It depends: Optionality in the production of filler-gap dependencies

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ABSTRACT

This study investigates the language production mechanisms underlying the creation of filler-gap dependencies (e.g., relative clauses: *This is the boy that the girl from Norway saw_ yesterday*), which require speakers to establish an argument-predicate relationship between a phrase, the 'filler', (*the boy*) and a further embedded predicate (*saw*). We show that filler-gap dependency production involves the retention of a representation of the filler until the relevant embedded position. We then report three elicitation experiments examining how English and Hebrew speakers manage and moderate filler retention demands via production choices. In Experiments 1 (English) and 2 (Hebrew), speakers produced restrictive relative clauses and non-restrictive relative clauses with the latter predicted to impede filler retention. In Experiment 3 (Hebrew), speakers produced relative clauses with and without intervening material creating interference for filler retention. We found that English speakers use passivization to moderate filler-retention demands via the creation of shorter dependencies. In Hebrew, impeded filler retention resulted in increased rate of grammatical resumption. We conclude that the production of filler-gap dependencies invokes cognitive strategies that manage the memory burdens that they impose.

Introduction

Language production involves complex procedures, including the mapping of abstract notions to lexically represented concepts and the integration of these items into grammatically well-formed structures (Bock & Levelt, 1994; Dell, Chang, & Griffin, 1999; Garrett, 1988; Levelt, 1999, among many others). Central to this complexity are the many micro-decisions speakers make during this process. Studying the circumstances and considerations leading speakers to prefer one production alternative over another is hence fundamental to understanding the subtleties of the production system.

Like many other production processes, structure building often requires speakers to decide between several constructions permitted by their grammar. For example, when describing a pushing incident between a girl and a boy, speakers choose whether to produce an active sentence (*The girl pushed the boy*) or a passive sentence (*The boy was pushed by the girl*). In some contexts, they can choose between using a full noun phrase (*the boy*) or a pronoun (*him*) to refer to the pushed party. If they wish to also report the boy's emotional reaction, they can do so using coordination (*The girl pushed the boy and he is crying*) or by using a subordinate clause (*The boy that the girl pushed is crying*). This clause can also be encoded in different ways. For example, English speakers can either use or omit the word *that* from their description and

Hebrew speakers can either produce a resumptive pronoun after the verb *pushed* (*The boy that the girl pushed* him *is crying*) or leave the direct object unpronounced.

This paper focuses on a particular structural relationship that gives rise to optionality in production, namely *filler-gap dependencies* (also referred to as *long distance* or *unbounded* dependencies). This type of construction includes an argument-predicate relationship between a phrase (the *filler*, as in *the secretary*, *which book*, and *the brown cow* in 1–3) and a predicate (*stalked*, *brought*, *from* in 1–3) in a deeper (i.e., further embedded) position. The position in which the filler is interpreted remains unpronounced and is dubbed the *gap*. Examples (1)–(3) present three structures exhibiting this type of dependency. In what follows, fillers are italicized, clause boundaries are indicated by square brackets and gap sites are represented as underscores.

(1) This is *the secretary* that [John told us [_ stalked the manager]]. (Relative clause)
(2) *Which book* did [the teacher think [the student brought _ to class]]? (wh-question)
(3) It was *the brown cow* [that the chocolate milk had come from _]. (Cleft)

Existing research on the processing of filler-gap dependencies has

mainly investigated how they are parsed during comprehension. Evidence from cross-modal priming and probe-identification studies indicate that during comprehension, the semantic representation of the filler decays throughout the dependency and is reactivated at the gap (Love & Swinney, 1996; McElree, 2000; Nicol & Swinney, 1989; Nicol, Fodor, & Swinney, 1994). In addition, it is well-established that comprehenders process filler-gap dependencies 'actively' by positing a gap at the first possible position without waiting for conclusive evidence for a missing argument (Frazier, 1987; Garnsey, Tanenhaus, & Chapman, 1989; Lee, 2004; Omaki & Schulz, 2011; Phillips, 2006; Stowe, 1986; Traxler & Pickering, 1996; Wagers & Phillips, 2009, 2014, among others; for a comprehensive review see Phillips & Wagers, 2007). Wagers and Phillips (2014) propose a model that accounts for the accumulated findings on dependency comprehension by assuming two complementary processes: maintenance of some of the filler's features throughout processing of the dependency; and retrieval of the other features (including the full semantic representation of the filler) upon its resolution.

In contrast, much is still unknown about the mechanisms underlying the production of filler-gap dependencies. In what follows we argue that the production of utterances which include filler-gap dependencies must involve retention of some representation of the filler throughout the generation of the dependency. We then report a series of experiments designed to identify how this demand modulates production choices during the formation of object relative clauses in English (Experiment 1) and Hebrew (Experiments 2 and 3), two SVO languages allowing different sets of possibilities for the creation of structures with filler-gap dependencies.

Background

Dependency production demands filler retention

As explained above, in filler-gap dependencies, a phrase (the filler) is not fully interpreted where it occurs, but rather in a different position, which typically remains unpronounced. In (1)–(3), for example, the phrases *the secretary*, *which book* and *the brown cow* are respectively interpreted as the arguments of the predicates *stalk*, *bring* and *from*, embedded two clauses deeper. Crucially for our purposes, in English (and other languages) *stalk*, *bring* and *from* cannot occur with missing arguments in the absence of a filler-gap dependency. The argument structure information associated with these predicates, typically assumed to be represented at the lemma level or on a syntactic structure node as part of a word's network, specifies that they must realize a noun phrase in these positions. During production, this information is used to generate the syntactic structure of the utterance, determining its constituents (Bock & Levelt, 1994; Dell & O'Seaghdha, 1994; Ferreira, 2000; Levelt, 1989, 1999; Pickering & Branigan, 1998, for reviews see Ferreira & Engelhardt, 2006; Postma, 2000). Accordingly, ill formed utterances like in examples (4)–(6) would normally not be generated, and, if they were, would be detected via self-monitoring (De Smedt & Kempen, 1987; Levelt, 1989, 1999; for a review see Postma, 2000) and most likely corrected.

(4) John told us [_ stalked the manager].
(5) The teacher thinks [the student brought _ to class].
(6) The chocolate milk had come from _.

Nevertheless, speakers regularly produce sentences like (1)–(3), even though they include the ill-formed strings in (4)–(6). This means that these strings are generated and articulated in well-formed utterances, but only when they are embedded under a filler exhibiting a dependency with the gapped argument. Hence, the production system can recognize certain constructions, specifically, filler-gap dependencies, as allowing arguments that are represented at the message level, even obligatory ones, to remain unrealized in their typical

position. Moreover, upon the production of filler-gap constructions, the system refrains from generating (both obligatory and optional) arguments in this position, as demonstrated by the ill-formedness of utterances like (7) in English.

(7) I saw the boy that I like the boy/him.

Filler-gap dependencies are thus encoded during production in a manner that enables the generation of sentences like (1)–(3), but avoids ill-formed constructions like (4)–(7). Arguments that exist at the message-level cannot be gapped in the manner demonstrated above in the absence of a filler, and when an embedded argument position is associated with a filler, it cannot be realized again by a clause-internal phrase in the canonical argument position. To achieve this, speakers must be able to keep track of the well-formedness of these constructions as they produce them. To this end, some information about the filler, minimally its existence and its status as an argument of an embedded predicate, must be maintained until the dependency is completed.

Even under the assumption of retention of information about the filler, other questions about the architecture of this mechanism remain open. One of these questions is how the argument structure demands and selectional requirements of the embedded predicate are satisfied. One possibility is that the production of filler-gap dependencies involves mechanisms similar to the ones guiding their parsing, as predicted by views maintaining that production and comprehension use the same representation-building mechanisms (Kempen, 2000; Momma & Phillips, 2018). For languages like English, in which fillers are articulated before the gapped clause, this entails that the predicate-argument relationship between the embedded head and the filler is created through maintenance of some of the filler's properties throughout production of the dependency, and retrieval of others around the planning and/or production of the predicate that encodes it as an argument (at the gap site). The second possibility is that since speakers, as opposed to listeners, have propositional knowledge of the utterance they are producing, a retrieval mechanism like the one assumed for comprehension is redundant. Speakers are not required to verify that the filler can be interpreted as the gapped argument in the same way listeners do, and hence it is not necessary that they reactivate it at the predicate (for a similar discussion see Momma & Phillips, 2018). Such a view could then suggest that the relationship between the embedded predicate and the filler is achieved, rather than by retrieval of the filler at the gap, by predetermination of the argument-predicate relationship between them upon planning the relative clause. For a language like English this would mean that the production of a filler involves planning the relevant embedded predicate, encoding the filler's interpretation as one of its arguments and maintaining this relationship throughout the production of the relative clause. This, in turn, would license a gap in the embedded argument position.

We suggest, then, that retention of information about the filler is necessary for verifying that the grammatical encoding of the connection between the filler and gap position is well-formed. Moreover, this entails that under circumstances that challenge information retention, fillers should be more difficult to maintain. Thus, we predict that speakers' production choices will reflect a pressure to moderate these retention costs.

One way to minimize filler-retention demands in the production of certain types of dependencies is producing passive structures when that permits the gap to be produced earlier. We next turn to review studies that examined structural choices between the active and passive voice in the production of object relative clauses.

