية على اسم ليستر وسالي انتين

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**EARLY RESUMPTIVE PRONOUNS IN HEBREW RELATIVE CLAUSES: PRODUCTION AND
COMPREHENSION PREFERENCES**

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October 2022

ABSTRACT

Resumptive pronouns (RPs) are pronouns appearing at the tail of filler-gap dependencies (FGDs). In Hebrew, they are obligatory in object-of-preposition relative clauses (RCs), both argumental and adverbial, with the RP cliticized to the preposition. In addition, they can appear either post-verbally (in-situ), or immediately after the RC-initial complementizer (early RPs).

A prominent finding regarding the processing of FGDs is that the parser actively posits a gap as soon as possible, a strategy referred to as “active filler”. Two proposals have been put forth regarding the motivation guiding the parser in this strategy: A **structurally motivated** parser, positing a gap in any syntactically viable position; and a **thematically motivated** parser, positing a gap where a thematic role can be assigned to it. Altering the thematic motivation to a more general *semantic* motivation will allow to include interpretation of adverbs that do not receive thematic roles from the verb. Under this option, the parser attempts to maximize **semantic interpretation**, and will posit a gap at points where semantic interpretation can be reached.

To investigate the parser’s motivation, I contrasted *argumental* with *adverbial RCs* in acceptability and production experiments. Since in argumental RCs, the filler must be maintained until the verb for semantic interpretation, I hypothesized that early RPs will not be beneficial; they will not be rated higher than in-situ RPs, and will not be produced in high rates. In the case of adverbial fillers, semantic interpretation does not depend on the properties of a specific verb, as they are not selected by it, and therefore early resolution will be preferred.

The acceptability results revealed that both early and in-situ RPs are acceptable in argumental RCs, whereas RPs in-situ are strongly dispreferred in adverbial RCs. The production results show that, though acceptable, early argumental RPs are seldom produced. These findings support the hypothesis that the parser is motivated to maximize semantic interpretation. Hence early

argumental RPs, despite being a grammatical option in Hebrew, are not beneficial to comprehenders or producers. In contrast, adverbial RCs are not dependent on the verb, and can therefore employ the early RP mechanism for immediate resolution.

ACKNOWLEDGEMENTS

My first debt is to my wonderful, kind and incredibly wise advisor Prof. Aya Meltzer-Asscher, for her guidance throughout the entirety of this work and quite frankly throughout the entirety of my path in linguistics. I thank her not only for her academic guidance, and for reading, editing, discussing, and re-reading this study countless times, for which there are not nearly enough superlatives to describe my gratitude, but also for her kindness, boundless patience, devotion and for always knowing what to say to keep me on the right track. Without her, I could never have dreamed to uncover the passion I have for linguistics, and to have survived what seemed to have been the impossibility of completing a master's degree. Thank you, Aya, for making linguistics a dream come true.

A special appreciation is due to those who contributed insightful feedback and advice despite not having official affiliation to this study. Many thanks to Dr. Irena Botwinik, for discussing and improving my analysis of the data collected in this study. To Prof. Mira Ariel for comments, reviews and for inspiring much of initial steps of this study through her extensive work on resumptive pronouns in Hebrew. And to both for being an incredible inspiration for my path in linguistics. I could not possibly describe in words the depth of my gratitude to Dr. Maayan Keshev, who imparted all the knowledge she could to help me integrate into the Psycholinguistics lab. Thank you Maayan, for your kindness, patience, and support in my first steps as an MA student, and for your continued interest and insight in every discussion we have.

I would like to thank current and former faculty members in the linguistics department at Tel Aviv University: Prof. Einat Shetreet, Prof. Tali Siloni, Dr. Evan Cohen, Dr. Nirit Kadmon, Prof. Roni Katzir, Dr. Ezer Rasin, Prof. Julia Horvath, Prof. Outi Bat-El Foux, who were all a part in my path to finishing this work.

Without Ruti Zussman our linguistics department could not exist; thank you Ruti, for everything.

To my colleagues who became my friends, Naama Gidron and Mandy Cartner, thank you for keeping me such wonderful company in both happy and trying times; thank you for listening and providing helpful feedback to every version of this work that came to my mind.

To my dear friends/family who are my family/friends: Dani Koesterich, Eden Amran and Feli Liberty (mentioned in alphabetical order), you are my life. Thank you for supporting me, always.

To those who will remain in my thoughts only, thank you.

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1. INTRODUCTION

Language processing and production involve integration between multiple linguistic components in a sentence, in both short and long dependencies. One such example is Filler-Gap dependencies (FGDs), used across languages to create constituent questions, relative clauses (RCs) and other structures. FGDs are an unbounded dependency in which there is a relation between an element that has been displaced from its canonical position, referred to as the ‘filler’, and the canonical, thematic position of the displaced element, the ‘gap’. This is exemplified in (1), in which the NP ‘the book’ is the filler, and it forms a dependency with the post verbal position, the gap.

(1) Lucy read [NP the book]_i that Lisa bought ____i / it_i

As shown in (1), the canonical position of the filler can either remain phonologically empty, i.e. remain a gap, or be realized as a resumptive pronoun (RP), a pronoun at the tail of the unbounded dependency. These RPs are grammatical in some, but not all languages. Languages in which RPs are grammatical are often referred to as *Grammaticalized Resumption languages* (e.g. Hebrew, Palestinian Arabic, Irish), though the distribution of their permissibility still varies depending on the construction and the syntactic position of relativization. Languages in which RPs are ungrammatical were termed *Intrusive Resumption languages* (e.g. Turkish, Korean, English). It can be noted though, that despite being judged as ungrammatical, RPs are nonetheless attested in production in these languages (Sells, 1984; Han et al., 2012; McCloskey, 2017b; Morgan & Wagers, 2018, among others).

Hebrew is a grammaticized resumption language, as RPs are permitted, and even obligatory, in some constructions. Moreover, in addition to their in-situ position, RPs in Hebrew can occur

earlier in the structure, as discussed in 1.1. below. The production and comprehension of these early RPs has received little to no attention in the literature. However, uncovering the factors that affect their distribution can provide insight into the mechanisms responsible for the production and comprehension of FGDs in general.

The remainder of the Introduction is structured as follows: first, I will introduce the distribution of RPs in Hebrew (section 1.1), followed by an overview of early RPs in the literature (section 1.2). I will then move on to discuss the parser's active-filler strategy and how early RPs can inform us as to the parser's motivation in this strategy (section 1.3). Finally, I will present the current research and discuss early RPs in object of preposition relative clauses in Hebrew, and the ways in which their existence can be helpful in further determining the parser's motivation in its active-filler strategy.

Following the Introduction, I will present the three experiments that were conducted in the current study. The first experiment is an acceptability ratings task aimed at determining the general acceptability of early RPs as compared with RPs in-situ in argumental versus adverbial object of preposition RCs in Hebrew (chapter 2). The second experiment is a production task testing the production of early RPs in the same environments tested in Experiment 1 (chapter 3). The third experiment aimed to reveal the acceptability of gaps in object of preposition RCs; such structures were produced in Experiment 2, though they are typically thought to be ungrammatical in Hebrew (chapter 4). Finally, in chapter 5 I will discuss the results of all three experiments in relation to the phenomena presented in the introduction.

1.1 RPs in Hebrew Relative Clauses

In Hebrew, RPs are ungrammatical in questions, and optional or obligatory in RCs. In RCs, they are ungrammatical in unembedded subject positions and optional in the direct object position. As shown in (2a-b), RPs in object of preposition RCs are often assumed to be obligatory (e.g. Borer, 1984; but c.f. Ariel, 1999). Additionally, in Hebrew the RP can appear pre-verbally, in the position following the complementizer *še-* ‘that’, as in (2c) (‘early RP’ henceforth¹).

(2) Indirect Objects (IO) RCs:

a. RP in-situ

ze ha-ma’amar *še-*iyanti **bo** etmol
this the-article that-browsed.1SG in-it.3MS yesterday

b. *Gap

*ze ha-ma’amar *še-*iyanti __ etmol
this the-article that-browsed.1SG __ yesterday

a. Early RP

ze ha-ma’amar (*še-*) **bo** iyanti etmol
this the-article (that-) in-it.3MS browsed.1SG yesterday

Intended meaning of (a-c): ‘this is the article that I browsed yesterday.’

In addition to indirect object (IO) RCs as in (2), Hebrew exhibits another type of object of preposition RC, namely relativization of adverbials. For example, in (3) the locative adverbial *makom* ‘place’ is relativized and serves as the RC head. These constructions have seldom been investigated, and their grammaticality status is unclear. Presumably, their grammaticality status is

¹ Early RPs are sometimes referred to as ‘fronted RPs’, but I will refrain from doing so, as that assumes an underlying structure that I do not necessarily hold by.

identical to that of indirect object RCs, as they are both oblique RCs. This study hopes to shed additional light on this.

(3) Adverbial:

a. **?RP in-situ**

?ze ha-makom še-xiyaxti **bo** etmol
this the-place that-smiled.1SG in.it yesterday

a. ***Gap**

*ze ha-makom še-xiyaxti __ etmol
this the-place that-smiled.1SG __ yesterday

b. **Early RP**

ze ha-makom (še-)**bo** xiyaxti etmol
this the-place that-in.it smiled.1SG yesterday
intended meaning of (a-c): ‘this is the place where I smiled yesterday.’

Theoretical syntax as well as psycholinguistic research have investigated the factors that affect the distribution of RPs across and within languages (e.g. for Hebrew, theoretical accounts: e.g. Doron, 1982; Borer, 1984; Shlonsky, 1992; Erteschik-Shir, 1992; Ariel, 1999; Sichel, 2014; McCloskey, 2017. Experimental studies: e.g. Keshev & Meltzer-Asscher, 2017; Fadlon et al., 2018; Fadlon et al., 2019. for a recent review see Meltzer-Asscher, 2021). Additionally, different analyses have been suggested for the derivation of gaps and RPs (Sells, 1984; McCloskey, 2017). As a simple overview, gaps are standardly thought to be derived by movement, while RPs have been proposed to be derived through a binding mechanism (Sells, 1987). This has been claimed mainly relying on the fact that gaps are impermissible in island constructions, whereas RPs have

been argued to ameliorate island effects (demonstrated both in theoretical work e.g. Erteschik-Shir, 1992 and experimental work e.g. Keshev & Meltzer-Asscher, 2017). Crucially though, the current study will not assume a particular analysis, as the derivation of gaps as compared with RPs is orthogonal to the processing considerations relevant here; Regardless of the derivation, speakers and comprehenders must reach a co-referential interpretation of the RC head with the RC-internal (gap or RP) position.

1.2 Early RPs

Very little research was dedicated to Hebrew RCs with early RPs, so not much is known about the factors affecting the distribution of these early RPs, the linguistic mechanism that motivates their production, the processing involved in their comprehension, or what occurs at the post-verbal integration site in these constructions.

1.2.1 In theoretical syntax

Doron (1982) suggests that an early RP is the product of topicalization (see also Friedman, Belletti & Rizzi 2020), whereas Borer (1984) suggests they are pronominal operators. Fox (1994) differentiates between early RPs with and without the complementizer *še-*. According to his analysis, an early RP preceded by the complementizer *še-* (the focus of the current study) is a fronted-topicalized RP, whereas an early RP not preceded by the complementizer is a pronominal RC operator licensing the empty category at the post-verbal position. Importantly, in most of this research, early RPs were used as evidence supporting some general theory of RPs and/or wh-movement, and were not directly investigated in their own right.

1.2.2 *In sentence processing*

Fadlon et al. (2018) is the only experimental study I found that has tested early RPs, but like in theoretical syntax, here too the goal of the study was not to investigate early RPs, but rather to test the hypothesis that post-verbal direct object (DO) RPs are not in actual free variation with gaps, as they incur a processing cost (reflecting reanalysis). Sentences with pre-verbal (that is, early) RPs served as baseline conditions. Three experiments were conducted in this study: A self-paced reading (SPR) task (exp. 1), SPR + an acceptability judgment task (exp. 2) and a production task (exp. 3). In the study, post-verbal DO RPs were indeed judged as less acceptable than gaps, supporting the proposal that gaps and RPs are not in actual free variation even in Hebrew, a grammatical resumption language in which DO RPs are frequently referred to as optional (especially in theoretical syntax). More relevant to the current discussion, early RPs in DO RCs were judged to be as acceptable as early RPs in IO RCs and for IO RCs early RPs were not judged significantly different than RPs in-situ (exp. 2). However, in the production task, only around 10-15% of responses included early RPs. This asymmetry between acceptability and production is further investigated in the current study and a possible explanation for it is explored. To this end, it is worth noting that in Fadlon et al. (2018)'s experiment all RC heads were *argumental* NPs and not adverbials.