Passivization in the production of object relative clauses

Gennari, Mirković, and MacDonald (2012) report a series of experiments that elicited the production of direct object relative clauses in English, Spanish and Serbian. In the first set of experiments, speakers

were prompted to use relative clauses to modify animate or inanimate entities interpreted as patients or themes in the embedded clause. For example, given a depiction of a woman (animate) punching a yellow bag (inanimate) or a bald man (animate), participants had to answer "what is yellow?" or "who is bald?", respectively. In English, the answers can be formulated as actives (*The bag/man* [that the woman is punching_]) where the filler is interpreted in object position, or as passives (*The bag/man* [that _ is being punched (by the woman)]) where the filler is interpreted in subject position and the embedded agent is either articulated at the end of the clause or is omitted. Spanish and Serbian speakers can additionally construct active impersonal relative clauses to identify the entity in question. In active impersonals the filler is interpreted in object position and the embedded verb manifests a third-person plural marker indicating an unspecific agent, which remains unpronounced (literally: '*The bag/man* [who are punching _]').

Gennari et al. observed that in all three languages, speakers tended to produce more passives in the animate condition, which the authors view as a tendency to omit the embedded agent (*woman* in the example above) or "demote" it to final position. A second finding was that speakers of all three languages used more agentless constructions (impersonals and agentless passives) in this condition. Two additional experiments demonstrated that this tendency was related to the semantic similarity between the animate relative head and the embedded agent, as opposed to just its animacy.

Gennari et al. argue that the cross-linguistic tendency to omit or demote the agent in the animate-animate condition, shown to be related to its semantic similarity with the relative head, is consistent with the idea that similarity-based competition was at play. They suggest that as relative heads and relative clauses are planned in temporal proximity, semantic similarity between animate relative heads (fillers) and embedded agents results in similarity-based competition at the conceptual level or at the level of syntactic role assignment, leading to inhibition of the embedded agent's lemma. This is reflected in the production of an agentless clause, or the 'demotion' of the agent to a later position.

Hsiao and MacDonald (2016) report similar results from Mandarin, in which relative heads are uttered after the relative clause. Mandarin speakers produced more passives and omitted more agents with animate relative heads as compared to inanimate ones. Finally, Montag, Matsuki, Kim, and MacDonald (2017) report a replication of Gennari et al.'s findings from English, and a similar tendency to produce more passive relative clauses with animate relative heads as compared to inanimate ones, in Japanese and Korean, which exhibit the same constituent order as Mandarin. In addition to further establishing the importance of similarity-based interference for grammatical encoding, this effect of relative head animacy on the formulation of head final relative clauses also demonstrates that the properties of the not-yet produced relative head can affect the formulation of the prior clause, and hence that Mandarin, Japanese and Korean speakers have planned some aspects of the relative head before producing the first words of the relative clause. This is explained as a result of a need to plan the head noun before or together with the relative clause even though the head is uttered later (Hsiao & MacDonald, 2016; Montag et al., 2017). We return to head final relative clauses in the General Discussion.

The finding that speakers tend to omit more agents from their passivized productions and produce more (agentless) impersonal clauses with animate relative heads is an indication that agent inhibition indeed plays a role in determining structural choices given similarity-based interference. However, there is another factor that should not be overlooked when attempting to explain choices in the production of relative clauses, namely that, as detailed above, they involve the formation of a filler-gap dependency. Taking the occurrence of a filler-gap dependency into account can provide further insight into the factors guiding structural choices in the production of relative clauses as well as the ways speakers moderate information-retention demands during dependency formation.

Filler-retention moderation

Based on the data provided in Gennari et al. (2012, study 1a), 47.5% of all animate head relative clauses in English were passives with a pronounced agent, as compared to 12.5% of all inanimate head relatives. As mentioned above, Gennari et al. refer to this tendency as 'agent demotion' due to its inhibition. An alternative interpretation for this tendency is that because filler-retention is more taxing throughout the processing of similar elements, speakers prefer to produce a construction where the filler is interpreted earlier – that is, in subject position, as this will minimize the demand to maintain its representation. We will refer to this processing consideration as filler retention-moderation.

The idea that early dependency resolution reduces processing load has been extensively explored in the psycholinguistic literature. In comprehension, many accounts for the repeatedly observed contrast between the parsing of subject relative clauses and the costlier parsing of object relative clauses attribute it to a difficulty to integrate the filler at the gap position when more lexical material occurs between them (Gibson, 1998; Grodner & Gibson, 2005; Hawkins, 1999, 2003, among others). In production, it has been argued that NP-shift and related phenomena are due to minimization of the distance between two related elements (Diessel, 2005; Hawkins, 1994, 2003; Temperley, 2007; Wasow, 1997). Further, extensive corpus studies demonstrate that dependency length is shorter than what would be expected based on a random distribution, cross-linguistically, (Futrell, Mahowald, & Gibson, 2015; Gildea & Temperley, 2007; Temperley, 2007).

Finally, two experimental studies by Scontras, Badecker, Shank, Lim, and Fedorenko (2015) and Scontras, Badecker, and Fedorenko (2017) bring evidence that filler-object dependencies (in English) are more costly to produce than filler-subject ones, supporting the hypothesis that they require filler maintenance throughout the production of intervening elements (Gibson, 1998). In two experiments, Scontras et al. (2015) elicited the production of subject and object relative clauses and wh-questions (e.g. *the reporter* [that_ attacked the senator]/ *the reporter* [that the senator attacked_]) and measured initiation latencies, durations, and disfluency rates. They observed that object dependencies were produced with longer initiation latencies and durations and more disfluencies than subject ones, concluding they cause difficulty in language production relative to their subject counterparts. In a follow-up study, Scontras et al. (2017) responded to concerns about the validity of the original findings raised by MacDonald, Montag, and Gennari (2016). The most crucial critique from MacDonald et al. (2016) was that because participants were instructed not to use passives, difficulty in production of filler-object dependencies was due to suppression of the passive alternative. This was addressed in Scontras et al. (2017) by a conceptual replication (using the written modality) excluding this instruction. The results were that passivization rates were indeed higher with relative clauses as compared to the original experiment, but that this was not the case with wh-questions. Hence, passive suppression cannot fully explain the findings reported in Scontras et al. (2015).

Our suggestion that passivization may be a filler retention-moderation technique is consistent with the view that longer dependencies demand filler-retention throughout the processing of more intervening material, hence that their production is more cognitively taxing (Gibson, 1998; Scontras et al., 2015, 2017). In Experiment 1, we test the possibility that increased maintenance demands cause a preference for conveying a given message with shorter dependencies. If our suggestion is correct, and passivization under similarity-based interference is related to the challenge of retaining the filler, it is predicted that speakers should also tend to passivize more often when facing other retention hindering circumstances.

Experiment 1: Restrictiveness and passivization in English

To determine whether passive choices are indeed related to retention-moderation, we need to disentangle it from agent-inhibition. The experimental design used in Gennari et al. (2012), which manipulates the semantic similarity between the filler and the agent is not suitable for this purpose. Both agent-inhibition and filler-retention moderation predict the same performance pattern under this manipulation. Similarity-based competition between the filler and embedded agent could either result in agent-inhibition which would lead to passive formation, or hinder filler maintenance, leading speakers to early dependency resolution by passivization. Experiment 1 was designed to disentangle these two scenarios by manipulating the message-level connection between fillers and relative clauses while keeping semantic similarity between fillers and embedded agents constant. We did this by employing the distinction between *restrictive* and *non-restrictive* relative clauses.

The defining difference between restrictive and non-restrictive relative clauses is their role in the establishment of the nominal head's referent in context. Whereas restrictive relative clauses are essential for narrowing the domain of reference denoted by the relative head, non-restrictive relatives (sometimes referred to as *parentheticals*) are used when the nominal referent can be established in context based on the denotation of the relative head alone, and convey other types of information. Given this difference, researchers tend to agree that restrictive and non-restrictive relative clauses are distinguished by their connectedness with the relative head at an information level. Accordingly, non-restrictive relatives are often described as being more independent from the relative head as compared to restrictive ones, and as exhibiting the status of a separate segment or information unit (Ariel, 1999, Bache & Jakobsen, 1980; Depraetere, 1995; Mann & Thompson, 1988, for a review see Ariel, 1999).

Example (8) demonstrates a restrictive use of a relative clause and (9) demonstrates a non-restrictive use of a similar relative clause. As opposed to the relative clause in (8), the one in (9) is not essential for establishing the referent of the relative head (*boy*), but merely provides additional information about it, which in that particular scenario would be interpreted as a justification for the speaker's choice for a dance partner.

(8) Contextual domain: a boy wearing tap shoes; a boy wearing disco pants; a boy wearing cowboy boots.
Q: Who would you choose as your dance partner?
A: (I would choose) *the boy* [that[1]_ is wearing cowboy boots].

(9) Contextual domain: a girl wearing tap shoes; a dog wearing disco pants; a boy wearing cowboy boots
Q: Who would you choose as your dance partner?
A: (I would choose) *the boy*, [who _ is wearing cowboy boots].

The fact that restrictive relative clauses are essential for determining the referent of the relative head means that their contents play a crucial role in conveying messages. In fact, in contextual domains in which the denotation of the relative head can be mapped to more than one referent, uttering a simple singular noun phrase (*the boy*) is futile in terms of successful message delivery. Consider, for example, the conversation in (8), in which the contextual domain includes three boys. If a speaker wishes to identify the one person he would choose as a dance partner,

an utterance like "the boy" would fail to deliver the message. To be successful, his answer must include further identifying information (possibly encoded as a relative clause). In contrast, in contexts like (9), producing a simple noun phrase (*the boy*) would provide enough details for referent identification, and successfully deliver the intended message. This contrast suggests that in comparable cases like the ones in (8)–(9), the relative head and the relative clause are more closely linked at the message-level in the restrictive case as compared to the non-restrictive case, since in the former both elements are essential for the message to be successfully conveyed, whereas in the latter this can be achieved without the production of a relative clause or another modifying element. As a result, in the restrictive case, production involves the creation of a filler-gap dependency between elements closely related at the message-level, whereas in the nonrestrictive case the message level connection between these elements is not as strong.

The potential effect of this difference in informational status between restrictives and non-restrictives on processing has been examined in several comprehension studies. To test the hypothesis that background information is processed more quickly earlier in the sentence, Gibson, Desmet, Grodner, Watson, and Ko (2005) compared reading times of restrictive relative clauses, taken to convey background information (since reference identification demands the use of background information which is common to both interlocutors) and non-restrictive relatives, modifying the main subject or object. The authors observed an interaction between restrictiveness and relative clause position, such that restrictive relatives were read faster in subject than in object position, whereas reading times for non-restrictives were higher overall and also unaffected by position. More recently, a line of studies by Dillon, Clifton, and Frazier (2014) and Dillon, Clifton, Sloggett, and Frazier (2017) compared the processing of at-issue and not-at-issue information through a comparison of restrictive and non-restrictive (termed *appositive*) relative clauses. In a series of three experiments, Dillon et al. (2014) compared the acceptability penalty associated with complex structures embedding additional material inside restrictive versus non-restrictive relatives as well as the penalty when a filler-gap dependency spanned restrictives versus non-restrictives. They observed an acceptability penalty only in the conditions involving restrictive relative clauses, and suggested this is related to not-at-issue content being a 'quasi-independent' speech act (Arnold, 2007; Frazier, Dillon, & Clifton, 2015; Syrett & Koev, 2015). When a single, integrated representation of the sentence is syntactically complex, the acceptability penalty is greater than when complexity is distributed across two distinct representations of the sentence. Further, Dillon et al. (2017) also investigated the degree to which restrictiveness of intervening material affects online processing of filler-gap dependencies. Extending Dillon et al. (2014), their first finding was that the presence of a filler-gap dependency interacted with the restrictiveness of the intervening material, such that the acceptability penalty of sentences with filler-gap dependencies vs. controls was greater when it spanned a restrictive relative. In the following two studies, eye-tracking-while-reading was used to examine this effect during incremental processing. In both experiments the authors observed that the slowdown at the gap site and total viewing times for conditions containing a filler-gap dependency versus controls was greater with an intervening restrictive as compared to an intervening non-restrictive. They proposed an analysis of this pattern viewing the syntactic content of restrictives as more available in memory than comparable non-restrictives after they have been processed, hence causing more interference for the processing of filler-gap dependencies which span them. According to the authors, this reflects the special discourse role of non-restrictives as independent speech acts, to which the processor may lose access.

In sum, by their nature, restrictive relative clauses are more connected to the relative head at the message-level than their non-restrictive equivalents. Further, evidence from comprehension indicates that this difference has consequences for processing: restrictives are processed slower when their position in the sentence is inconsistent

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[1] An accepted prescriptive rule in American English is that restrictive relative clauses open with the complementizer *that*, whereas non-restrictive ones open with a wh-element (i.e. which/who/whose/whom). This guideline can be found in many writing and style guides, for example Beins (2012). Additionally, in written English, non-restrictive relatives are typically separated from the relative head by a comma, and in speech they are often preceded by a pause (Ariel, 1999; Garro & Parker, 1980; Givon, 1995).

with their informational status (Gibson et al., 2005) and non-restrictive intervening relatives cause less interference for linking processes spanning them than restrictive relatives, suggesting that the processor may lose access to them Dillon et al., 2014; 2017).

Hypotheses

Going back to our current interest, the contrast in the connection from the message level to the relative head between restrictives and non-restrictives can be used to disentangle the filler-retention moderation account from the agent-inhibition account for relative clause passivization. Each of these accounts makes a different prediction with regard to this factor.

In the introduction, we argued that maintenance of some representation of the filler until the generation of the gap position is necessary for tracking that the connection between the filler and the gap position is well-formed. This should be easier given a strong message-level connection between the filler and the relative clause, which allows easier access to the filler during the planning and production of the relative clause. The idea is that as the production system formulates the relative clause content, it should be easier to maintain a representation of the filler if it is part of the same information unit than if it is a part of a separate information unit. From the perspective of filler-retention then, the production of a restrictive relative clause is less hindering than that of non-restrictive ones. Accordingly, if speakers use passivization to moderate challenging filler retention by creating shorter dependencies, we should see more passivization in non-restrictive occurrences. Preliminary support for this prediction comes from corpus data from English reported in Wagers and Pendleton (2016). Looking at 3488 relative clauses preceded by adjunct phrases, the majority of them non-restrictive, all but one had a subject gap. This suggests a connection between non-restrictives and early dependency resolution.

In contrast, passivization due to agent-inhibition (Gennari et al., 2012) is related to increased interference from the still active conceptual representation of the filler (the relative head) competing with the activation of the embedded agent. A strong message-level connection between the filler and the relative clause should increase the activation of the former during the planning/production of the latter and hence cause more interference for successful retrieval of the embedded agent. To the extent it operates in the materials tested here at all, agent-inhibition is predicted to occur more often during the production of restrictive relative clauses, resulting in more omitted or 'demoted' agents – that is, more passives in restrictive relatives as compared to non-restrictive ones.

Note that an extension to production of Dillon et al. (2017) suggestion that non-restrictives are syntactically inaccessible to the processor is compatible with both hypotheses. Under filler retention-moderation, more passivization will occur with non-restrictives as their inaccessibility will hinder filler retention within them, and under agent-inhibition we should observe less passivization with non-restrictives since this inaccessibility should decrease interference from the relative head.

Finally, if the nature of the head-clause message level connection does not have an effect on relative clause formation in production, or if both retention-moderation and agent-inhibition occur at the same rate, we do not expect to see a difference in passivization between restrictive and non-restrictive relatives.

Experiment 1 was conducted to examine these hypotheses. It used a written production elicitation task in which English speakers were required to answer referent identification questions by completing a preamble demanding the formation of a relative clause. Contexts were manipulated within items such that in the restrictive condition relative clauses were essential for referent identification and in the non-restrictive condition they were not. We chose the written modality for ease of data collection and analysis. Importantly, Studies 1a and 1b

reported in Gennari et al. (2012) directly compared English passivization rates in writing and in speech. They observed that choices to passivize patterned the same (i.e., more passives under similarity-based interference) in both modalities, and this motivated their choice to conduct Studies 2, 3 and 5 (Study 4 was a meta-analysis) using the written modality alone (see also Scontras et al., 2017). Additionally, as detailed below, our instructions encouraged participants to type in their answers in a manner that emulates spontaneous speech and avoids introspection.

Method

Participants

Fifty-two adult native English speakers were recruited using Amazon Mechanical Turk and paid 7 USD each. Their ages ranged between 19 and 63 (M = 31.9). Twenty reported some knowledge of Spanish (10), French (6), Mandarin (1), Korean (1), Farsi (1) or Hebrew (1). None had education concerning the subject matter of this study.

Materials and design

Thirty-two sets of experimental items were designed. Each item consisted of a few background sentences (the "context"), followed by a prompt preceding a textbox. Contexts specified a setting (e.g., *a farm*), four characters, and three events involving the characters in the setting. Subjects and objects of all events were human. In all cases, the question required choosing one character, based on the event in which s/he took part. Prompts were designed to encourage the formation of relative clauses, which the context manipulation (more details below) rendered restrictive or non-restrictive. Experimental items were constructed to elicit the production of a clause describing the patient of an event using an active object relative clause or a passive subject relative clause. All the events reported in our contexts were described by verbs with a direct object (i.e., noun phrase) complement. In addition, to control the elements repeated in the contexts, both restrictive and non-restrictive contexts included either verb or subject repetitions. More details about these manipulations are provided below. An example is provided in Table 1.

In restrictive contexts, characters included an authority figure (e.g. *farmer*) and three subordinates. The subordinates were described by the

Table 1
Set example, Experiment 1.