1.2.3 *Preliminary corpus search and the argument/adverb distinction*

Before running formal experiments on Hebrew early RPs, I wanted to get a sense of their everyday use. To do that, I carried out a small-scale, informal Hebrew corpus search using the sketchEngine: heTenTen14 corpus. Relying on Ariel (1999), the primary goal was to investigate a potential pattern of the RC head type occurring with early RPs. One step was therefore to search

for RPs cliticized to different prepositions following the clause initial complementizer in Hebrew RCs. The four prepositions that were chosen were *be-* ‘in’, *me-* ‘to’, *al* ‘on’ and *el* ‘toward’, in both genders and number inflections (e.g. *še-bo* ‘that-in-him’, *še-ba* ‘that-in-her’, *še-bahem* ‘that-in-them.M’, *še-bahen* ‘that-in-them.F’). The search revealed that early RPs are used most frequently with adverbial – locative, temporal and manner - RC heads, for example (4-6). It is worth noting that early RPs did also occur, though rarely, with argumental RC heads, as shown in (7).

(4) ha-nativ **še-bo** al pi ha-emuna huval yešu lifnei še-huca la-horeg

the-path that-in.it according to the-faith was.led.3SG Jesus before that-was executed.3SG

‘The path in which according to the (Christian) faith, Jesus was led to his execution’

(5) orxei ha-iton nexsafim la-raayonot ha-yecirati’im be-šalav **še-bo** medubar adain be-sirtut

editors the-newspaper exposed to-the-ideas the-creative in-stage that-in.it talked-about still

in-sketch

‘The newspaper editors are exposed to the creative ideas at a stage during which they are

still considered a sketch’

(6) medubar be-derex klal be-tkufa **še-ba** at nimcet adain be-bet ha-xolim

talked-about in-way general in-period that-in.it you.2SG located still in-house the-sick.PL

‘The time period discussed is usually one during which you are still in the hospital’

(7) ha-še’ela ha-ikarit **še-ba** yeš le-haxri’a hi...

the-question the-main that-in.it must to-determine she...

‘the main question that needs to be determined...’

This suggested that early RPs are not in free variation with their in-situ counterparts, and that a modifier/argument distinction with regard to early RPs is necessary.

A basic characterization of the modifier/argument distinction, provided by Schütze (1995) (following others, e.g. Jackendoff, 1977; Marantz, 1984; Pollard & Sag, 1987; Grimshaw, 1990) is the following: *A phrase is an **argument** of a verb if its semantic contribution to the meaning of the sentence depends on the particular identity of the verb.* For example, in (8), each verb represents a unique action and the semantic contribution of the direct object NP ‘a book’ highly depends on the particular verb in a given sentence.

(8) I {read/wrote/stole}_v [a book]_P enthusiastically

In contrast, *A phrase is a **modifier** or adverb if its semantic contribution is relatively constant across a range of sentences in which it combines with different verbs.* So, in (8) the modifier ‘enthusiastically’ can be interpreted similarly across all three verbs, and its semantic contribution remains relatively constant. It does not receive a theta role from the verb; rather, it is itself a predicate, predicated on the entire event.


1.3 The Active Filler Strategy

In this research I aimed to explore early RPs in Hebrew from a sentence processing perspective. One of the most prominent findings regarding the processing of FGDs is that the parser actively posits a gap as soon as possible, a strategy referred to as “active filler”, as defined in (9) (Stowe, 1986; Frazier & Clifton, 1989; Traxler & Pickering, 1996; Boland et al., 1995).

(9) **Active Filler Hypothesis:** When a filler has been identified, rank the option of assigning it to a gap above all other options. (as cited in Frazier & Clifton, 1989)

That is, when the parser encounters a filler, it actively searches for a gap position to which it can be assigned. The parser hypothesizes that there is a gap in the first position where there *might* be one and will retract this hypothesis only if subsequent input provides bottom-up evidence disconfirming it. In other words, it predicts a gap as opposed to a lexical NP in potential base positions. For instance, in (10) the dependency is likely to be constructed before the parser encounters the word ‘yesterday’. That is, the parser does not wait for unequivocal evidence that this position is indeed the empty canonical position of the displaced element, but rather assumes it is immediately upon reaching the transitive verb ‘read’.²

(10) I bought [_{NP} the book]_i that Lucy read ____i yesterday



The Active Filler strategy gives rise to different processing effects. One such effect is the *filled-gap* effect, a processing slow-down measured on a lexical NP that appears in a potential gap site. In (11), for example, a slow-down is expected to be measured on the NP ‘a review’ since this post-verbal position is a potential gap site for the filler NP ‘the book’ (as shown in 10). The parser posits a gap after the verb ‘read’ and must retract this hypothesis when it encounters the NP ‘a review’ that provides bottom-up evidence against its initial parse (as the gap actually appears following the preposition ‘about’)³.

(11) I bought [_{NP} the book]_i that Lucy read **a review** about ____i yesterday

² The question of whether the association is between the filler and the verb (‘direct association’ e.g. Pickering & Barry, 1991; Pickering, 1994) or the filler and a gap in the verb’s complement position (‘indirect association’ e.g. De Vincenzi, 1991; Frazier & Clifton, 1989; Gibson & Hickok, 1993; Nakano, Felser, & Clahsen, 2002; Nicol, 1993; Nicol & Swinney, 1989; Stowe, 1986) has been addressed in the literature. This study assumes ‘indirect association’.

³ Interestingly, it is debated whether the filled-gap effect occurs also in the subject position, e.g. where the lexical NP ‘Lucy’ appears in (10-11) (see Stowe (1986) and Lee (2004) for discussion).

The filled-gap effect has been shown cross-linguistically (e.g. Japanese: Aoshima et al. 2004; Hebrew: Keshev & Meltzer-Asscher, 2017; Dutch: Frazier, 1987; Frazier & Flores d Arcais, 1989; Kaan, 1997; Russian: Sekerina, 2003; Hungarian: Radó, 1999; Italian: De Vincenzi, 1991; German: Schlesewsky, Fanselow, Kliegl, & Krems, 2000; English: Stowe, 1986). Other evidence for the active filler strategy was observed in different experimental paradigms (ERP: Garnsey et al. 1989; Eye Tracking: Traxler & Pickering, 1996; Stops making sense SPR: Boland et al., 1995).

One possible underlying reason for the parser's active filler strategy is the relative complexity in processing filler-gap dependencies, which goes beyond the effort required for processing simple phrase structure. In FGDs, the filler must be held with at least some of its features in working memory, while simultaneously processing intervening material, and upon reaching its integration site, the parser must also retrieve other relevant features of the filler that were not maintained throughout the dependency, and integrate the filler with the verb (Gordon et al., 2002; Wagers & Phillips, 2014; Ness & Meltzer-Asscher, 2017; 2019). Consequently, the parser attempts to resolve this complex dependency as soon as possible. That is, it seems trivial that the parser would be motivated to close FGDs as quickly as possible, since retaining the filler is a difficult task. But what remains to be determined is what exactly is “difficult” for the parser in maintaining the filler – is it maintaining an element not attached to the syntactic tree of the sentence? Is it maintaining an element which has not received an interpretation? In other words, what motivates the parser in the Active Filler strategy?

Two proposals have been put forth regarding the motivation guiding the parser in this strategy. The first assumes a **structurally motivated** parser, positing a gap in the first syntactically viable position (e.g. de Vincenzi, 1991). In other words, gap creation is a means of its own, as the parser

attempts to associate the filler with some position in the structure. The second proposal assumes a **thematically motivated** parser, positing a gap where a thematic role can be assigned to it (e.g. Altmann, 1999). Under this approach, gap creation is not an independent goal, rather it is motivated by the need to fulfill a thematic constraint, e.g. Pritchett 1992's Theta Attachment constraint presented in (12).

(12) **Theta Attachment:** The theta criterion attempts to be satisfied at every point during processing given the maximal theta grid (Pritchett, 1992)

Note, that a theta attachment-type constraint relates solely to dependencies between a predicate and its arguments, as arguments are the only elements that receive thematic roles. Indeed, much of the existing experimental work on the parser's motivation in the Active Filler strategy has investigated argumental relative clauses, in which associating the filler with its base position is crucial for interpretation by means of theta role assignment. However, sentence processing involves dependencies and associations with non-argumental elements as well, namely for our purposes, adverbial modification relations. Whereas for argumental fillers theta-role assignment and semantic interpretation are not necessarily distinct, adverbs do not receive thematic roles, and therefore their interpretation does not depend on a particular verb.

Altering the thematic motivation to a more general **semantic motivation** will allow to include interpretation of adverbs. Under this option, the parser attempts to maximize semantic interpretation, and will posit a gap at points where semantic interpretation can be reached. For arguments, this typically happens at the verb, but this is not necessarily the case for adverbs.

1.4 The current research: Early RPs and gaps in object of preposition RCs

To investigate the parser's motivation, I made use of the properties of Hebrew mentioned above: (a) the possibility of *early* and *in-situ* RPs which allows to distinguish between the structural and the semantic approach; and (b) *the argument/adverb distinction* which allows to disentangle the theta-role assignment motivation from a more general semantic interpretation motivation. I contrasted *argumental* with *adverbial* RCs in acceptability and production experiments.

Since in argumental RCs, the filler must be maintained until the verb for theta-role assignment through which it receives its semantic interpretation, the thematic/semantic motivation accounts predict that early RPs will not be beneficial; they will not be rated higher than in-situ RPs, and will not be produced in high rates. In the case of adverbial fillers, semantic interpretation does not depend on the properties of a specific verb, as they are not selected for by it, and therefore, according to the thematic/semantic motivation account, early resolution will be preferred. Notably though, the thematic motivation approach makes no clear prediction regarding adverbial RCs, since adverbial fillers do not receive thematic roles (but possibly early RPs should not be preferred to RPs in-situ, as there is no clear motivation for this preference).

In contrast, under a structural motivation approach, early RPs should be preferred to RPs in-situ in adverbial RCs but also in argumental RCs, since the parser's motivation is primarily to structurally close the FGD, regardless of semantic interpretation, and structure can be reached at this point in the dependency in both argumental and adverbial RCs.

A summary of the predictions is available in Table 1:

	Structural	Thematic	Semantic
Argumental	early >> in situ	in situ >> early	in situ >> early
Adverbial	early >> in situ	early = in situ??	early >> in situ

Table 1. predictions.

To test these predictions, I ran three experiments: two acceptability ratings experiments (Sections 2 and 3) and one production experiment (Section 4). I also ran a self-paced reading experiment which will be briefly discussed (in Appendix F) as it was halted part way.

2. EXPERIMENT 1: ACCEPTABILITY A - EARLY RPS VS. RPS IN-SITU

Experiment 1 was an **offline acceptability rating task**, conducted to determine whether argumental RCs differ in the preferred RP position from adverbial RCs. If the parser's aim to is to reach semantic interpretation, early RPs are expected to be preferred only in adverbial RCs, because the adverbial is more loosely attached to the verb, and only in this case, the filler can be interpreted before the verb is encountered. In contrast, if the parser is structurally guided early RPs are expected to be preferred in both argumental and adverbial RCs, since the structural benefit of early resolution is identical in both cases.

2.1 Method

Participants

Forty Hebrew speakers, aged 18-43 (M = 25.2), participated in the experiment and were paid 10 NIS upon completing the experiment. Thirty-two of them were monolingual and 8 were

bilingual native speakers of Hebrew and Russian (7) or Portuguese (1). All experiments reported in this thesis were approved by the ethics committee in Tel Aviv University.

Materials

16 sentence sets consisting of four conditions served as the experimental material for this experiment. The experiment crossed the factors: **Argument Status** – adverbial/argumental; and **RP position** – early RP/RP in-situ, in a 2x2 factorial design. A sample material set for experiment 1 is available in Table 2; the full list of stimuli is available in Appendix A). Each sentence contained an argument of a PP-selecting embedded verb, and an adverb modifying the embedded verb. In the argumental condition, the relativized NP was the PP argument of the embedded verb, whereas in the adverbial condition, the relativized NP was the adverb modifier (this is possible in Hebrew, as adverbs can be NPs headed by a preposition). Additionally, in Hebrew the word order of arguments and adverbs is relatively flexible, such that adverbs can appear adjacent to the verb, before the indirect object (e.g. “Dori believes devotedly in the conspiracy”). This allowed for the RP in-situ to appear immediately following the embedded verb in all conditions (including the adverbial conditions).

In this as well as the following experiments (2&3), all verbs in the experimental materials selected a PP internal argument, and specifically the preposition *be-* ‘in’ (verbs were taken from Botwinik-Rotem, 2004). This means that the preposition used as the head of the relativized phrase was always *be-* ‘in’. This preposition was chosen for several reasons: (a) it is the most common P occurring in PP-verb constructions in Hebrew (Botwinik-Rotem, 2004); (b) it is a morphologically

simple preposition; and (c) Ariel (1999) suggests that Hebrew is undergoing a process of grammaticalization of gaps driven primarily by this preposition.

All conditions began with a sentence initial adjunct (in the set in Table 2 this was “on the way to visit Dori”). RC subjects were always a pronoun referring to an individual mentioned in this sentence initial clause. All fillers were singular, and in every set the argument and the adverb were matched for gender. Finally, all argumental fillers were inanimate to match in animacy with adverbial fillers which are inherently inanimate.

1 Adverbial, RP in-situ

... nizkarti ba-**adikut** ha-mufrezet še-hu hitxil leha’amin **ba** ba-konspiracia

... I+remembered in-the-**devotion** the-exaggerated that-he began to-believe **in-it** in-the-conspiracy

“... *I remembered the exaggerated devotion with which he began to believe in the conspiracy*”

2 Argumental, RP in-situ

... nizkarti ba-**konspiracia** ha-mufrezet še-hu hitxil leha’amin **ba** be-adikut

... I+remembered in-the-**conspiracy** the-farfetched that-he began to-believe **in-it** in-devotion

“... *I remembered the farfetched conspiracy that he began to believe devotedly*”

3 Adverbial, early RP

... nizkarti ba-**adikut** ha-mufrezet še-**ba** hu hitxil leha’amin ba-konspiracia

... I+remembered in-the-**devotion** the-exaggerated that-**in-it** he began to-believe in-the-conspiracy

“... *I remembered the exaggerated devotion with which he began to believe in the conspiracy*”

4 Argumental, early RP

... nizkarti ba-**konspiracia** ha-mufrezet še-**ba** hu hitxil leha’amin be-adikut

... I+remembered in-the-*conspiracy* the-farfetched that-**in-it** he began to-believe in-devotion
 “... *I remembered the farfetched conspiracy that he began to believe devotedly*”

Table 2. experiments 2: sample material set.

The experimental materials were distributed across four experimental lists, such that each participant saw only one sentence from each set. All lists contained the same 32 grammatical filler sentences which included, among others, sentences with subject RCs, DO RCs and sentential complements. This was done in order to blur the experimental manipulation and to keep filler sentences at a similar complexity level as the experimental materials. Overall, each participant saw a total of 48 sentences.

Procedure

The experiment was conducted using the online experiment platform PCIBex (Zehr & Schwarz, 2018). Participants read sentences and had to rate their level of acceptability in Hebrew on a 7-point Likert scale, with no time limit. The experiment began with five practice trials to allow participants to get used to the method. Zero variance performance was the exclusion criterion for this study, and no participants were excluded.

2.2 Results

Results are presented in Table 3 and Figure 1.

	early-RP	RP in-situ
Adverbial	4.88 (1.85)	3.92 (1.95)
Argumental	4.58 (1.85)	5.15 (1.83)

Table 3. Mean rating (SD) of early-RPs vs. RPs in-situ in argumental vs. adverbial RCs.

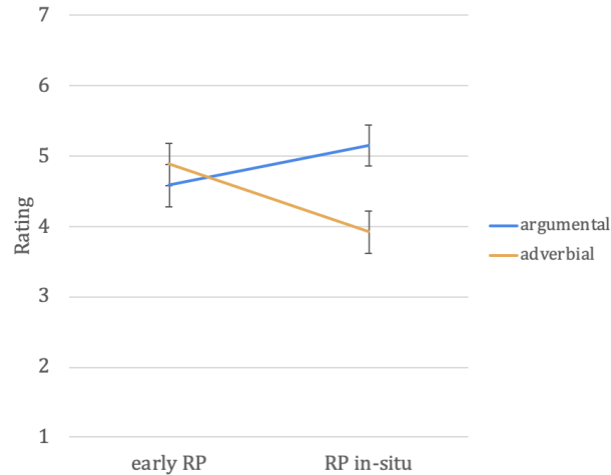


Figure 1. Mean rating of early-RPs vs. RPs in-situ in argumental vs. adverbial RCs. Error bars represent +/- 1 standard error.

A by-participants 2x2 repeated measures ANOVA with the within-subject factors **Argument Status** (adverbial/argumental) and **RP position** (early RP/RP in-situ) was carried out. The analysis yielded no main effect of RP position [**early RP**: $M = 4.73$, $SE = 0.293$; **RP in-situ**: $M = 4.21$, $SE = 0.314$, $F(1, 39) = 0.877$, $p = .355$]. However, a significant main effect of argument status emerged [**adverbial**: $M = 4.4$, $SE = 0.309$; **argumental**: $M = 4.87$, $SE = 0.294$, $F(1, 39) = 13.183$, $p < .001$], such that sentences with adverbial RCs rendered items less acceptable than those with argumental RCs. This effect was qualified by a significant interaction between argument status and RP position [$F(1, 39) = 27.653$, $p < .001$]. Post-hoc analyses (Bonferroni-corrected) revealed the source of the interaction to be that in the **Adverbial** condition RPs in-situ were judged as significantly worse than early RPs [$p = .002$], but this difference did not reach significance in the **Argumental** condition [$p = .176$].

A by-items analysis revealed a similar pattern, though less significant. The significant effect of argument status [$F(1, 15) = 4.699$, $p = .047$] was due to the significant interaction between

argument status and RP position [$F(1, 15) = 12.429, p = .003$]. Post-hoc analyses (Bonferroni-corrected) revealed the source of the interaction to be that in the adverbial condition early RPs were judged as significantly better than RPs in-situ [$p = .047$] but this difference did not reach significance in the argumental condition [$p = 1$].

2.3 Discussion

Overall, early and in-situ RPs were judged as relatively acceptable, with scores around 5 on a 7-point scale. However, there was a marked decrease in acceptability for *RPs in-situ* in the *adverbial* condition, which received a score of less than 4. My interpretation of these results is that all these structures are grammatical, with the lower ratings from the adverbial RP in-situ not reflecting ungrammaticality, but rather a processing difficulty.

Specifically, the low ratings in this condition could possibly reflect a “clash” between the drive to resolve the structural dependency, and the drive to assign the verb’s thematic role. Upon reaching the verb in the *adverbial in-situ condition*, the parser is eager to attach an indirect argument structurally **and** to assign it a thematic role. However, the RP referring to the adverbial cannot semantically fulfill this role (one cannot believe in a devotion, i.e. devotion is not a semantically felicitous object of believing). Alternatively, the adverbial RP is initially analyzed (perhaps somewhat anomalously) as the direct object, an analysis which needs to be changed once the true indirect object appears. These processing considerations lead to a decrease in acceptability.

In contrast, in the *argumental condition*, the RP in-situ fulfills both requirements simultaneously: it resolves the structural dependency and receives the thematic role from the verb. Importantly, this does not necessarily render early RPs ungrammatical in this condition, and hence their relative acceptability. But early resolution is an unnecessary strategy, since interpretation can

only be reached at the verb in these configurations, and indeed RPs in-situ are expected to be preferred.

Given that both early and in situ RPs were shown to be grammatical possibilities for the *argumental* condition, Experiment 2 aimed to investigate the production preferences for the different RP positions. To this end, a **sentence completion task** was conducted to determine whether argument status (adverbials versus arguments) is a determining factor in the tail-type **produced** in Hebrew RCs.

3. EXPERIMENT 2: PRODUCTION

For the purposes of this study, I assume that a similar, if not the same active filler strategy is employed in production as in comprehension, relying on Gennari et al. (2012) and Fadlon et al. (2019)'s findings that demonstrate speakers' preference to resolve FGDs as quickly as possible also in production. This assumption is non-trivial and should be further corroborated experimentally and theoretically (see Momma (2021) for work on FGD production).

3.1 Method

Participants

Thirty-four native Hebrew speakers, aged 18-42 ($M = 26.32$), participated in the experiment and were paid 10 NIS upon completing the experiment. Twenty-nine of them were monolingual and 5 were bilingual native speakers of Hebrew and Russian (3), English (1) or Spanish (1).

Materials

16 sentence sets consisting of a lead-in sentence and one of two possible preambles – eliciting an argumental or an adverbial RC – served as the experimental materials for this experiment (a sample set is shown in Table 4; a full set of stimuli is available in Appendix B). The lead-in sentence included a canonical sentence containing an indirect object and an adverb. The argument condition preamble always included the same NP as the base sentence. This was not the case for the adverbial condition, as shown in Table 5. Future research should ideally control for this aspect of the materials. Here too all conditions began with a sentence initial adjunct (shown in Appendix B).

Lead-in sentence:

... dori hitxil leha'amin ba-kospiracia be-adikut

... dori began to-believe in-the-conspiracy in-devotion

Argument preamble:

huftati me-ha-*kospiracia* še-

I+was+surprised from-the-*conspiracy* that-

Adverb preamble:

huftati me-ha-*adikut* še-

I+was+surprised from-the-*devotion* that-

Table 4. a sample set for Experiment 2

Lead-in sentence:

... yoni hitrakez ba-avoda la'omek

... yoni concentrated on-the-work in-depth

Argument preamble:

he'eraxti et ha-avoda še-

Adverb preamble:

he'eraxti et ha-rama še -

I+appreciated ACC *the-work* that-

I+appreciated ACC *the-level* that-

Table 5. a sample set for Experiment 2 in which the NP in the base sentence in the adverbial condition is not identical to the adverbial filler in the preamble

The materials were distributed across four experimental lists, such that each participant saw only one preamble from each set. In order to keep the experiment short so as to prevent exhaustion, all lists contained only 4 items from each condition (a total of 8 experimental items) and 12 filler items: 6 subject RC preambles and 6 direct object RC preambles, in which RPs are not obligatory in Hebrew. This was done in order to minimize the possibility of strategy formation by participants and to keep the filler sentences at a similar level of complexity as the experimental materials. Overall, each participant completed 20 preambles.

Procedure

The experiment was conducted using the online experiment platform PCIbex (Zehr & Schwarz, 2018). Participants were presented with a lead-in sentence followed by a preamble preceding a text box which they had to complete based on the information in the lead-in sentence. The sentences remained visible until the end of each trial.

Participants were instructed to make sure that their answer mentions all the relevant details provided in the lead-in sentence. The instructions included two example sentences, each with sample correct and incorrect answers and explanations (Appendix C). Participants then completed a practice session with four practice items such that after each item its correct answer was presented. Unlike the experimental materials, which elicited the production of object of preposition relative clauses, practice items elicited the production of direct object relative clauses.

3.2 Results

No RPs were produced in the filler items (which consisted of DO RCs and Subject RCs). Responses for the experimental items were classified as containing one of the three dependency tail types – early, gap, or in-situ – or as incorrect.

Incorrect responses comprised 33.08% of responses (of which 21.32% were from the adverbial condition and 11.76% were from the argumental condition) and included: (1) use of a verb other than the one presented in the lead-in sentence (often replaced with a verb that takes a direct object rendering the RP non-obligatory); (2) completion of the complementizer *še-* as the preposition *šel* ‘of’ ‘belonging to’; (3) use of a preposition other than *be-* ‘in’; (4) subject-verb inversion. For examples of incorrect responses see Appendix D. All incorrect responses were omitted from analysis.

Table 6 presents examples of correct responses by response type of the remaining 66.92% of the trials. Table 7 and Figure 2 present the distribution of response type by condition.

	Adverbial	Argumental
RP in-situ	<u>nidamti me-ha-<i>mikco'iyut</i> še- gai da'ag</u>	<u>nizkarti ba-<i>konspiracia</i> še- dori hitxil leha'amin</u>
	lehitmace <i>ba</i>	<i>ba</i> be-adikut
	<u>I+was+amazed from-the-<i>professionalism</i> that-</u>	<u>I+remembered in-the-<i>conspiracy</i> that- Dori</u>
	Guy worried to-be-familiar <i>in-it</i>	began to-believe <i>in-it</i> in-devotion
	<i>'I was amazed by the professionalism with which</i>	<i>'I remembered the conspiracy that Dori began to</i>
	<i>Guy made sure to be familiar'</i>	<i>believe devotedly'</i>

<p>early RP</p>	<p><u>nizkarti ba-<i>adikut</i> še- <i>ba</i> dori hitxil leha'amin</u> ba-konspiracia <u>I+rememebered in-the-<i>devotion</i> that- <i>in-it</i></u> Dori began to-believe in-it in-the-conspiracy '<i>I remembered the devotion with which Dori began to believe in the conspiracy</i>'</p>	<p><u>nidamti me-ha-<i>safrut</i> še- <i>ba</i> gai da'ag lehitmace</u> <u>I+was+amazed from-the-<i>literature</i> that- <i>in-it</i></u> Guy worried to-be-familiar '<i>I was amazed by the literature that Guy made sure to be familiar with</i>'</p>
<p>gap</p>	<p><u>nizkarti ba-<i>adikut</i> še- dori hitxil leha'amin ba-</u> konspiracia <u>I+rememebered in-the-<i>devotion</i> that- Dori</u> began to-believe in-the-conspiracy '<i>I remembered the devotion with which Dori began to believe in the conspiracy</i>'</p>	<p><u>nizkarti ba-<i>konspiracia</i> še- dori hitxil leha'amin</u> <u>I+rememebered in-the-<i>conspiracy</i> that- Dori</u> began to-believe '<i>I remembered the conspiract that Dori began to believe</i>'</p>

Table 6. Example of correct responses by response type (preambles are underlined), Experiment 2.