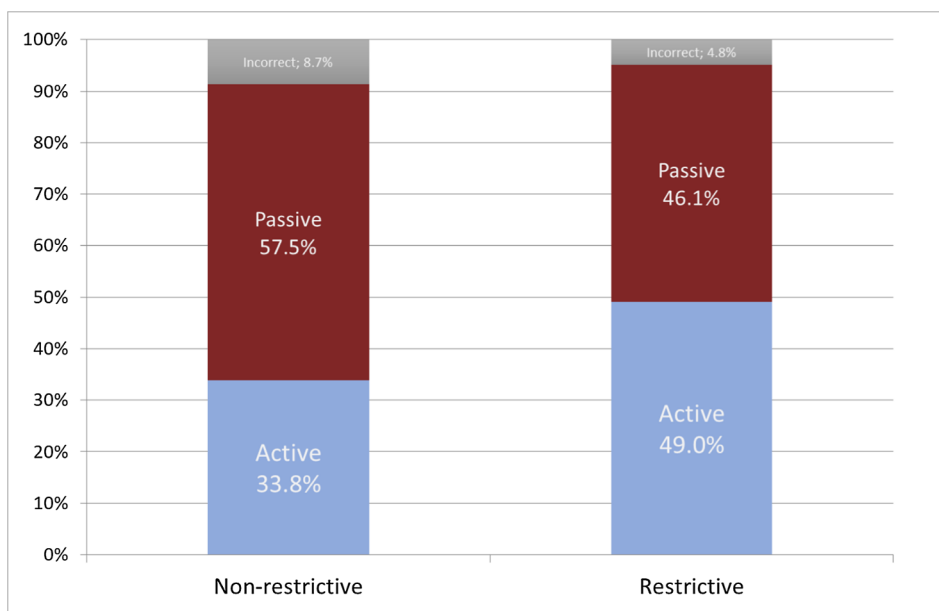|	Restrictive	
	Repeated verb	*Repeated subject*
Setting	A Banana plantation	
Characters	Farmer, Day-worker 1 (female), Day-worker 2 (female), Day-worker 3 (female).	
Events	The farmer praised day-worker 1.	The farmer praised day-worker 1.
	Day worker 3 praised day-worker 2.	The farmer watched day-worker 2.
	Day worker 2 praised day-worker 3.	The farmer heard day-worker 3.
Question	Who is most likely to buy the boss a nice gift for Christmas?	
Prompt	The __ that _____	
	Non-restrictive	
	Repeated verb	*Repeated subject*
Setting	A Banana plantation	
Characters	Farmer, Day-worker (female), Cowboy, Banker (male).	
Events	The farmer praised the day-worker.	The farmer praised the day-worker.
	The cowboy praised the banker.	The farmer watched the cowboy.
	The banker praised the cowboy.	The farmer heard the banker.
Question	Who is most likely to buy the boss a nice gift for Christmas?	
Prompt	The ___, that, as mentioned, _____	
	Or (between subjects)	
	The ___, who _____	

Fig. 1. Experiment 1, distribution of responses by restrictiveness.

same referential noun phrase and distinguished only by a notation (*day-worker 1*, *day-worker 2*, *day-worker 3*). Each of the three sentences in the "events" component featured one of these subordinates in object position. One of four possible questions asked to identify the character on the receiving end of an act of kindness. Answers were typed into a prompt of the format "The _____ that _____". As these contexts included three characters described by the same referential noun phrase (e.g., *day-worker*), to successfully identify the correct referent, it was essential that subjects modify the noun typed at the first open position. The format of the rest of the prompt imposed that this modification be in the form of a relative clause. In this condition, then, the relative head and clause exhibited a strong message-level connection. Further, to control the type of repetitions within each context, the information distinguishing three possible referents of the relative head was either the event in which it participated ('repeated subject') or the agent of that event ('repeated verb'). Accordingly, in repeated subject contexts, the authority figure was the agent of three different eventualities. In repeated verb contexts, the same event took place with three different agents. The target eventualities (*praise* in this case) were described by one of 16 verbs, repeated once across contexts (embedded in a different setting with different characters). Non-target eventualities were described by a different set of 64 verbs.

In non-restrictive contexts, characters still included an authority figure (e.g. *farmer*), but only one subordinate (*day-worker*) and two other participants (*banker, cowb*oy). The eventualities featured these three characters as affected objects. Here as well, the task was to identify the participating party who was the receiver of an act of kindness. In this case, however, the referential noun phrase describing the target participant (*day-worker*) was sufficient to identify its referent in the context. Nevertheless, the prompt format required participants to provide a relative clause in their response. In these contexts, the production of a relative clause provides relevant information, namely a justification for choosing that particular participant as the correct answer; however, importantly, relative clauses are not essential for reference identification. In addition to having provided a non-restrictive context, we underscored non-restrictiveness by separating the relativizer from the relative head with a comma. Furthermore, given that the dissociation between restrictive and non-restrictive relativizers (described in Footnote 1) is often ignored, we included a between-subjects manipulation whereby half of our participants saw 'who' in the relativizer position and the rest saw 'that, as mentioned'. In the latter,

"as mentioned" marked the discourse role of the non-essential relative clause as repetition of given information. As we report below, this manipulation did not affect response patterns. Here too, each item had a repeated verb and a repeated subject version.

Materials were assigned to four lists in a Latin square design and the order of reported eventualities in each context was fully randomized for each participant. Settings, characters, verbs and questions used in each experimental item are given in Appendix A.

Thirty-two distractor contexts were added to each list. In distractor contexts, questions elicited the production of subject relative clauses (*Who admires the boss?*), that cannot be passivized.

Procedure

The experiment was programmed using Ibex Farm (Drummond, 2013) and administered online. Participants read a brief description of the experiment and were instructed to type their answers as naturally as possible, as if they were chatting with a friend online, and to make sure that their answer mentions all the relevant details provided by the context. They were then presented with one restrictive and one non-restrictive practice item, each with sample correct and incorrect answers and explanations (see Appendix A). Unlike experimental contexts, which elicited the production of direct-object relative clauses, practice contexts elicited the production of indirect-object relative clauses. One incorrect answer included a relative clause describing irrelevant details and the other provided a wrong answer (i.e., the choice of a wrong character). All sample answers included active relative clauses. After completing the practice session, subjects proceeded to the experimental items. They were allowed to complete the experiment at their own pace and take as many breaks as they wished. To answer the question, participants completed the prompt by typing their responses in text boxes.

Results

Responses were considered correct if they described the target event. Incorrect responses were produced in 6.8% of the trials. Overall, active object relative clauses accounted for 51.8% of productions, and passive subject relative clauses accounted for 41.4%. Out of the passives produced, 99.3% (854/860) included a by-phrase. Examples for each type of answer are provided in (10) below. Fig. 1 shows the distribution of production type by condition.

(10) Examples for correct responses by response type (words provided by the prompt are underlined):

   a. The *day-worker* {that; who, / that, as mentioned,} the farmer praised _ (Active)

   b. The *day-worker* {that; who, / that, as mentioned,} _was praised by the farmer (Passive)

We applied a binomial mixed-effects model for the dependent variable 'produced structure' (active/passive) with the fixed factors 'restrictiveness' and 'repeated element'. We started out by running a maximal model, with subject and item random intercepts and random slopes for the fixed factors. Due to failure to converge, we simplified the random effects structure of the model by removing random correlations and then eliminating the components which accounted for the least variance. The converging model included random slopes for subjects.[2] This model yielded a significant effect of restrictiveness (Estimate = 1.87, SE = .37, $z = 5.04$, $p < .001$), such that more passives were produced in non-restrictive contexts. Repeated element was not significant ($p = .2$).

We then applied a post-hoc model, comparing error rates between the restrictive and non-restrictive conditions, with the fixed factor 'restrictiveness' with corresponding random intercepts for both subjects and items. This yielded a significant effect of restrictiveness (Estimate = 1.4, SE = .53, $z = 2.7$, $p = .007$), such that more incorrect completions were produced in the non-restrictive condition.

Finally, as demonstrated in Fig. 2, the format of the non-restrictive prompt (*who, / that, as mentioned*) did not affect the pattern of production rates.

Discussion

The results of Experiment 1 support our hypothesis that English speakers' choices to produce passive relative clauses are affected by the difficulty of maintaining the representation of the filler throughout the production of the relative clause. As predicted under the assumption that passivization can serve as a retention moderation technique, non-restrictive relative clauses yielded more passive dependencies than restrictive relatives. Further support for this hypothesis comes from the rate of incorrect completions, which was significantly higher for non-restrictive items. In contrast, the alternative hypothesis, which views agent-inhibition as the factor modulating passive choices, predicts the opposite performance pattern.

The observed performance pattern indicates that the formation of passive dependencies is modulated by the cognitive effort associated with the retention of the filler throughout the dependency, hence supporting our hypothesis that English speakers can form passives as a way to moderate dependency formation demands by resolving them at an earlier point in production.

One prediction of our interpretation of the tendency to produce more passives in the non-restrictive condition as related to a moderation of filler retention demands is that when passivization is less available, speakers should experience difficulty in maintaining the filler. Experiment 2 was designed to test this hypothesis by contrasting the formation of restrictive and non-restrictive relative clauses in a language where passivization is less productive, namely Hebrew.

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[2] It could seem worrying that the converged model did not include random effects for items. However, an earlier analysis, following a procedure that did not include correlation removal, only gradual elimination of components according to the level of variance for which they account, converged with all intercepts for subjects and items and a random slope of restrictiveness for subjects, yielding results similar to those reported above – a significant effect of restrictiveness (Estimate = 1.85, SE = .37, $z = 4.97$, $p < .001$) and no repeated element effect ($p = .2$).

Experiment 2: Restrictiveness and resumption in Hebrew

In Hebrew, although passives are a part of the normative verbal system, they are not productive in spontaneous speech, and are rarely produced in spoken language as well as written formal text (Berman 1979, 2008; Bolozky, 1999; Dekel, 2014; Jisa, Reilly, Verhoeven, Baruch, & Rosado, 2002). For example, Dekel (2014) reports that in a spoken corpus of almost 7000 verbal forms, only 18 were passive. In a cross-linguistic comparison of passivization rate in written corpora, Jisa et al. (2002) found that the rate of passivization of Hebrew clauses produced by adults (6.6%) was significantly lower than their rate in Dutch (15.2%), English (11.48%) and French (13.2%) which did not differ significantly from one another. Passivization rate in Spanish (4.3%) was also significantly lower compared to English, Dutch and French but not when compared to Hebrew. Explanations for this variation were offered within functional pragmatic models (Berman, 1979; Jisa et al., 2002), which view passivization as a means of expressing a pragmatic function of "downgrading" the agent or "foregrounding" another noun phrase (Keenan, 1985; Myhill, 1997). Accordingly, it was suggested that the availability of other constructions suitable for these functions (such as impersonals in Hebrew and Spanish) decrease the "functional load" (Jisa et al., 2002) attributed to passives and as a result their frequency. We return to these accounts in the General Discussion.