	RP in-situ	early-RP	gap
Adverbial	9.1%	48.5%	42.4%
Argumental	85.5%	6.9%	7.6%

Table 7. Percentage of RPs in-situ, early-RPs and gaps in argumental vs. adverbial RCs, Experiment 2

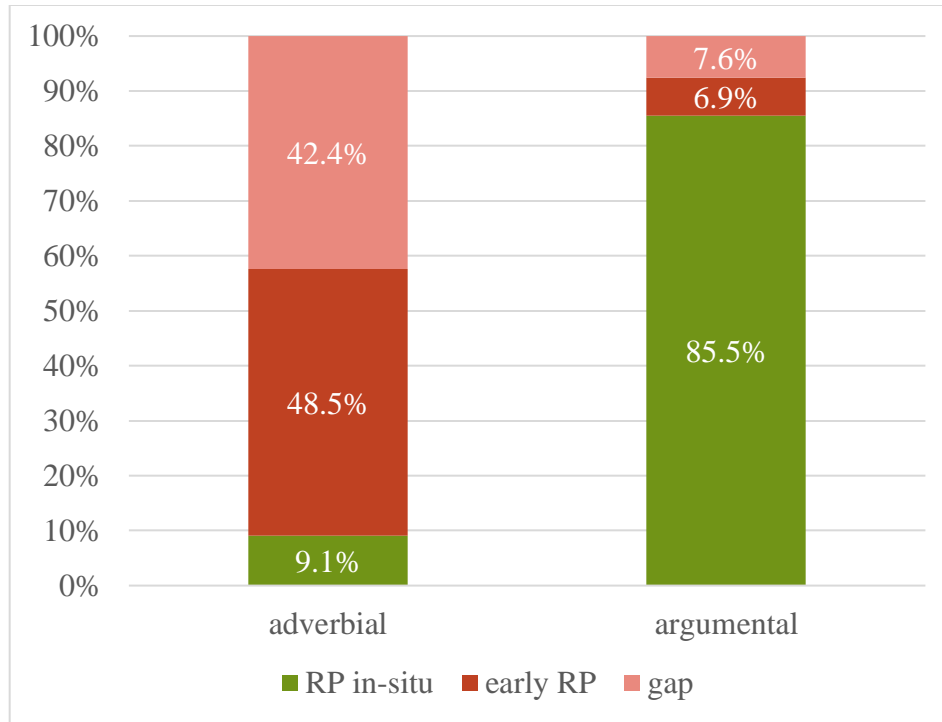


Figure 2. distribution of responses by condition, Experiment 2

Three a-priori hypotheses were assessed using paired samples t-tests with a Bonferroni adjusted alpha level of .016 per test (.05/3). By-participants results showed that that (a) RPs in-situ were produced at a significantly higher rate in the Argumental condition as compared with the Adverbial condition, $t(33) = 5.217, p < .001$; (b) early RPs were produced at a significantly higher rate in the Adverbial condition as compared with the Argumental condition, $t(33) = 5.863, p < .001$; and (c) gaps were produced at a significantly higher rate in the Adverbial condition as compared with the Argumental condition, $t(33) = 12.731, p < .001$. A by items analysis revealed the same pattern: (a) RPs in-situ were produced at a significantly higher rate in the Argumental condition as compared with the Adverbial condition, $t(7) = 13.195, p < .001$; (b) early RPs were produced at a significantly higher rate in the Adverbial condition as compared with the Argumental condition, $t(7) = 6.19, p < .001$; and (c) gaps were produced at a significantly higher rate in the Adverbial condition as compared with the Argumental condition, $t(7) = 3.528, p = .01$.

3.3 Discussion

The results of the experiment show that the rates of early RPs and gaps produced in the Adverbial condition are significantly higher than those produced in the Argumental condition. In addition, in argumental RCs there was an overwhelming preference to produce the RP in-situ, and in adverbial RCs speakers preferred to either omit the RP or produce it clause-initially. This suggests that early RPs are not in free variation with RPs in-situ, and that their distribution is restricted by the RC head type.

The findings are in line with the idea that speakers' preference for dependency resolution is at the point of semantic interpretation, also in production. Early RPs are dispreferred in **argumental** conditions, where semantic interpretation is only possible at the verb. In contrast, in **adverbials**, due to the looser association between the adverb and the verb and the fact that the semantic contribution of the adverbial is relatively constant across verbs, interpretation is possible before the verb is reached, and early RPs are therefore preferred.

4. EXPERIMENT 3: ACCEPTABILITY B - GAPS VS. RPS IN-SITU

RPs in object-of-preposition RCs are traditionally considered obligatory. Nonetheless, in Experiment 2, they were produced at very high rates (~42% of the adverbial RC productions). Additionally, Ariel (1999) in her corpus study has already shown that gaps in these configurations are in fact attested in spontaneous speech. It seems clear that gaps are an option in Hebrew production, and Experiment 2 shows that argument status also plays a role in determining their distribution in production (higher likelihood in Adverbial RCs).

Experiment 3 aimed to investigate whether gap production in RCs headed by an adverbial is a last resort strategy in production, or whether it is a grammatical option in Hebrew. An **offline**

acceptability rating task was conducted to determine whether argumental RCs differ in the preferred tail-type than adverbial RCs. If Hebrew has undergone grammaticization of gaps in adverbial RCs, then gaps should be preferred over RPs in-situ in the adverbial condition (which are unacceptable, as shown in Experiment 1), but RPs in-situ should be preferred over gaps in the argumental condition. If gaps are a last resort strategy in adverbial RCs, they should not necessarily be preferred to RPs in-situ in the adverbial conditions.

4.1 Method

Participants

Forty-one Hebrew speakers, aged 19-48 ($M = 28.78$), participated in the experiment and were paid 10 NIS upon completing the experiment. Thirty-seven of them were monolingual and 4 were bilingual native speakers of Hebrew and Russian (2), Arabic (1) or Spanish (1).

Materials

The experimental materials crossed the factors: **Argument Status** (adverbial/argumental) and **Tail Type** (gap/RP in-situ), in a 2x2 factorial design (see sample material set for experiment 3 in Table 8; a full set of the stimuli is available in Appendix X). The materials were divided into four lists in a Latin Square design. Filler items were identical to those in Experiment 1. Overall, each participant was exposed to a total of 48 sentences; 16 experimental sentences and 32 grammatical filler sentences.

1 Adverbial, RP in-situ

... nizkarti ba-*adikut* ha-mufrezet še-hu hitxil leha'amin **ba** ba-konspiracia

... I+remembered in-the-*devotion* the-exaggerated that-he began to-believe **in-it** in-the-conspiracy
 “... *I remembered the exaggerated devotion with which he began to believe in the conspiracy*”

2 Argumental, RP in-situ

... nizkarti ba-*konspiracia* ha-mufrezet še-hu hitxil leha’amin **ba** be-adikut

... I+remembered in-the-*conspiracy* the-farfetched that-he began to-believe **in-it** in-devotion

“... *I remembered the farfetched conspiracy that he began to believe devotedly*”

3 Adverbial, gap

... nizkarti ba-*adikut* ha-mufrezet še-hu hitxil leha’amin ba-konspiracia

... I+remembered in-the-*devotion* the-exaggerated that-he began to-believe in-the-conspiracy

“... *I remembered the exaggerated devotion with which he began to believe in the conspiracy*”

4 Argumental, gap

... nizkarti ba-*konspiracia* ha-mufrezet še-hu hitxil leha’amin be-adikut

... I+remembered in-the-*conspiracy* the-farfetched that-he began to-believe in-devotion

“... *I remembered the farfetched conspiracy that he began to believe devotedly*”

Table 8. Experiment 3: sample material set.

Procedure

The procedure and design of Experiment 3 was identical to that of Experiment 1.

4.2 Results

Mean acceptability ratings in the different conditions are presented in Table 9 and Figure 3.

	gap	in-situ RP
Adverbial	4.073 (1.28)	3.793 (1.19)
Argument	3.616 (1.36)	5.0 (1.05)

Table 9. Mean (SD) ratings of gaps vs. RPs in-situ in argumental vs. adverbial RCs, Experiment 3

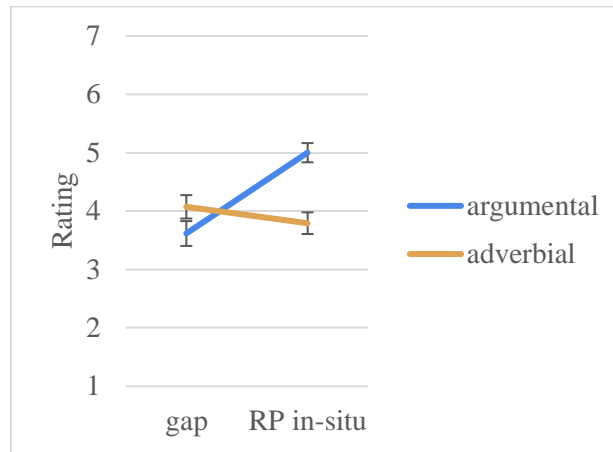


Figure 3. Mean rating of gaps vs. RPs in-situ in argument vs. adverbial RCs

A by-participants 2x2 repeated measures ANOVA with the within-subject factors **Argument Status** (adverbial/argumental) and **Tail Type** (gap/RP in-situ) was carried out. The analysis yielded a significant main effect of tail type [**gap**: $M = 3.845$, $SE = 0.317$; **RP in-situ**: $M = 4.396$, $SE = 0.301$, $F(1, 40) = 11.302$, $p = .002$] such that sentences with gaps were judged less acceptable than sentences with RPs in-situ. Additionally, a significant main effect of argument status was found [**adverbial**: $M = 3.933$, $SE = 0.308$; **argumental**: $M = 4.308$, $SE = 0.313$, $F(1, 40) = 8.246$, $p = .007$], such that sentences with adverbial RC heads rendered items less acceptable than those with argumental RC heads. These main effects were due to the significant interaction between argument status and tail type [$F(1, 40) = 17.746$, $p < .001$]. Post-hoc analyses (Bonferroni-corrected) revealed the source of the interaction to be that in the **Argumental** condition RPs in-situ were judged as significantly better than gaps [$p < .001$], but this difference was not significant in the **Adverbial** condition [$p = 1.0$].

A by-items analysis revealed a mostly similar pattern, though less significant and with no main effect for argument status [$F(1, 15) = 1.697$, $p = .212$]. A main effect of tail type [$F(1, 40) =$

12.068, $p = .003$] was due to the significant interaction between argument status and tail type [$F(1, 15) = 16.223, p = .001$]. Post-hoc analyses (Bonferroni-corrected) revealed the source of the interaction to be that in the Argumental condition RPs in-situ were rated as significantly better than gaps [$p < .001$], while this difference was not significant in the Adverbial condition [$p = 1.0$].

4.3 Discussion

The results of Experiment 3 show that overall, gaps were judged as relatively unacceptable (with ratings around 4 out of 7), this was true in the argumental as well as in the adverbial condition. This result seems to suggest that, to the extent that speakers prefer gaps to RPs in-situ in production, the parser is employing a last resort strategy, and gaps are not a grammatical option in Hebrew adverbial RCs.

An increase in acceptability was found for RPs in-situ in the *argumental* condition. In contrast, RPs in-situ in the adverbial condition were not judged as acceptable. The contrast between adverbial and argument RCs for the RP in-situ condition found in Experiment 1 was thus replicated in Experiment 3. As I proposed for Experiment 1, this contrast could reflect the “clash” between the drive to resolve the dependency, and the drive to assign the verb’s thematic role.

5. GENERAL DISCUSSION

5.1 Support for the semantic motivation for the active filler strategy

The goal of this study was to begin to define the distribution of in-situ RPs, early RPs and gaps in Hebrew RCs in which RPs are considered obligatory, namely object of preposition RCs, and to uncover the factors determining this distribution in relation to the parser’s Active Filler Strategy. Three accounts for the parser’s Active Filler strategy were considered as possible motivations: (a) **the structural motivation:** the parser attempts to resolve syntactic dependencies; (b) **the thematic**

motivation: the parser attempts to maximize thematic role assignment; (c) **the semantic motivation:** the parser attempts to maximize semantic interpretation; including, but not limited to, theta-role assignment.

The predictions for each approach are presented again in Table 10. Significant results of all three experiments are summarized in Table 11.

	Structural	Thematic	Semantic
argumental	early >> in situ	in situ >> early	in situ >> early
adverbial	early >> in situ	early = in situ??	early >> in situ

Table 10. Predictions of the different approaches

	Acceptability 1 (exp. 1)	Production	Acceptability 2 (exp. 3)
Argumental	RP in-situ = early RP	RP in-situ >> early RP, gap	RP in-situ >> gap
Adverbial	early RP >> RP in-situ	early RP, gap >> RP in-situ	RP in-situ = gap

Table 11. Summary of results from Experiments 1-3.

To summarize the results, an argument/modifier distinction in the production and comprehension of early RPs emerged, such that early RPs were preferred over RPs in-situ only in the adverbial condition. These findings provide evidence in favor of the semantic motivation for the Active Filler strategy, as only adverbs can be interpreted before the occurrence of the verb.

In acceptability, for argumental RCs, both early and in-situ RPs were judged as relatively acceptable. Early resolution is not beneficial for semantic interpretation in this case (and was

therefore not employed in production). Nonetheless, it is still a grammatical option in Hebrew, and is therefore still judged as acceptable in comprehension.

Turning to adverbial RCs, these were judged as acceptable with early resolution. However, adverbial RCs with in-situ RPs exhibited reduced acceptability. I proposed that in adverbial RCs in which early resolution was not employed, the parser is eager to resolve the dependency upon reaching the verb on the one hand, and on the other hand the parser is also eager to assign a thematic role to an argument of the transitive verb. In this scenario, the RP in-situ is possibly initially analyzed as an argument, resulting in a highly implausible or even infelicitous statement (e.g. “...*the devotion that he began to believe in*”, where believing in the devotion is at the very least odd) and once encountering the argumental lexical NP, the parser is faced with a need for structural reanalysis, leading to a decrease in acceptability.

This account could also explain why despite their relative unacceptability, gaps were produced in a high proportion in this condition. The speaker faced with conflicting motivations employs a last resort gap strategy in the adverbial condition, which is possibly not so costly, since the preposition and RP cliticized to it hold little to no semantic content. That is, in cases in which the speaker does not produce the RP early in the clause, once they reach the verb, they are faced with conflicting motivations; on the one hand, the need to resolve the adverbial FGD and on the other hand the need to attach an indirect object (as all verbs in the experiment were PP selecting verbs). Production of an RP in-situ can lead to misinterpretation of the adverbial filler as the argument of the verb. As a result, full PP and RP omission is preferred to RPs in-situ, and this is possible since the RP and the preposition it is cliticized to do not contribute much to the semantic interpretation of the clause.

In production, adverbial fillers can be interpreted early, and are therefore produced early. Additionally, speakers might refrain from in-situ RP production to avoid interpretation of the adverbial RP as an argument. Instead, they produce an early RP, which cannot yet be interpreted as an argument (and is preferred precisely because of this), or, as a last resort, they opt for a gap.

In contrast, early RPs in argumental RCs are highly dispreferred in production, since arguments depend on the verb for their semantic interpretation, and early resumption does not contribute to interpretation at this point in the dependency. Interestingly, despite the low rate of production, early RPs are still judged as acceptable. As noted in the introduction, early RPs in argumental RCs were also found in the corpus. This suggests that both early and in-situ RPs are a grammatical option in argumental RCs, and further investigation into early resolution in the current study should attempt to uncover what, if any, properties of the filler can lead to the choice of early resolution in argumental RC production.

5.2 *Directions for future research*

In the current study, the adverbial conditions included primarily manner adverbs (e.g. *adikut* ‘devotion’, *mehirut* ‘speed’), but also a number of temporal and locative adverbs (e.g. *tkufa* ‘time-period’, *comet* ‘intersection’). It is possible that different adverb RC heads pattern differently in relation to the preferred tail type and RP position, since not all adverb RCs are derived in the same manner (Ernst, 2001). Possibly, temporal and locative adverbs behave similarly to arguments, whereas manner adverbs are base-generated higher in the syntactic structure, similarly to wh-adjunct questions (i.e. *why* and *how*) (Reinhart, 1989). If this is the case, then in temporal and locative early RP constructions, the RP is a regular relative pronoun, and undergoes movement from the post verbal position to specCP. In contrast, for manner adverb RCs, the adverb is base-

generated in the clause periphery, and the complementizer *še-* is in a second COMP position (Reinhart, 1981). Such an analysis would predict that RPs in-situ in manner adverb conditions should not only be unacceptable, but entirely ungrammatical. Consequently, this would predict that early RPs should be preferred only in manner, but not necessarily in temporal and locative adverbs, a prediction worth testing further.

Moreover, to further support the need for an argument/modifier distinction, it is worth testing the behavior of early and in-situ RPs in configurations in which a typical manner adverb RC head functions as an argument of the verb. For example, in (13a) the NP *hitlahavut* ‘excitement’ is the argument of the verb *dibra* ‘spoke’, i.e. Lisa spoke about Lucy’s excitement. Relativizing the NP *hitlahavut* yields the sentence in (13b). If the argument status of the filler is the determining factor in RP location, then early resolution is not expected to be preferred in these cases.

(13) a. *lisa dibra al ha-hitlahavut ha-mugzemet šel lusi*

Lisa spoke about the-excitement the-exaggerated of Lusi

‘Lisa spoke about Lucy’s exaggerated excitement’

b. *nizkarti ba-hitlahavut šel lusi še-lisa dibra aleha*

I+remembered in-the-excitement of Lucy that-Lisa spoke about-her

‘I remembered Lucy’s excitement that Lisa spoke about’

Relatedly, if manner adverb RC structures are indeed derived differently than locative and temporal adverbs and are not base generated in a post-verbal position, then during processing, a gap is expected to be posited in the post-verbal position in temporal and locative adverb filler conditions, but not in manner adverb conditions. If this is the case, a filled-gap effect in manner adverb RCs is not predicted. So, for example in (14), no filled-gap effect is expected to be

measured on the adverb *be-axzava* ‘in disappointment’ following the embedded verb *sipra* ‘told’. However, constructions such as (14) cannot test this prediction, as a processing slow-down can also be attributed to the surprise at encountering an adverb that cannot be attached at this point in the sentence.

(14) huftati me-ha-hitlahavut še-ba dina sipra be-axzava še-ha-iša rokedet

I+was-surprised from-the-excitement that-in-it Dina told in-disappointment that-the-woman dancing

6. CONCLUSION

To conclude, in this study I investigated the production and comprehension of early RPs vs. RPs in-situ in Hebrew RCs, in order to gain insight into the parser’s motivation in its active-filler strategy. Three motivations were considered: A **structurally motivated** parser, positing a gap in any syntactically viable position; a **thematically motivated** parser, positing a gap where a thematic role can be assigned to it; and a more general *semantic* motivation, to allow interpretation of adverbs that do not receive thematic roles from the verb, under which the parser attempts to maximize **semantic interpretation**, and will posit a gap at points where semantic interpretation can be reached.

The acceptability results revealed that both early and in-situ RPs are acceptable in argumental RCs, whereas RPs in-situ are strongly dispreferred in adverbial RCs. The production results showed that, though acceptable, early argumental RPs are seldom produced. These findings support the hypothesis that the parser is motivated to maximize semantic interpretation. Hence early argumental RPs, despite being a grammatical option in Hebrew, are not beneficial to comprehenders or producers. In contrast, adverbial RCs are not dependent on the verb, and can

therefore employ the early RP mechanism for immediate resolution. Further research should test the additional predictions that emerge from the findings of this study.

APPENDIX

Appendix A: Experiment 1 materials

sentence	RP position	Argument Status	set
לפני שדן יצא מהמוזיאון, צחקתי מהתמונה המוזרה שהוא בהה בה בתמיהה	in-situ	arg	1
לפני שדן יצא מהמוזיאון, צחקתי מהתמונה המוזרה שבה הוא בהה בתמיהה	early		
לפני שדן יצא מהמוזיאון, צחקתי מהדרך המוזרה שהוא בהה בה בתמונה	in-situ	adv	
לפני שדן יצא מהמוזיאון, צחקתי מהדרך המוזרה שבה הוא בהה בתמונה	early		
בגלל שרן אהב אפנועים, הופתעתי מהמשאית הישנה שהוא התחיל להתעניין בה בהתלהבות	in-situ	arg	2
בגלל שרן אהב אפנועים, הופתעתי מהמשאית הישנה שבה הוא התחיל להתעניין בהתלהבות	early		
בגלל שרן אהב אפנועים, הופתעתי מההתלהבות המרובה שהוא התחיל להתעניין בה במשאית	in-situ	adv	
בגלל שרן אהב אפנועים, הופתעתי מההתלהבות המרובה שבה הוא התחיל להתעניין במשאית	early		
אחרי שאייל הרצה על הנושא, התפעלתי משאלת המחקר הברורה שהוא התחיל להתעסק בה בשקדנות	in-situ	arg	3
אחרי שאייל הרצה על הנושא, התפעלתי משאלת המחקר הברורה שבה הוא התחיל להתעסק בשקדנות	early		
אחרי שאייל הרצה על הנושא, התפעלתי מהשקדנות המסורה שהוא התחיל להתעסק בה בשאלת המחקר	in-situ	adv	
אחרי שאייל הרצה על הנושא, התפעלתי מהשקדנות המסורה שבה הוא התחיל להתעסק בשאלת המחקר	early		
בדרך לבקר את דורי, נזכרתי בקונספירציה המופרכת שהוא התחיל להאמין בה באדיקות	in-situ	arg	4
בדרך לבקר את דורי, נזכרתי בקונספירציה המופרכת שבה הוא התחיל להאמין באדיקות	early		
בדרך לבקר את דורי, נזכרתי באדיקות המופרות שהוא התחיל להאמין בה בקונספירציה	in-situ	adv	
בדרך לבקר את דורי, נזכרתי באדיקות המופרות שבה הוא התחיל להאמין בקונספירציה	early		
אחרי שיוסי ניצח בתחרות, התרשמתי מהמטרה המתגרת שהוא הצליח לפגוע בה בדייקנות	in-situ	arg	5
אחרי שיוסי ניצח בתחרות, התרשמתי מהמטרה המתגרת שבה הוא הצליח לפגוע בדייקנות	early		
אחרי שיוסי ניצח בתחרות, התרשמתי מהמהירות המרשימה שהוא הצליח לפגוע בה במטרה	in-situ	adv	
אחרי שיוסי ניצח בתחרות, התרשמתי מהמהירות המרשימה שבה הוא הצליח לפגוע במטרה	early		
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהספרות המעניינת שהוא דאג להתמצא בה במקצועיות	in-situ	arg	6
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהספרות המעניינת שבה הוא דאג להתמצא במקצועיות	early		
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהצורה המקצועית שהוא דאג להתמצא בה בספרות	in-situ	adv	
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהצורה המקצועית שבה הוא דאג להתמצא בספרות	early		

אחרי שמשה חזר מהתאטרון, הסתקרנתי מההצגה המבדרת שהוא זלזל בה בהפגנתיות	in-situ	arg	7
אחרי שמשה חזר מהתאטרון, הסתקרנתי מההצגה המבדרת שבה הוא זלזל בהפגנתיות	early		
אחרי שמשה חזר מהתאטרון, הסתקרנתי מהמידה המוגזמת שהוא זלזל בה בהצגה	in-situ	adv	
אחרי שמשה חזר מהתאטרון, הסתקרנתי מהמידה המוגזמת שבה הוא זלזל בהצגה	early		
לפני שיוני הגיש את הדוקטוראט, הערכתי את העבודה העניינית שהוא התרכז בה לעומק	in-situ	arg	8
לפני שיוני הגיש את הדוקטוראט, הערכתי את העבודה העניינית שבה הוא התרכז לעומק	early		
לפני שיוני הגיש את הדוקטוראט, הערכתי את הרמה המעמיקה שהוא התרכז בה בעבודה	in-situ	adv	
לפני שיוני הגיש את הדוקטוראט, הערכתי את הרמה המעמיקה שבה הוא התרכז בעבודה	early		
כשערך סיים עם המשקפת, התבוננתי ברמזור הרחוק שהוא הצליח להבחין בו בקלות	in-situ	arg	9
כשערך סיים עם המשקפת, התבוננתי ברמזור הרחוק שבו הוא הצליח להבחין בקלות	early		
כשערך סיים עם המשקפת, התבוננתי בצומת הסואן שהוא הצליח להבחין בו ברמזור	in-situ	adv	
כשערך סיים עם המשקפת, התבוננתי בצומת הסואן שבו הוא הצליח להבחין ברמזור	early		
אחרי שירון עזב סופית, הסתכלתי על החוברת העבה שהוא נהג לעיין בה באריכות	in-situ	arg	10
אחרי שירון עזב סופית, הסתכלתי על החוברת העבה שבה הוא נהג לעיין באריכות	early		
אחרי שירון עזב סופית, הסתכלתי על הפינה השקטה שהוא נהג לעיין בה בחוברת	in-situ	adv	
אחרי שירון עזב סופית, הסתכלתי על הפינה השקטה שבה הוא נהג לעיין בחוברת	early		
כשרועי עצר את הרכב, ראיתי את החתול הקטן שהוא נהג לטפל בו ברחוב	in-situ	arg	11
כשרועי עצר את הרכב, ראיתי את החתול הקטן שבו הוא נהג לטפל ברחוב	early		
כשרועי עצר את הרכב, ראיתי את הרחוב הקטן שהוא נהג לטפל בו בחתול	in-situ	adv	
כשרועי עצר את הרכב, ראיתי את הרחוב הקטן שבו הוא נהג לטפל בחתול	early		
אחרי שעידן התנגד בהתחלה, התאכזבתי מהחיקה הפוגענית שהוא התחיל לתמוך בה פתאום	in-situ	arg	12
אחרי שעידן התנגד בהתחלה, התאכזבתי מהחיקה הפוגענית שבה הוא התחיל לתמוך פתאום	early		
אחרי שעידן התנגד בהתחלה, התאכזבתי מהפתאומיות הפתאומית שהוא התחיל לתמוך בה בחקיקה	in-situ	adv	
אחרי שעידן התנגד בהתחלה, התאכזבתי מהפתאומיות הפתאומית שבה הוא התחיל לתמוך בחקיקה	early		
בגלל המייל שעידו שלח, נזכרתי בתכנית המפורטת שהוא רצה לחבל בה במשך תקופה	in-situ	arg	13
בגלל המייל שעידו שלח, נזכרתי בתכנית המפורטת שבה הוא רצה לחבל במשך תקופה	early		
בגלל המייל שעידו שלח, נזכרתי בתקופה הקצרה שהוא רצה לחבל בה בתכנית	in-situ	adv	
בגלל המייל שעידו שלח, נזכרתי בתקופה הקצרה שבה הוא רצה לחבל בתכנית	early		
בסוף האימון של אלון, הזכרתי את הציוד הכבד שהוא התעקש להיעזר בו בשבוע שעבר	in-situ	arg	14
בסוף האימון של אלון, הזכרתי את הציוד הכבד שבו הוא התעקש להיעזר בשבוע שעבר	early		
בסוף האימון של אלון, הזכרתי את השבוע המוזר שהוא התעקש להיעזר בו בציוד	in-situ	adv	
בסוף האימון של אלון, הזכרתי את השבוע המוזר שבו הוא התעקש להיעזר בציוד	early		