Given this, passivization is predicted to be less available as a technique for filler-retention moderation in Hebrew. In the case of the restrictive/non-restrictive distinction, this may mean that Hebrew speakers who produce non-restrictive object relative clauses (RCs) would create a dependency between the non-restrictive relative head and the embedded object position. If the maintenance of non-restrictive relative heads is indeed more taxing than that of restrictive ones, filler-retention during the creation of non-restrictive object dependencies is predicted to be more difficult than that of restrictive ones. As a result, it is expected that Hebrew speakers would demonstrate a stronger tendency to create these dependencies in a form associated with the generation of a dependency with an inaccessible filler. One such strategy is the use of resumptive pronouns (RPs) (Ariel, 1990, 1999) instead of gaps, as demonstrated in (11):

(11) ra'iti	'et	ha-yeled	še-ima	divxa	še-ha-yalda	daxfa	'oto
I-saw	ACC	the-boy	that-mom	the-boy	reported	that-the-girl	pushed **him**

'I saw the boy that Mom reported the girl pushed.'

It has long been observed that when English speakers produce filler-gap dependencies which span syntactic configurations known as *islands*, rendering an ungrammatical utterance, they sometimes produce a pronoun in the embedded argument position instead of leaving a gap (Alexopoulou & Keller, 2007; Ferreira & Swets, 2005; McCloskey, 2017; Morgan & Wagers, 2018; Polinsky, Clemens, Milton, Morgan, & Heestand, 2013; Ross, 1967; Sells, 1984, among others). In English, this dependency formation technique is categorized as 'intrusive resumption' (McCloskey, 2006) – that is, not a part of the grammar. Accordingly, it is often viewed as related to the processing of these constructions (Alexopoulou & Keller, 2007; Asudeh, 2004; Dickey, 1996; Erteschik-Shir, 1992; Hawkins, 1999, 2003; Morgan & Wagers, 2018; among others). Consistent with the view that resumption in English is an intrusive mechanism, many acceptability judgment studies have replicated the finding that resumptives are rated as uniformly unacceptable across different constructions (Alexopoulou & Keller, 2007; Dickey, 1996; Han et al., 2012; Heestand, Xiang, & Polinsky, 2011; Morgan & Wagers, 2018; Polinsky et al., 2013).

In contrast, Hebrew is a 'grammaticized resumption' language, in which resumption is a grammatical technique for creating dependencies in relative clauses, optional with direct object relative clauses and obligatory with indirect object ones (Borer, 1984; McCloskey, 2006;
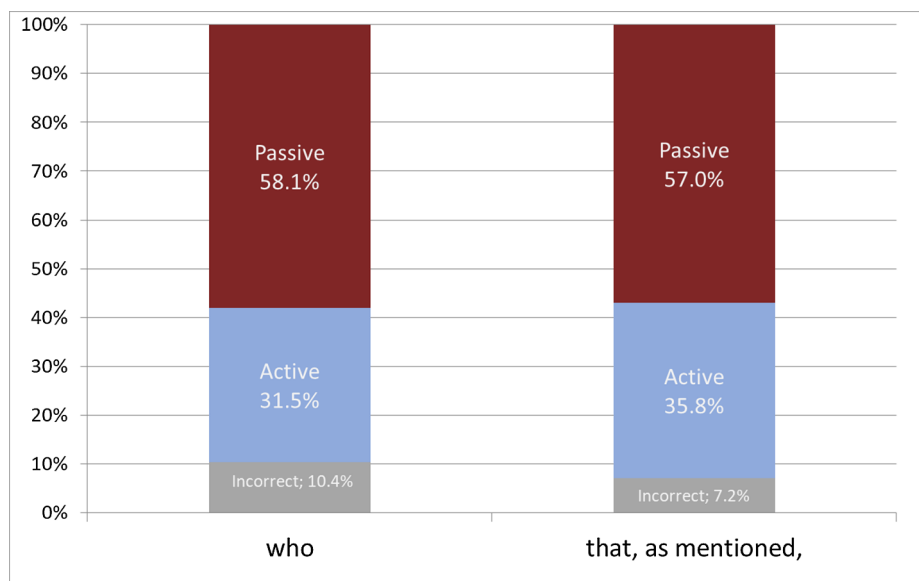
Fig. 2. Experiment 1, passivization rate by non-restrictive prompt type.

Meltzer-Asscher, Fadlon, Goldstein, & Holan, 2015; Sells, 1984; Shlonsky, 1992). This is supported by evidence from large scale acceptability experiments demonstrating that even in the absence of an island violation, the difference in naturalness ratings provided for gapped and resumptive direct-object relative clauses is very small, namely about half a point on a five point Likert scale (Farby, Danon, Walters, & Ben-Shachar, 2010) or a seven point Likert scale (Meltzer-Asscher et al., 2015).

A number of studies have proposed that resumption in English is related to processing in production, (Asudeh, 2004, 2011; Ferreira & Swets, 2005; Kroch, 1981; Morgan & Wagers, 2018; Polinsky et al., 2013). These authors all share the view that intrusive resumption occurs when the production system cannot complete an already initiated filler-gap dependency. Following Kroch (1981), Ferreira and Swets (2005) and Polinsky et al. (2013) suggest that resumptives in English are used as a last resort in production, when speakers realize that a gap is not possible at the end of a dependency they have already started uttering (e.g., when the dependency terminates inside a syntactic island). Asudeh (2004, 2011) distinguishes between locally well-formed and globally well-formed constructions. Resumption in English is accordingly analyzed as a case where the system produces a globally ill-formed construction (a dependency across a syntactic island) and thus opts for local well-formedness by producing a pronoun where a gap would be illicit. Finally, Morgan and Wagers (2018) also propose that RPs are symptomatic of a breakdown in the production of a filler-gap dependency, where at some point prior to its completion, speakers assess the acceptability of the planned structure. In cases where the system decides against the completion of the dependency, for example, when it would result in a highly unacceptable utterance, production continues, but the dependency is abandoned. This results in the realization of an anaphoric pronoun in the embedded argument position in order to satisfy local subcategorization constraints.

If speakers of intrusive resumption languages, such as English, use resumptives to continue production in cases of a breakdown in the formation of filler-gap dependencies, a plausible a-priori assumption is that speakers of grammaticized resumption languages would also find that resumption is useful when dependency encoding is challenged. In other words, if in intrusive resumption languages, in which resumption is not a grammatical strategy for creating dependencies, speakers use it to satisfy local argument structure demands when they find themselves producing ill-formed dependencies, it is possible that the rate of its occurrence in grammatical resumption languages is also related to

impeded dependency formation. Moreover, that resumption is grammatical in these languages should render its implementation as a production strategy even less restricted. In other words, in grammatical resumption languages, we might see that speakers show an increased tendency to use resumption while producing grammatically licit, yet cognitively challenging, filler-gap dependencies. This is expected to occur, among other cases, when working memory resources - essential for verifying that the grammatical encoding of the connection between the filler and the gap is well-formed - are taxed. In such cases, the choice to encode the embedded argument as a resumptive would be a strategy to ensure that local argument structure demands are satisfied, which, unlike in intrusive resumption languages, does not involve global ill-formedness or dependency abandonment.

This view predicts that the rate of grammaticized resumption would be modulated by filler maintenance demands such that more resumptives would be produced upon the creation of a dependency for which filler maintenance is impeded. In the context of the current study, it predicts that Hebrew speakers would produce more RPs in non-restrictive relative clauses as compared to restrictive ones. This prediction is in accordance with Ariel (1999) model of resumption. Based on the results of a small scale corpus study on conversational Hebrew, Ariel proposes the Accessibility Theory, stating that a relatively high degree of "mental accessibility" of the filler when the embedded argument position is reached favors gaps, whereas a relatively low degree of mental accessibility encourages the use of resumptives. Accessibility is impacted by a combination of factors, such as the length of the dependency, the length of the filler, and whether or not the relative clause is restrictive (see also Ariel, 1990). Of specific interest to the current study is Ariel (1999) finding that in her corpus, non-restrictiveness raised the proportion of resumption such that no RPs were observed in restrictive relatives (0/42) whereas about a third of the non-restrictive relatives (12/35) included an RP. An additional aim of Experiment 2 is hence to examine if this finding can be conceptually replicated using experimental methodology and under a more rigorous statistical analysis procedure.

Given the above, under filler-retention moderation, it is predicted that Hebrew speakers would produce more resumptives when required to create non-restrictive relative clauses as compared to their corresponding restrictive relatives. Note that it is also theoretically possible that Hebrew speakers make structural choices similar to the ones we observed in Experiment 1 and minimize filler maintenance demands by creating more passive dependencies on non-restrictive relatives, despite

Table 2
Set Example, Experiment 2 (translated from Hebrew).

	Restrictive	
	repeated verb	repeated subject
Setting	A university	
Characters	Professor (male), Student A (female), student B (female), student C (female).	
Events	The professor patted student A.	The professor patted student A.
	Student B patted student C.	The professor preferred student B.
	Student C patted student B.	The professor bypassed student C.
Question	Which of the characters should report the incident to the conduct committee?	
Prompt	The ___ that _____	
	Non-restrictive	
	repeated verb	repeated subject
Setting	A university	
Characters	Professor (male), Student (female), the professor's son, the professor's daughter.	
Events	The professor patted the student.	The professor patted the student.
	The professor's son patted the	The professor preferred his son.
	professor's daughter.	The professor bypassed his daughter.
	The professor's daughter patted the professor's son.	
Question	Which of the characters should report the incident to the conduct committee?	
Prompt	The ___, that, as mentioned, _____	

the general dispreference for passive in this language.