כשטל התפטר מהפרוייקט, דיברתי על הפלטפורמה המועילה שהוא השתמש בה בתכיפות	in-situ	arg	15
כשטל התפטר מהפרוייקט, דיברתי על הפלטפורמה המועילה שבה הוא השתמש בתכיפות	early		
כשטל התפטר מהפרוייקט, דיברתי על התדירות הגבוהה שהוא השתמש בה בפלטפורמה	in-situ	adv	
כשטל התפטר מהפרוייקט, דיברתי על התדירות הגבוהה שבה הוא השתמש בפלטפורמה	early		
כשארז פרסם את הפורטפוליו, הוקסמתי מהקולקציה המקורית שהוא התגאה בה בנחישות	in-situ	arg	16
כשארז פרסם את הפורטפוליו, הוקסמתי מהקולקציה המקורית שבה הוא התגאה בנחישות	early		
כשארז פרסם את הפורטפוליו, הוקסמתי מהנחישות המתמדת שהוא התגאה בה בקולקציה	in-situ	adv	
כשארז פרסם את הפורטפוליו, הוקסמתי מהנחישות המתמדת שבה הוא התגאה בקולקציה	early		

Appendix B: Experiment 2 materials

adverb preamble	argument preamble	base sentence
צחקתי מהדרך ש-	צחקתי מהתמונה ש-	לפני שהוא יצא מהמוזיאון, דן בהה בתמונה בתמיהה
הופתעתי מההתלהבות ש-	הופתעתי מהמשאית ש-	על אף שהוא אהב אופנועים, רן התחיל להתעניין במשאית בהתלהבות
התפעלתי מהשקדנות ש-	התפעלתי משאלת המחקר ש-	אחרי שהוא הרצה על הנושא, אייל התחיל להתעסק בשאלת המחקר בשקדנות
נזכרתי באדיקות ש-	נזכרתי בקונספירציה ש-	אחרי שהוא עבר מסע שכנוע, דורי התחיל להאמין בקונספירציה באדיקות
התרשמתי מהדייקנות ש-	התרשמתי מהמטרה ש-	לפני שהוא ניצח בתחרות, יוסי הצליח לפגוע במטרה בדייקנות
נדהמתי מהמקצועיות ש-	נדהמתי מהספרות ש-	לפני שהוא פרסם את לוח הזמנים, גיא דאג להתמצא בספרות במקצועיות
הסתקרנתי מהצורה ש-	הסתקרנתי מההצגה ש-	אחרי שהוא חזר מהתיאטרון, משה זלזל בהצגה בהפגנתיות
הערכתי את הרמה ש-	הערכתי את העבודה ש-	לפני שהוא הגיש את הדוקטוראט, יוני התרכז בעבודה לעומק
התבוננתי בצומת ש-	התבוננתי בשלט ש-	כשהוא הסתכל במשקפת, ערן הצליח להבחין ברמזור בצומת
הסתכלתי על הפינה ש-	הסתכלתי על החוברת ש-	לפני שהוא עזב סופית, ירון נהג לעיין בחוברת באריכות/בפינת הגן
ראיתי את הרחוב ש-	ראיתי את החתול ש-	כשעוד היה לו רכב, רועי נהג לטפל בחתול ברחוב
התאכזבתי מהפתאומיות ש-	התאכזבתי מהחגיגה ש-	אחרי שהוא התנגד בהתחלה, עידן התחיל לתמוך בחגיגה פתאום
נזכרתי בתקופה ש-	נזכרתי בתכנית ש-	עוד לפני שהוא שלח את המייל, עידו רצה לחבל בתכנית במשך תקופה
הזכרתי את השבוע ש-	הזכרתי את הציוד ש-	למרות שזה לא היה אופייני לו, אלון התעקש להיעזר בציוד בשבוע שעבר
דיברתי על התדירות ש-	דיברתי על הפלטפורמה ש-	לפני שהוא התפטר מהפרוייקט, טל השתמש בפלטפורמה בתכיפות
הוקסמתי מהנחישות ש-	הוקסמתי מהקולקציה ש-	כשהוא פרסם את הפורטפוליו, ארוז התגאה בקולקציה בנחישות

Appendix C: Experiment 2 instructions

הוראות:

בניסוי זה תתבקשו לקרוא משפטים על מסך מחשב, ולאחר כל משפט, להשלים משפט אחר עם פרפראזה של המשפט הראשון.

לדוגמה:

המשפט: הסופר הנודע חיבק את המוציא לאור לפני סגירת המשרד

המטלה:

נתון: שוחחתי עם המוציא לאור ש-

תשובה טובה: הסופר חיבק

כך שהמשפט השלם יהיה: שוחחתי עם המוציא לאור שהסופר חיבק

תשובה גרועה: חיבק את הסופר

כך שהמשפט השלם יהיה: שוחחתי עם המוציא לאור שחיבק את הסופר

סיבה: התשובה לא מתאימה לתוכן המשפט, הסופר חיבק את המוציא לאור ולא להיפך.

דוגמה נוספת:

המשפט: דן קטף הרבה תפוחים מהעץ בגינה האחורית אתמול

המטלה:

נתון: הופתעתי מכמות התפוחים ש-

תשובה טובה: דן קטף מהעץ בגינה האחורית אתמול

כך שהמשפט השלם יהיה: הופתעתי מכמות התפוחים שדן קטף מהעץ בגינה האחורית אתמול

תשובה גרועה: היו בעץ

כך שהמשפט השלם יהיה: הופתעתי מכמות התפוחים שהיו בעץ

סיבה: לא נעשה שימוש בפרטים הרלוונטים הנתונים במשפט הראשון.

תשובה גרועה: דן אסף בגינה האחורית

כך שהמשפט השלם יהיה: הופתעתי מכמות התפוחים שדן אסף בגינה האחורית

סיבה: התשובה לא מתאימה לתוכן המשפט, דן קטף תפוחים מהעץ בגינה האחורית, דן לא אסף תפוחים בגינה האחורית.

Appendix D: Experiment 2 - examples for incorrect responses

	response	preamble	lead-in sentence
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(1) verb switch	ערן ראה במשקפת	התבוננתי ברמזור ש-	כשהוא הסתכל במשקפת, ערן הצליח להבחין ברמזור בצומת
(2) <i>še-</i> → <i>šel</i>	ל אייל	התפעלתי מהשקדנות ש-	אחרי שהוא הרצה על הנושא, אייל התחיל להתעסק בשאלת המחקר
(3) preposition other than <i>be-</i>	שערן הסתכל עליה במשקפת	התבוננתי בצומת ש-	כשהוא הסתכל במשקפת, ערן הצליח להבחין

Appendix E: Experiment 3 materials

tail type	Argument status	set	sentence
in-situ	arg	1	לפני שדן יצא מהמוזיאון, צחקתי מהתמונה המוזרה שהוא בהה בה בתמיהה
gap			לפני שדן יצא מהמוזיאון, צחקתי מהתמונה המוזרה שהוא בהה בתמיהה
in-situ	adv		לפני שדן יצא מהמוזיאון, צחקתי מהדרך המוזרה שהוא בהה בה בתמונה
gap			לפני שדן יצא מהמוזיאון, צחקתי מהדרך המוזרה שהוא בהה בתמונה
in-situ	arg	2	בגלל שרן אהב אופנועים, הופתעתי מהמשאית הישנה שהוא התחיל להתעניין בה בהתלהבות
gap			בגלל שרן אהב אופנועים, הופתעתי מהמשאית הישנה שהוא התחיל להתעניין בה בהתלהבות
in-situ	adv		בגלל שרן אהב אופנועים, הופתעתי מההתלהבות המרובה שהוא התחיל להתעניין בה במשאית
gap			בגלל שרן אהב אופנועים, הופתעתי מההתלהבות המרובה שהוא התחיל להתעניין במשאית
in-situ	arg	3	אחרי שאייל הרצה על הנושא, התפעלתי משאלת המחקר הברורה שהוא התחיל להתעסק בה בשקדנות
gap			אחרי שאייל הרצה על הנושא, התפעלתי משאלת המחקר הברורה שהוא התחיל להתעסק בשקדנות
in-situ	adv		אחרי שאייל הרצה על הנושא, התפעלתי מהשקדנות המסורה שהוא התחיל להתעסק בה בשאלת המחקר
gap			אחרי שאייל הרצה על הנושא, התפעלתי מהשקדנות המסורה שהוא התחיל להתעסק בשאלת המחקר
in-situ	arg	4	בדרך לבקר את דורי, נזכרתי בקונספירציה המופרכת שהוא התחיל להאמין בה באדיקות
gap			בדרך לבקר את דורי, נזכרתי בקונספירציה המופרכת שהוא התחיל להאמין באדיקות
in-situ	adv		בדרך לבקר את דורי, נזכרתי באדיקות המופרות שהוא התחיל להאמין בה בקונספירציה
gap			בדרך לבקר את דורי, נזכרתי באדיקות המופרות שהוא התחיל להאמין בקונספירציה
in-situ	arg	5	אחרי שיוסי ניצח בתחרות, התרשמתי מהמטרה המאתגרת שהוא הצליח לפגוע בה בדייקנות
gap			אחרי שיוסי ניצח בתחרות, התרשמתי מהמטרה המאתגרת שהוא הצליח לפגוע בדייקנות
in-situ	adv		אחרי שיוסי ניצח בתחרות, התרשמתי מהמהירות המרשימה שהוא הצליח לפגוע בה במטרה

אחרי שיוסי ניצח בתחרות, התרשמתי מהמהירות המרשימה שהוא הצליח לפגוע במטרה	gap		
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהספרות המעניינת שהוא דאג להתמצא בה במקצועיות	in-situ	arg	6
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהספרות המעניינת שהוא דאג להתמצא במקצועיות	gap		
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהצורה המקצועית שהוא דאג להתמצא בה בספרות	in-situ	adv	
עוד לפני שגיא פרסם את לוח הזמנים, נדהמתי מהצורה המקצועית שהוא דאג להתמצא בספרות	gap		
אחרי שמשה חזר מהתאטרון, הסתקרנתי מההצגה המבדרת שהוא זלזל בה בהפגנתיות	in-situ	arg	7
אחרי שמשה חזר מהתאטרון, הסתקרנתי מההצגה המבדרת שהוא זלזל בהפגנתיות	gap		
אחרי שמשה חזר מהתאטרון, הסתקרנתי מהמידה המוגזמת שהוא זלזל בה בהצגה	in-situ	adv	
אחרי שמשה חזר מהתאטרון, הסתקרנתי מהמידה המוגזמת שהוא זלזל בהצגה	gap		
לפני שיוני הגיש את הדוקטוראט, הערכתי את העבודה העניינית שהוא התרכז בה לעומק	in-situ	arg	8
לפני שיוני הגיש את הדוקטוראט, הערכתי את העבודה העניינית שהוא התרכז לעומק	gap		
לפני שיוני הגיש את הדוקטוראט, הערכתי את הרמה המעמיקה שהוא התרכז בה בעבודה	in-situ	adv	
לפני שיוני הגיש את הדוקטוראט, הערכתי את הרמה המעמיקה שהוא התרכז בעבודה	gap		
כשערן סיים עם המשקפת, התבוננתי ברמזור הרחוק שהוא הצליח להבחין בו בקלות	in-situ	arg	9
כשערן סיים עם המשקפת, התבוננתי ברמזור הרחוק שהוא הצליח להבחין בקלות	gap		
כשערן סיים עם המשקפת, התבוננתי בצומת הסואן שהוא הצליח להבחין בו ברמזור	in-situ	adv	
כשערן סיים עם המשקפת, התבוננתי בצומת הסואן שהוא הצליח להבחין ברמזור	gap		
אחרי שירון עזב סופית, הסתכלתי על החוברת העבה שהוא נהג לעיין בה באריכות	in-situ	arg	10
אחרי שירון עזב סופית, הסתכלתי על החוברת העבה שהוא נהג לעיין באריכות	gap		
אחרי שירון עזב סופית, הסתכלתי על הפינה השקטה שהוא נהג לעיין בה בחוברת	in-situ	adv	
אחרי שירון עזב סופית, הסתכלתי על הפינה השקטה שהוא נהג לעיין בחוברת	gap		
כשרועי עצר את הרכב, ראיתי את החתול הקטן שהוא נהג לטפל בו ברחוב	in-situ	arg	11
כשרועי עצר את הרכב, ראיתי את החתול הקטן שהוא נהג לטפל ברחוב	gap		
כשרועי עצר את הרכב, ראיתי את הרחוב הקטן שהוא נהג לטפל בו בחתול	in-situ	adv	
כשרועי עצר את הרכב, ראיתי את הרחוב הקטן שהוא נהג לטפל בחתול	gap		
אחרי שעידן התנגד בהתחלה, התאכזבתי מהחיקה הפוגענית שהוא התחיל לתמוך בה פתאום	in-situ	arg	12
אחרי שעידן התנגד בהתחלה, התאכזבתי מהחיקה הפוגענית שהוא התחיל לתמוך פתאום	gap		
אחרי שעידן התנגד בהתחלה, התאכזבתי מהפתאומיות המוחלטת שהוא התחיל לתמוך בה בחוק	in-situ	adv	
אחרי שעידן התנגד בהתחלה, התאכזבתי מהפתאומיות המוחלטת שהוא התחיל לתמוך בחוק	gap		
בגלל המייל שעידו שלח, נזכרתי בתכנית המפורטת שהוא רצה לחבל בה במשך תקופה	in-situ	arg	13
בגלל המייל שעידו שלח, נזכרתי בתכנית המפורטת שהוא רצה לחבל במשך תקופה	gap		
בגלל המייל שעידו שלח, נזכרתי בתקופה הקצרה שהוא רצה לחבל בה בתכנית	in-situ	adv	
בגלל המייל שעידו שלח, נזכרתי בתקופה הקצרה שהוא רצה לחבל בתכנית	gap		