In contrast, under agent-inhibition, it is predicted that in Hebrew as well, a structure reflecting omission or demotion of the agent would be preferred in the restrictive case. For example, the creation of more passives in this condition. Importantly, note that agent-inhibition does not predict differences in resumption rates, namely, choices related to the realization of the object position, where the patient/theme argument corresponding to the filler is interpreted.

Method

Participants

Fifty-four adult native Hebrew speakers from the Tel Aviv University community were recruited via Facebook. They participated for partial course credit or a 25 NIS (~7 USD) participation remuneration. Their ages ranged between 20 and 47 (M = 28.2). Thirty-five reported good knowledge of English and 15 reported some knowledge of Russian (6), Spanish (5), German (4) or Palestinian Arabic (1). None had education concerning the subject matter of this study.

Materials and design

Like Experiment 1, Experiment 2 consisted of 32 experimental contexts, each followed by a direct-object eliciting prompt. The materials were modeled on the English materials of Experiment 1, with some modifications as explained directly below. All other details were identical to the ones reported in Experiment 1.

Since experimental items were designed to elicit the production of direct-object relative clauses, many translation equivalents of target verbs used in Experiment 1 had to be replaced because of differences in the types of complements these verbs take in the two languages. Specifically, many of the verbs in Experiment 1 require a prepositional object in Hebrew, not a direct object (this is particularly problematic because resumption is obligatory for prepositional object positions in Hebrew.) Further, we used many psychological (experiencer) verbs for

target events in Experiment 1 (e.g. *embarrassed*, *comforted*, *encouraged*), but these had to be avoided as they have been claimed to be illicit with gap complements in Hebrew (Landau, 2009). In addition, many of the Hebrew verbs with a direct object complement denote close or physical contact. For example, whereas the Hebrew equivalents of *push*, *kiss*, *bite* and *sniff* (*nišek*, *daxaf*, *našax*, *rixre'ax*, respectively) are followed by a noun phrase complement, just as their English counterparts, the Hebrew equivalents of verbs denoting more abstract eventualities like *acknowledge*, *applaud* and *recommend* (*hikir*, *heri'a* and *himlic*) must be followed by a preposition (*be-* 'in', *le-* 'to' and *al-*'on', respectively). Given this, all of the target events used in Experiment 2 denoted the occurrence of a close or physical contact between two humans.

To naturally elicit the description of this type of events, contexts were constructed to create the impression that the experiment concerned participants' ability to identify inappropriate behavior between an authority figure and a subordinate. Characters included an authority figure (e.g. *a professor*), at least one subordinate of the opposite sex (*student A*) and two additional subordinates (e.g., *student B, student C* in restrictive conditions) or two characters who are relatives of the authority figure or have a non-professional relationship with him/her (e.g., *the professor's son, the professor's daughter* in non-restrictive conditions). In experimental items, one of the three events reported an inappropriate act performed by the authority figure on their subordinate (*the professor patted the student/student A*). This was followed by one of four possible questions, all requiring subjects to identify which character was subjected to an inappropriate act performed by their superior (e.g. *Which of the characters should report the incident to the conduct committee?*). Once again, target events were described by one of 16 verbs, repeated once across contexts, and non-target events were described by a different set of 64 verbs. Finally, just like in Experiment 1, each experimental set included 4 conditions, which were the result of crossing 'restrictiveness' with 'repeated element' (see Table 2). The restrictive prompt was the translation equivalent of the one used in Experiment 1, i.e. ha-___ še-_____ ('the ___ that ___'). As the *that/which* distinction does not exist in Hebrew, non-restrictive prompts were the translation equivalents of the "that, as mentioned" prompt. i.e. ha___, še-ka'amur, _____.

Each list also included 32 distractor items. In distractor contexts, eventualities were reversed such that the authority figure was the affected participant (*the student patted the professor*) and questions elicited the production of subject relative clauses (*who behaved inappropriately?),* which do not allow resumption in Hebrew. For practice items, settings, characters, verbs and questions used in each experimental item see Appendix B.

Procedure

The procedure was identical to that of Experiment 1. Practice contexts elicited the production of indirect-object relative clauses, which do not allow optionality in gap manifestation, hence assuring that example answers would not imply a preference with regard to optional resumption. Instructions were also identical those provided in Experiment 1. Note that in this case, the requirement to mention all the relevant details provided by the context prevents participants from encoding the relative clause as an agentless impersonal.

Results

We considered all responses describing the relevant participant and target event as correct. 4.8% of the responses were incorrect. All correct responses included direct object relative clauses or their passivized counterparts. We observed three types of relative clauses: active with a gap (active-gap) in 32.8% of productions; active with an RP (active-RP) in 39.4% of productions, and passives in 22.5% of productions. Examples (12a-c) demonstrate these production types. Fig. 3 presents the distribution of different response types by restrictiveness.
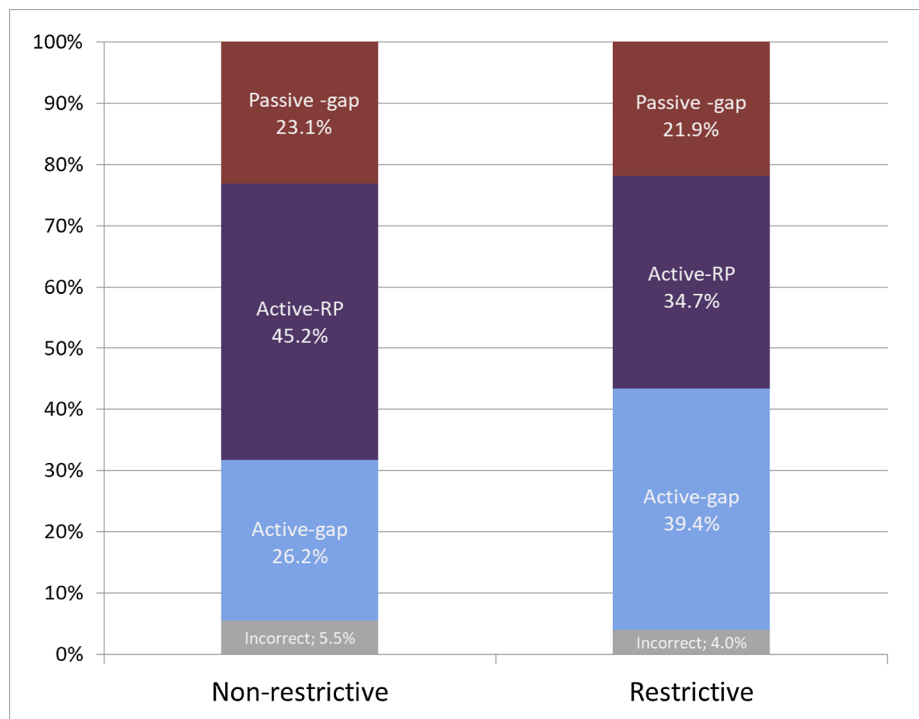
Fig. 3. Experiment 2, distribution of responses by restrictiveness.

(12) Examples for correct responses by response type (words provided by the prompt are underlined):

a. <u>ha</u>-studentit   <u>še-ha</u>-profesor   litef   Active-gap
    the-student.fe-   that-the-pro-   patted
    male   fessor
    'The student that the professor patted'

b. <u>ha</u>-studentit   <u>še-ha</u>-profesor   litef 'ota   Active-RP
    the-student.fe-   that-the-pro-   patted
    male   fessor   her
    'The student that the professor patted her'

c. <u>ha</u>-studentit   še-lutfa   al-yedy   ha-profesor)   Passive-
                                                                                        gap
    the-student.fe-   that-patted.pas- (by   the-pro-
    male   sive   fessor)
    'The student that was patted (by the professor)'

We applied binomial mixed-effects models for the two most frequently observed levels of the dependent variable 'produced structure' (active-gap and active-RP), with the fixed factors 'restrictiveness' and 'repeated element'. We started out by running a maximal model, which included subject and item random intercepts and random slopes for the fixed factors and their interaction. Due to failure to converge, we first removed the correlation between random effects and then simplified the random effects structure of the model, eliminating the components which accounted for the least variance. The converging model included random intercepts and random slopes of 'restrictiveness' for both participants and items, and random slope of 'repeated element' for subjects. This model yielded a significant effect of restrictiveness (Estimate = 1.8, SE = .5, $z = 3.7$, $p < .001$), such that more RPs were produced in non-restrictive contexts (see Fig. 3). Repeated element was not significant ($p = .2$).

We further applied two post-hoc models, comparing error and passivization rates between the restrictive and non-restrictive conditions, with the fixed factor 'restrictiveness' with corresponding random intercepts for both subjects and items. These analyses failed to find significant effects of restrictiveness on passivization (Estimate = 1.01, SE = .65, $z = 1.54$, $p = .13$) or error rate (Estimate = .004, SE = .44, $z = .009$, $p = .99$).