בסוף האימון של אלון, הזכרתי את הציוד הכבד שהוא התעקש להיעזר בו בשבוע שעבר	in-situ	arg	14
בסוף האימון של אלון, הזכרתי את הציוד הכבד שהוא התעקש להיעזר בשבוע שעבר	gap		
בסוף האימון של אלון, הזכרתי את השבוע המוזר שהוא התעקש להיעזר בו בציוד	in-situ	adv	
בסוף האימון של אלון, הזכרתי את השבוע המוזר שהוא התעקש להיעזר בציוד	gap		
כשטל התפטר מהפרוייקט, דיברתי על הפלטפורמה המועילה שהוא השתמש בה בתכיפות	in-situ	arg	15
כשטל התפטר מהפרוייקט, דיברתי על הפלטפורמה המועילה שהוא השתמש בתכיפות	gap		
כשטל התפטר מהפרוייקט, דיברתי על התדירות הגבוהה שהוא השתמש בה בפלטפורמה	in-situ	adv	
כשטל התפטר מהפרוייקט, דיברתי על התדירות הגבוהה שהוא השתמש בפלטפורמה	gap		
כשארז פרסם את הפורטפוליו, הוקסמתי מהקולקציה המקורית שהוא התגאה בה בנחישות	in-situ	arg	16
כשארז פרסם את הפורטפוליו, הוקסמתי מהקולקציה המקורית שהוא התגאה בנחישות	gap		
כשארז פרסם את הפורטפוליו, הוקסמתי מהנחישות המתמדת שהוא התגאה בה בקולקציה	in-situ	adv	
כשארז פרסם את הפורטפוליו, הוקסמתי מהנחישות המתמדת שהוא התגאה בקולקציה	gap		

Appendix F: Experiment 4 - self-paced reading

It has been shown in the FGD processing literature that the filler is maintained throughout the dependency with at least some of its features (Gordon et al., 2002; Wagers & Phillips, 2014; Ness & Meltzer-Asscher, 2017, 2019).

Stepanov & Stateva (2015) report an English SPR study (their Exp. 2) comparing embedded declarative clauses such as (15) with embedded adverb questions (or wh-adjuncts), replacing the complementizer with the wh-phrase ‘how quickly’ such as (16).

(15) The reporter didn’t know *that* the soldier shot the panel of doctors in the hospital

(16) The reporter didn't know *how quickly* the soldier shot the panel of doctors in the hospital

They measured increased reading times throughout the dependency only in the adverb-question condition. They take this to reflect a maintenance cost for the latter compared to the former and conclude that wh-adjuncts instantiate a filler-gap dependency similarly to arguments.

Thus, the experiment shows that adverbial dependencies are also resolved clause internally. However, they only compared cases with no dependency to cases with wh-adjuncts. As they did not compare wh-adjuncts to argumental dependencies, their conclusion that wh-adjuncts do indeed form a FGD similarly to arguments is not fully warranted. It is possible that, though fully resolved clause internally, in the case of adverbial dependencies, more can be done, and is done, before the verb is reached (since the interpretation of the adverb does not depend on the verb). This would entail a maintenance cost for argumental fillers, but a reduced (though present) maintenance cost for adverbial fillers.

Experiment 4 was conducted to determine whether an increased maintenance cost for holding argumental fillers in early RP configurations can be measured as compared with adverbial fillers. If an adverbial filler is, at least partially, resolved early in the RC, then these storage costs should be reduced following the RP as compared with the argumental condition, where early interpretation and therefore complete dependency resolution is not possible until after the verb is encountered.

To test this, an **online self-paced-reading task** was conducted, in which the filler, argumental or adverbial, was followed by an RC which begins with an early RP, followed by a long RC subject on which costs of filler maintenance can be measured. RTs on the subject NP of the RCs were to be compared to the same subject NP in sentences with a sentential complement, where no maintenance is necessary. If indeed early resolution is beneficial for the adverbial filler but less so for the argumental filler, then processing the subject NP should be **similar** to the sentential complement condition in the *adverbial* condition, but **longer** in the *argumental* condition.

Method

Participants

Twenty-two Hebrew speakers, aged 21-35 (M = 24.5), participated in the experiment for which they received course credit. Sixteen of them were monolingual and 6 were bilingual native speakers of Hebrew and Russian (4) or English (2).

Materials

The experimental materials consisted of 20 sentence sets, crossing the factors: **Argument Status** – adverbial/argumental; **Clause Type** – RC/sentential-complement, in a 2x2 factorial design (see sample material set in Table 12).

1 Adverbial, Relative Clause

ha-mafgin ha-da'atani hutrad me-ha-*dvekut* še-ba rov ha-ovdim ba-misrad ha-memšalti he'eminu
ba-konspiracia

the-protestor the-opinionated was+bothered from-the-*devotion* that-in-it most the-workers the-office
the-governmental believed in-the-conspiracy

*“The opinionated protestor was bothered by the devotion with which most of the governmental office
employees believed in the conspiracy”*

2 Argumental, Relative Clause

ha-mafgin ha-da'atani hutrad me-ha-*konspiracia* še-ba rov ha-ovdim ba-misrad ha-memšalti
he'eminu be-dvekut

the-protestor the-opinionated was+bothered from-the-*conspiracy* that-in-it most the-workers the-office the-governmental believed in-devotion

“The opinionated protestor was bothered by the conspiracy that most of the governmental office employees believed devotedly”

3 Adverbial, Sentential Complement

ha-mafgin ha-da’atani ta’an še-rov ha-oovdim ba-misrad ha-memšalti he’eminu ba-konspiracia be-dvekut

the-protestor the-opinionated claimed that-most the-workers the-office the-governmental believed in-the-conspiracy in-devotion

“The opinionated protestor claimed that most of the governmental office employees believed devotedly in the conspiracy”

4 Argumental, Sentential Complement

ha-mafgin ha-da’atani ta’an še-rov ha-oovdim ba-misrad ha-memšalti he’eminu be-dvekut ba-konspiracia

the-protestor the-opinionated claimed that-most the-workers the-office the-governmental believed in-devotion in-the-conspiracy

“The opinionated protestor claimed that most of the governmental office employees believed in the conspiracy devotedly”

Table 12. experiment 4: sample material set. Critical region is underlined.

Materials were divided to four lists in a Latin Square design. All lists contained the same 40 grammatical filler sentences which included, among others, sentences with subject RCs, DO RCs, sentential complements with pronouns appearing in various positions and sentences with non-filler adverbs. This was done in order to blur the experimental manipulation and to keep filler sentences

at a similar complexity level as the experimental materials. Overall, each participant saw a total of 60 sentences. The full set of stimuli is available in Appendix G.

Procedure

The experiment was conducted using the online experiment platform PCibex (Zehr, & Schwarz, 2018). Participants read sentences word-for-word at their own pace, controlling the pace by pressing the space bar. 75% of materials (both experimental and filler stimuli) were followed by a shallow yes/no comprehension question to ensure concentration. Accuracy rates were meant to constitute the experiment's exclusion criterion. The experiment began with five practice trials familiarize participants with the method.

Results

Figure 4 and Table 13 show reading times in the critical region in the different conditions. As is apparent in Figure 4 the critical region in the sentential complement conditions was read overall slower than the in the RC conditions. So, though this fact is interesting in and of itself, this pattern could not be informative regarding the research question at hand, and the experiment was halted.

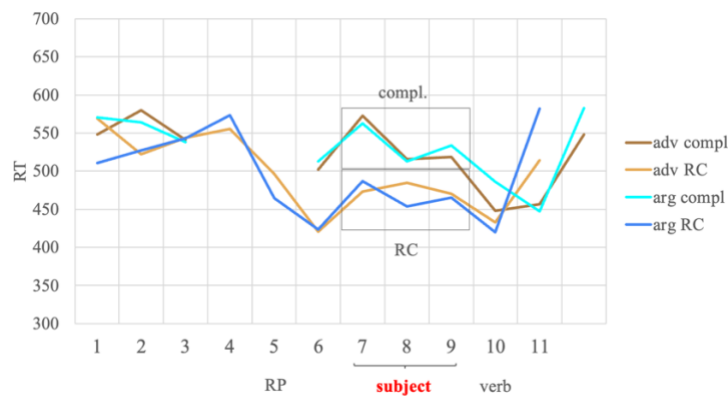


Figure 4. RTs for adverbial vs. argumental RCs and sentential complements.

		Adverb		Argument	
		Complement	RC	Complement	RC
Subject	7	572.59	472.92	562.39	486.88
	8	515.92	484.51	512.92	453.55
	9	518.71	470.22	534.01	465.3
Verb	10	447.97	433.11	485.97	419.89

Table 13. RTs for adverbial vs. argumental RCs and sentential complements.

Appendix G: Experiment 4 materials

Sentence	RP position	Argument Status	set
הצלם היהיר צחק מהתפאורה שבה כל האורחים הנלהבים מירושלים התבוננו בתדהמה	FGD	arg	1
הצלם היהיר אמר שכל האורחים הנלהבים מירושלים התבוננו בתדהמה בתפאורה	compl.		
הצלם היהיר צחק מהתדהמה שבה כל האורחים הנלהבים מירושלים התבוננו בתפאורה	FGD	adv	
הצלם היהיר אמר שכל האורחים הנלהבים מירושלים התבוננו בתפאורה בתדהמה	compl.		
המכונאי הוותיק תיאר את_ הקסדה שבה רוב האופנוענים הקשוחים מהצפון התעניינו בהתלהבות	FGD	arg	2
המכונאי הוותיק עדכן שרוב האופנוענים הקשוחים מהצפון התעניינו בהתלהבות בקסדה	compl.		
המכונאי הוותיק תיאר את_ ההתלהבות שבה רוב האופנוענים הקשוחים מהצפון התעניינו בקסדה	FGD	adv	
המכונאי הוותיק עדכן שרוב האופנוענים הקשוחים מהצפון התעניינו בקסדה בהתלהבות	compl.		
החוקר הראשי התפעל משאלת_ המחקר שבה שְׁנֵי הדוקטורנטים הצעירים במחלקה התעסקו בשקדנות	FGD	arg	3
החוקר הראשי סיפר שְׁנֵי הדוקטורנטים הצעירים במחלקה התעסקו בשקדנות בשאלת_ המחקר	compl.		
החוקר הראשי התפעל מהשקדנות שבה שְׁנֵי הדוקטורנטים הצעירים במחלקה התעסקו בשאלת_ המחקר	FGD	adv	
החוקר הראשי סיפר שְׁנֵי הדוקטורנטים הצעירים במחלקה התעסקו בשאלת_ המחקר בשקדנות	compl.		
המפגין הדעתני הוטרד מהקונספירציה שבה רוב העובדים במשרד הממשלתי האמינו בִּדְבָקוֹת	FGD	arg	4
המפגין הדעתני טען שרוב העובדים במשרד הממשלתי האמינו בִּדְבָקוֹת בקונספירציה	compl.		
המפגין הדעתני הוטרד מִהִדְבָקוֹת שבה רוב העובדים במשרד הממשלתי האמינו בקונספירציה	FGD	adv	
המפגין הדעתני טען שרוב העובדים במשרד הממשלתי האמינו בקונספירציה בִּדְבָקוֹת	compl.		
המתקרה הידידותי נדהם מהקפיצה שבה רוב הספורטאים האמיצים מגרמניה הצליחו במיומנות	FGD	arg	5
המתקרה הידידותי הודיע שרוב הספורטאים האמיצים מגרמניה הצליחו במיומנות בקפיצה	compl.		