Discussion

We conducted Experiment 2 to test the prediction of the retention moderation account of filler-gap dependency production, namely that Hebrew speakers would produce more RPs in the embedded object position when creating more challenging, non-restrictive relative clauses. The results confirm this prediction: resumption rates were significantly higher in the non-restrictive condition as compared to the restrictive one. In addition, resumption was the preferred dependency creation choice with non-restrictive relatives. This performance pattern cannot be viewed as a reflection of agent-inhibition as these choices did not vary the inclusion or the position of the agent. In the General Discussion we provide an account for the observed pattern in terms of the production mechanism responsible for filler-gap dependency formation.

It is interesting to note the unexpectedly high passivization rates (~20% across conditions) observed in Experiment 2. Although this represents a much lower rate than the one observed with English speakers in Experiment 1 (averaging at 41.4%), considering the consensus in the literature regarding the scarcity of passivization in spoken Hebrew (which is in line with the intuitions of the two native Hebrew speaking authors), this result is rather surprising. One possible explanation for this finding is that it is an artifact of the task used in this study, which demanded participants to *type* their answers as opposed to producing speech. As Dekel (2014) notes, Hebrew passives are more likely to be used in written language. However, our participants were instructed to type their answer as if they were chatting with a friend. This instruction was included to obtain responses through a process as similar as possible to speech production and was indeed found to be sensitive to filler retention demands. An alternative explanation for the higher than expected passivization rate views it as an artifact of another property of the experimental design. Recall that in Experiment 2, the subject matter of the contexts was an inappropriate act between an authority figure and a subordinate. The tendency of speakers to report sexual misconduct using the passive voice, typically viewed as a way of focusing on the victim, is well-studied with regard to English (Bohner, 2001; Frazer & Miller, 2009; Henley, Miller, & Beazley, 1995; Nagar,

2016; Wood & Rennie, 1994). While to our knowledge there are no equivalent studies examining this phenomenon in Hebrew, we can anecdotally report that the use of the passive voice is prevalent in Hebrew media reports about sexual misconduct. We offer that some combination of these two potential explanations may account for the high rates of passivization in Experiment 2.

Together, the findings of Experiment 1 and Experiment 2 converge to support our suggestion that choices during the production of relative clauses are modulated by filler-retention demands. The requirement to create non-restrictive relative clauses, in which relative heads and relative clauses are less connected at the message-level, and are thus challenging in terms of filler-retention, increased passivization rates in English and resumption rates in Hebrew. Hence, the view that both dependency creation techniques as related to filler-retention demands provides a natural account for these performance patterns.

Experiment 3: Similarity-Based interference and resumption in Hebrew

Our suggestion that Hebrew speakers use more resumption upon creating challenging dependencies, which English speakers moderate by earlier dependency resolution via passivization would receive further support if we also observe this tendency when filler retention is challenged by factors other than restrictiveness. Experiment 3 was conducted to seek converging evidence in support of this suggestion. More specifically, we used Gennari et al. (2012) materials and a similar relative clause elicitation paradigm to examine the structural choices Hebrew speakers make when similarity-based interference between the filler and the embedded subject is manipulated.

As reviewed above, English speakers were observed to produce more passive object relative clauses when the relative head and the embedded agent shared animacy specification (*The man* [who_ was punched by the woman]) as compared to cases where the filler was inanimate (*The bag* [that_ was punched by the woman]). We suggested that this performance pattern can be viewed as reflecting a tendency towards earlier dependency resolution, implemented to moderate filler retention requirements, as opposed to a reflection of inhibition on the embedded agent. If we find that Hebrew speakers produce more RPs instead of gaps in object position in these cases, our hypothesis that this property imposes a challenge for filler retention would be further supported. Interestingly, corpus data from Irish, a grammatical resumption language which does not allow passivization of the English type (McCloskey, 2017), provide initial support for this prediction. In his Irish corpus, McCloskey found that 55 out of the 60 object relatives with resumptive pronouns included an animate relative head, suggesting that this tendency reflects the occurrence of processing difficulty due to similarity-based competition, in combination with unavailability of passivization.

In contrast, if structural choices in these cases are solely determined by agent inhibition, we do not expect to observe differences in the realization of the object position, where the patient/theme argument corresponding to the filler is interpreted.

In Experiment 3, we directly examine these hypotheses, using a slightly modified version of the experiments reported in Gennari et al. (2012).

Method

Participants

Forty-nine adult native Hebrew speakers from the Tel Aviv University community participated for partial course credit or a 25 NIS (~7 USD) participation remuneration. Their ages ranged between 20 and 30 (M = 24.3). Forty-five reported good knowledge of English. Twenty-five reported some knowledge of Spanish (11), Standard Arabic

(5), French (4), Palestinian Arabic (4), Russian (4), Portuguese (1) or Farsi (1). None had education concerning the subject matter of this study.

Materials and design

Materials consisted of the 60 depicted scenes used in Gennari et al. (2012) Experiment 1. The 20 experimental pictures depicted the same transitive eventuality taking place once between an agent and an animate patient and once between an agent and an inanimate theme. Each experimental picture was presented in both the agent-patient and the agent-theme conditions (manipulated between participants). Participants had to produce direct-object relative clauses describing either the animate patient or the inanimate theme. Conditions were distinguished by the relative clause eliciting question participants had to answer, which required the description of either the animate patient or the inanimate theme.

Unlike Gennari et al. (2012), our design implemented additional limitations on the set of possible answers. First, to impose the formation of a direct-object relative clause as the answer, subjects were instructed to construct their answer using a given verb on each trial. Verbs were chosen such that they correctly described the target eventuality and selected an NP (rather than a PP) object in Hebrew. In addition, to answer the question, participants completed a fill-in-the-blank format that imposed the formation of a relative clause. Accordingly, each trial consisted of a verb, a picture and a fill-in-the-blank format, that were presented together. Table 3 demonstrates the implementation of this manipulation across the two conditions. For the full set of experimental items see Appendix C.

Forty distractors presented questions eliciting the formation of subject relative clauses (31), indirect-object relatives (6) and direct-object relatives (3). Each of the 60 pictures was paired with a different verb. Experimental items were distributed into two experimental lists using a Latin square. Each subject thus completed 60 trials − 10 from each condition and 40 distractor items - presented in a fully randomized order.

Procedure

The experiment was programmed using Ibex Farm and administered online. Participants read a brief description of the experiment and were instructed to type their answers as naturally as possible, as if they were chatting with a friend online. They then saw two practice items, each with sample correct and incorrect answers and explanations. Practice contexts, given in Appendix C, elicited the production of a subject relative clause, where resumption cannot be used, and an indirect-object relative clause, where resumption is obligatory. One example of an incorrect answer included the use of a verb different from the one given in the task and the other provided a wrong description (i.e., the choice of a wrong character). After completing the practice session, subjects proceeded to the experimental items. They were allowed to complete the experiment at their own pace and take as many breaks as they wished.

Results

We considered all responses identifying the correct participant using the given verb as correct. Incorrect responses comprised 13.8% of the data. In this category, we counted either ill-formed sentences or subject relative clauses (created by disregarding the instruction to use the given verb). All correct responses included direct object relative clauses or their passivized counterparts. As demonstrated in example (13) below, we observed three main types of correct relative clauses: Active-gap, Active-RP and Passive. In addition, 13.2% of correct productions were verb initial active RCs (with and without RPs – 13(d-e)), a possible but non-canonical order in Hebrew. As shown and explained below, the proportion of V-initial relatives did not vary between conditions.

(13) Examples for correct responses by response type (parts provided by the format are underlined):

a.	<u>ha-matara</u>	<u>še-ha-yeled</u>	be-yarok	martiv		Active-gap
	the-target	that-the-boy	in-green	wets.TRANS		
	'The target that the boy in green is getting wet'					
b.	<u>ha-matara</u>	<u>še-ha-yeled</u>	be-yarok	martiv	ota	Active-RP
	the-target	that-the-boy	in-green	wets.TRANS	her	
c.	<u>ha-matara</u>	<u>še-murtevet</u>	(al yedey)	ha-yeled	be-yarok	Passive-gap
	the-target	that-is-wetted.PASS	by	the-boy	in-green	
	'The target that is being wet by the boy in green'					
d.	<u>ha-matara</u>	<u>še-martiv</u>	ha-yeled	be-yarok		Active-Vinitial-gap
	the-target	that-wets.TRANS	the-boy	in-green		
	<u>ha-matara</u>	<u>še-martiv</u>	ota	ha-yeled	be-yarok	Active-Vinitial-RP
e.	the-target	that-wets.TRANS	her	the-boy	in-green	

Finally, a small percentage of correct productions (1.6%) were categorized as impersonals (i.e., they had no subject). As this small number suggests that the production of impersonals was not a preferred method in our experiment, these were coded as Active-gap or Active-RP, according to the manifestation of the object. Of these impersonals, 87.5% appeared with a RP. Fig. 5 shows the distribution of produced structures by condition.

We applied a binomial mixed-effects model with the fixed factor patient animacy (animate/inanimate) on the two most frequently produced levels of the dependent factor produced structure – Active-gap and Active-RP, with subject and item random intercepts and random slopes of patient animacy. Due to failure to converge, we simplified the random effects structure of the model, by removing the correlation between random effects. This yielded a significant effect of condition (Estimate = 5.9, SE = 1.5, z = 3.89, p < .001), such that more RPs were produced in the animate patient condition. A similar model, applied on the same data set after excluding all verb-initial relatives, converged in its maximal version and yielded the same performance pattern – significantly higher resumption rates in the animate patient condition (Estimate = 5.9, SE = 2.1, z = 2.8, p = .005).