המתקרה הידידותי נדהם מהמיומנות שבה רוב הספורטאים האמיצים מגרמניה הצליחו בקפיצה	FGD	adv	6
המתקרה הידידותי הודיע שרוב הספורטאים האמיצים מגרמניה הצליחו בקפיצה במיומנות	compl.		
השחקן השקט הובך מהתלבושת שבה שְׁנִי הצופים הפטפטנים מהיציע התמקדו בהתרסה	FGD	arg	
השחקן השקט גילה שְׁנִי הצופים הפטפטנים מהיציע התמקדו בהתרסה בתלבושת	compl.		
השחקן השקט הובך מההתרסה שבה שְׁנִי הצופים הפטפטנים מהיציע התמקדו בתלבושת	FGD	adv	
השחקן השקט גילה שְׁנִי הצופים הפטפטנים מהיציע התמקדו בהתרסה	compl.		
המתרגל החרוץ סיפר על המלגה שבה כל הסטודנטים המצטיינים מהתכנית נעזרו לתקופה	FGD	arg	7
המתרגל החרוץ האמין שכל הסטודנטים המצטיינים מהתכנית נעזרו לתקופה במלגה	compl.		
המתרגל החרוץ סיפר על התקופה שבה כל הסטודנטים המצטיינים מהתכנית נעזרו במלגה	FGD	adv	
המתרגל החרוץ האמין שכל הסטודנטים המצטיינים מהתכנית נעזרו במלגה לתקופה	compl.		8
השוטר החששן בהה פְּאֵלָה שבה שְׁנִי העבריינים הפיקחים מרעננה השתמשו בזירת הפשע	FGD	arg	
השוטר החששן קלט שְׁנִי העבריינים הפיקחים מרעננה השתמשו בזירת הפשע פְּאֵלָה	compl.		
השוטר החששן בהה בזירת הפשע שבה שְׁנִי העבריינים הפיקחים מרעננה השתמשו פְּאֵלָה	FGD	adv	
השוטר החששן קלט שְׁנִי העבריינים הפיקחים מרעננה השתמשו פְּאֵלָה בזירת הפשע	compl.		9
הגרפיקאי הנמרץ התעצבן מהיצירה שבה כל המאיירים המוכשרים מאיטליה קינאו בקטגוריות	FGD	arg	
הגרפיקאי הנמרץ חשב שכל המאיירים המוכשרים מאיטליה קינאו בקטגוריות ביצירה	compl.		
הגרפיקאי הנמרץ התעצבן מהקטגוריות שבה כל המאיירים המוכשרים מאיטליה קינאו ביצירה	FGD	adv	
הגרפיקאי הנמרץ חשב שכל המאיירים המוכשרים מאיטליה קינאו בקטגוריות	compl.		10
הוותריןר המסור חזר לחתולה שבה רוב הדיירים הזקנים מהשכונה טיפלו בחצר	FGD	arg	
הוותריןר המסור אמר שרוב הדיירים הזקנים מהשכונה טיפלו בחצר בחתולה	compl.		
הוותריןר המסור חזר לחצר שבה רוב הדיירים הזקנים מהשכונה טיפלו בחתולה	FGD	adv	
הוותריןר המסור אמר שרוב הדיירים הזקנים מהשכונה טיפלו בחתולה בחצר	compl.		11
הלוביסט התשוש נחרד מהחיקה שבה רוב השרים השמרנים בממשלה תמכו בפתאומיות	FGD	arg	
הלוביסט התשוש חשף שרוב השרים השמרנים בממשלה תמכו בפתאומיות בחקיקה	compl.		
הלוביסט התשוש נחרד מהפתאומיות שבה רוב השרים השמרנים בממשלה תמכו בחקיקה	FGD	adv	12
הלוביסט התשוש חשף שרוב השרים השמרנים בממשלה תמכו בחקיקה בפתאומיות	compl.		
המְנַפֵּ"ל האדיש התעלם מהתכנית שבה שְׁנִי המנהלים התחמנים מהחברה חיבלו בערמומיות	FGD	arg	
המְנַפֵּ"ל האדיש חשש שְׁנִי המנהלים התחמנים מהחברה חיבלו בערמומיות בתכנית	compl.		13
המְנַפֵּ"ל האדיש התעלם מהערמומיות שבה שְׁנִי המנהלים התחמנים מהחברה חיבלו בתכנית	FGD	adv	
המְנַפֵּ"ל האדיש חשש שְׁנִי המנהלים התחמנים מהחברה חיבלו בתכנית בערמומיות	compl.		
המאמן הסבלני נזכר בציד שבו שְׁנִי המתעמלים העקשנים מגבעתיים נעזרו בשבוע שעבר	FGD	arg	13
המאמן הסבלני נזכר שְׁנִי המתעמלים העקשנים מגבעתיים נעזרו בשבוע שציד	compl.		
המאמן הסבלני נזכר בשבוע שבו שְׁנִי המתעמלים העקשנים מגבעתיים נעזרו בציד	FGD	adv	

המאמן הסבלני נזכר שִׁשְׁנֵי המתעמלים העקשנים מגבעתיים נעזרו בציווד בשבוע_ שעבר	compl.		
המִתְקַנֵּת החדש התרשם מהפלטפורמה שבה כל העובדים הקודמים בפרוייקט שלטו במקצועיות	FGD	arg	14
המִתְקַנֵּת החדש הבין שכל העובדים הקודמים בפרוייקט שלטו במקצועיות בפלטפורמה	compl.		
המִתְקַנֵּת החדש התרשם מהמקצועיות שבה כל העובדים הקודמים בפרוייקט שלטו בפלטפורמה	FGD	adv	
המִתְקַנֵּת החדש הבין שכל העובדים הקודמים בפרוייקט שלטו בפלטפורמה במקצועיות	compl.		
הברמן החששן נזכר במשחק שבו רוב המהמרים השיכורים מִהְפֵּךְ השתתפו בערב	FGD	arg	15
הברמן החששן גילה שרוב המהמרים השיכורים מִהְפֵּךְ השתתפו בערב במשחק	compl.		
הברמן החששן נזכר בערב שבו רוב המהמרים השיכורים מִהְפֵּךְ השתתפו במשחק	FGD	adv	
הברמן החששן גילה שרוב המהמרים השיכורים מִהְפֵּךְ השתתפו במשחק בערב	compl.		
הילד הביישן התלהב מהמגבעת שבה כל הליצנים המצחיקים והמשעשעים שיחקו במסיבה	FGD	arg	16
הילד הביישן שמח שכל הליצנים המצחיקים והמשעשעים שיחקו במסיבה במגבעת	compl.		
הילד הביישן התלהב מהמסיבה שבה כל הליצנים המצחיקים והמשעשעים שיחקו במגבעת	FGD	adv	
הילד הביישן שמח שכל הליצנים המצחיקים והמשעשעים שיחקו במגבעת במסיבה	compl.		
המורה המתוסכל תיאר את_ הכדור שבו שני התלמידים המופרעים מהשכבה בעטו בבוקר	FGD	arg	17
המורה המתוסכל חשד שִׁשְׁנֵי הנערים המופרעים מהשכבה בעטו בבוקר בכדור	compl.		
המורה המתוסכל תיאר את_ הבוקר שבו שני הנערים המופרעים מהשכבה בעטו בכדור	FGD	adv	
המורה המתוסכל חשד שִׁשְׁנֵי הנערים המופרעים מהשכבה בעטו בכדור בבוקר	compl.		
האמן הלחוצן דיבר על_ הפסל שבו זוג המבקרים החצופים מתל_ אביב נגעו באירוע	FGD	arg	18
האמן הלחוצן פחד שזוג המבקרים החצופים מתל_ אביב נגעו באירוע בפסל	compl.		
האמן הלחוצן דיבר על_ האירוע שבו זוג המבקרים החצופים מתל_ אביב נגעו בפסל	FGD	adv	
האמן הלחוצן פחד שזוג המבקרים החצופים מתל_ אביב נגעו בפסל באירוע	compl.		
הסוהר המבוהל דיווח על_ החלון שבו שני האסירים העצבניים והאלימים חבטו בלילה	FGD	arg	19
הסוהר המבוהל גילה שִׁשְׁנֵי האסירים העצבניים והאלימים חבטו בלילה בחלון	compl.		
הסוהר המבוהל דיווח על_ הלילה שבו שני האסירים העצבניים והאלימים חבטו בחלון	FGD	adv	
הסוהר המבוהל גילה שִׁשְׁנֵי האסירים העצבניים והאלימים חבטו בחלון בלילה	compl.		
היום התמהוני תיאר את_ המוצר שבו כל המשקיעים העשירים והבררניים זלזלו בכנס	FGD	arg	20
היום התמהוני גילה שכל המשקיעים העשירים והבררניים זלזלו במוצר	compl.		
היום התמהוני תיאר את_ הכנס שבו כל המשקיעים העשירים והבררניים זלזלו במוצר	FGD	adv	
היום התמהוני גילה שכל המשקיעים העשירים והבררניים זלזלו במוצר בכנס	compl.		

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תקציר

כינוי גוף חוזר (resumptive pronoun, כג"ח) הינו כינוי גוף בזנב תלות פילר-גאפ (filler-gap dependency). בעברית, כג"חים הכרחיים בפסוקיות זיקת מושא-יחסי ארגומנטליות (argumental) ואדורביאליות (adverbial, תואר-פועל). בנוסף, כג"חים יכולים להופיע בתר-פעלית (in-situ, אינסיטו) או מיד לאחר מילת השיעבוד בתחילת הפסוקית (early RP, כג"ח מוקדם).

ממצא בולט במחקר על עיבוד תלויות פילר-גאפ הוא שהמעבד מניח גאפ בהקדם האפשרי באופן אקטיבי, אסטרטגיה שנקראת אקטיב-פילר (active-filler). שתי אפשרויות הוצעו בספרות למוטיבציית המעבד באסטרטגיה זו: **מעבד מונחה מבנית** (structurally motivated) יניח גאפ בכל עמדה תחבירית אפשרית; **מעבד מונחה תמטית** (thematically motivated) יניח גאפ בעמדה שבה תפקיד תמטי יכול להיות מוענק לו. שינוי המוטיבציה התמטית למוטיבציה סמנטית כללית יותר תאפשר לכלול גם אינטרפרטציה של אדורביים, שאינם מקבלים תפקיד תמטי מהפועל. תחת גישה זו, המעבד מבקש למקסם **אינטרפרטציה סמנטית**, ועל כן יניח גאפ בנקודות שבהן ניתן להגיע לאינטרפרטציה כזו.

על מנת לחקור את מוטיבציית המעבד, השויתי בין זיקות ארגומנטליות לזיקות אדורביאליות בניסויי קבילות והפקה. משום שבזיקות ארגומנטליות הפילר מוחזק עד הפועל לאינטרפרטציה סמנטית, השערתי היא שכג"חים מוקדמים לא תורמים; על כן, אין ציפייה שידורגו גבוה מכג"חים אינסיטו, או שיופקו בשיעור גבוה. לעומת זאת, אינטרפרטציה של זיקות אדורביאליות לא נשענות על תכונות הפועל הספציפי, ועל כן תועדף סגירת תלות מוקדמת.

תוצאות ניסוי הקבילות חשפו כי הן כג"חים מוקדמים והן כג"חים אינסיטו קבילים בזיקות ארגומנטליות, לעומת כג"חים אינסיטו בזיקות אדורביאליות שדורגו בעדיפות נמוכה. תוצאות ניסוי ההפקה חשפו כי, אמנם קבילים, כג"חים ארגומנטליים מוקדמים מופקים בתדירות נמוכה. ממצאים אלו תומכים בהיפותזה על פיה מוטיבציית המעבד היא מקסום אינטרפרטציה סמנטית. על כן, כג"חים ארגומנטליים מוקדמים אמנם דקדוקיים בעברית, אך אינם יעילים לדוברים. לעומת זאת, זיקות אדורביאליות לא נשענות על הפועל, ועל כן ניתן להשתמש בכג"חים מוקדמים לפתירת התלות מוקדם.



הפקולטה למדעי הרוח ע"ש לסטר וסאלי אנטין

كلية العلوم الإنسانية على اسم ليستر وسالي انتين

The Lester and Sally Entin Faculty of Humanities

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על ידי

ניקי קוסטרייך

עבודה בהדרכת

פרופ' איה מלצר-אשר

אוקטובר 2022