Further, as verb initial structures constitute a subset of the constructions we compare in the first analysis and since they exhibit shorter dependencies, which may be related to our experimental manipulation, we applied a follow-up model comparing their rates in each condition. We started out with the maximal model, with random intercepts and random slopes on both subjects and items. The converging model did not include random intercepts or correlations between random effects and did include random slopes on subjects and items. It failed to find a significant effect of our experimental manipulation on the rate of v-initial RCs (Estimate = 1.13, SE = 7, z = 1.6, p = .09).

Table 3
Set Example, Experiment 3.

הרטיב/ה

hirtiv/a

made-wet. M/F

Figure 4. Experiment 3, picture used with the verb *hirtiv* 'made-wet'.

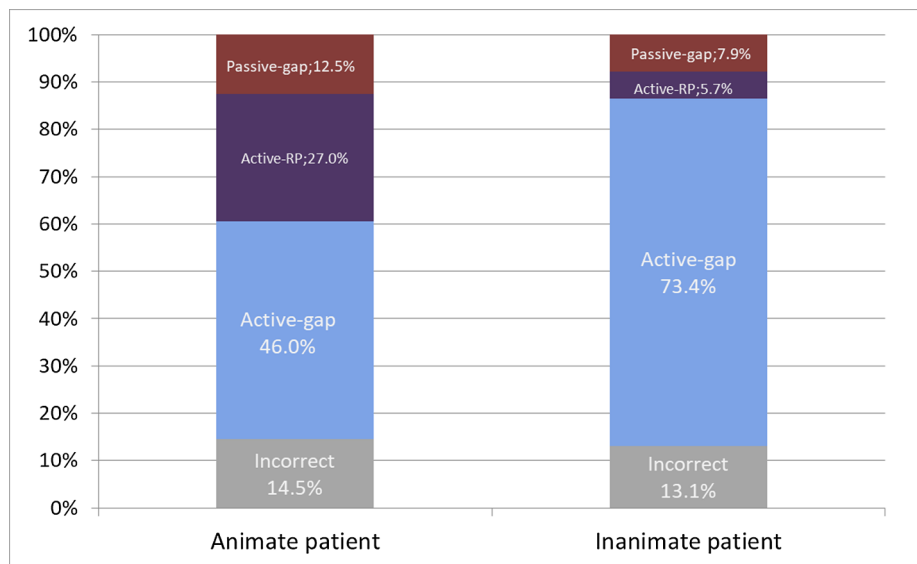| Animate patient	Inanimate patient
mi loveš bgadim kxulim?	*ma adom ba-tmuna?*
who wearing cloths blue?	what red in-the-picture?
'Who is wearing blue clothes?'	'What is red in the picture?'
ha ____ še_____	ha ____ še_____
'The_____ that_____'	'The_____ that_____'

Fig. 5. Experiment 3, distribution of relative clause type by condition.

Discussion

Experiment 3 tested whether animacy-based similarity between the relative head and the embedded agent would result in increased resumption in the direct object position in Hebrew relative clauses. We predicted that if similarity-based interference hinders filler retention, speakers of Hebrew should produce more resumptives in the object position of a dependency maintained throughout the production of a semantically similar lexical item. This prediction was borne out. The rate of direct object resumption was significantly higher when both the filler and the embedded agent were animate. This performance pattern provides additional support for our suggestion that similarity-based interference hinders filler maintenance. In contrast, since this variation does not entail a distinction the inclusion of the agent or its position, the observed performance pattern cannot be explained as reflecting agent-inhibition.

Finally, although we observed an unexpectedly high rate of verb-initial relatives in this experiment, this tendency was not modulated by animacy-based similarity. We view it as an artifact of our experimental task, which demanded that participants use a given and prominently presented verb in their answers.

General discussion

This study examined how filler-retention demands affect production choices in the formation of filler-gap dependencies in three experiments. In Experiment 1, more passive relative clauses were produced in non-restrictive compared to restrictive relative clauses, suggesting that English speakers use passivization to moderate filler-retention demands by creating shorter dependencies. In Experiment 2, in accordance with filler retention-moderation, Hebrew speakers used more resumptive pronouns in non-restrictive compared to restrictive relatives, supporting the association of non-restrictiveness with challenging filler-retention. In Experiment 3, Hebrew speakers produced more resumptive pronouns in the object position of active animate-animate relative clauses as compared to animate-inanimate ones, a pattern consistent with hindered filler-retention and that agent inhibition cannot explain.

Early dependency resolution as a retention moderation mechanism

As noted in the introduction, there is an extensive body of research focusing on the idea of a locality cost – that shorter dependencies may be easier to process than longer ones. In comprehension, this means that (active) relative clauses with a gapped subject position are more easily processed than relative clauses with gapped object position across populations (Caramazza & Zurif, 1976; Caplan, Alpert, & Waters, 1998; Just, Carpenter, & Keller, 1996; King & Just, 1991; MacWhinney, 1982; Mak, Vonk, & Schriefers, 2002; Traxler, Morris, & Seely, 2002; Wanner & Maratsos, 1978, among others). Many researchers have attempted to explain this phenomenon in terms of the distance between the relative head and the embedded position in which it is interpreted (Gibson, 1998; Grodner & Gibson, 2005; Hawkins, 1999, 2003, among others). Accordingly, these views attribute the processing difficulty incurred during the parsing of object relatives to an increased difficulty in integrating the filler and the embedded predicate when more lexical material intervenes. In production, it has been noted that the ordering of constituents is partially determined by their complexity and length (Wasow, 1997). Specifically, in English, heavier NPs tend to be uttered later than lighter ones when there is optionality (Arnold, Losongco, Wasow, & Ginstrom, 2000; Kimball, 1973; Ross, 1967; Stallings & MacDonald, 2011; among others). This phenomenon, known as heavy NP shift, has also been attributed to a tendency to minimize the distance between two dependent elements (Diessel, 2005; Hawkins, 1994, 2003; Temperley, 2007). According to an analysis by Hawkins (1994, 2003), this is done to minimize the length of the dependency between the verb and its complements by placing the shorter one closer to the verbal head. Further, extensive corpus studies quantitatively assessing the tendency of languages to minimize dependency length (Temperley, 2007; Gildea & Temperley, 2007; and more recently Futrell et al., 2015 in a large scale study of 37 languages) have demonstrated that dependency lengths are significantly shorter than expected based on random distributions.

Most of these works (Diessel, 2005; Hawkins, 1994, 2003; Temperley, 2007) attribute the tendency towards shorter dependencies to an effort to achieve communicative efficiency by improving the comprehensibility of the produced utterance. Nevertheless, as noted by Temperley (2007), another possible explanation for this tendency are speaker-oriented processing pressures. This possibility is also considered in Gibson (1998), who suggests that a memory account viewing the processing cost of longer dependencies as incurred by the need to "keep a category in mind" (p. 52) throughout the processing of other elements extends to a possible account in terms of production complexity. According to this type of account, it is costlier for the speaker to maintain an element in working memory across the production of additional interfering elements. Hence, shorter dependencies, which

involve fewer interfering elements between dependent lexical items, would be less challenging to produce.

Our suggestion that dependency production must involve a retention of some information related to the filler until it is completed is similar in its logic to Gibson (1998) note cited above. We view the higher passivization rates observed with non-restrictive relatives in Experiment 1 and the association between passivization-encouraging environments in English and resumption-encouraging environments in Hebrew, established in Experiments 2 and 3, as demonstrating that English speakers do tend to produce shorter dependencies when filler retention is challenging. This, we propose, indicates that structural choices during the production of filler-gap dependencies are modulated by the requirement to retain information about the filler until the dependency is completed. In some cases, this requirement would lead to the production of shorter dependencies, and in others, increase the tendency to avoid unpronounced gaps by using resumptive pronouns (see relevant discussion below). Our findings hence extend existing evidence (Scontras et al., 2015, 2017) for Gibson (1998) suggestion that filler-gap dependencies are more costly to produce with more intervening material by demonstrating the challenges posed for dependency production under retention hindering circumstances. Accordingly, it provides additional support for memory-based accounts (Gibson, 1998, 2000; Grodner & Gibson, 2005; Wanner & Maratsos, 1978), which attribute difficulties associated with the processing of non-local dependencies to challenges of filler maintenance.

Finally, what about preferences to passivize in languages with head-final relative clauses (e.g., Mandarin, Japanese, and Korean)? Given the evidence that final relative heads are planned prior to or with the relative clause (Hsiao & MacDonald, 2016; Montag et al., 2017) it may seem that filler-gap distance should not play a role in moderating retention load in these cases, since the filler is planned before the gap but uttered after it. Nevertheless, note that in these languages as well, the production of a passive results in earlier positioning of the gapped argument. Since the argument-predicate relationship between the planned filler and the embedded predicate is established once the gap is positioned, under the assumption that filler retention is meant for keeping track of the well-formedness of the dependency during production, it is possible that structural encoding from that point on is less demanding in terms of filler-retention. This means that passivization during the production of head-final relative clauses may also be related to challenges for filler maintenance. Concrete conclusions about this relationship demand further research.

Filler inaccessibility and increased rates of grammatical resumption

In Experiments 2 and 3, we observed that Hebrew speakers tend to use more resumptive pronouns when filler retention is hypothetically hindered. As noted, this observation is predicted by Ariel (1999) Accessibility Model of resumption, maintaining that a relatively low degree of mental accessibility of the filler at the gap site encourages the use of resumptives. As mentioned above, this increased tendency to use resumptives in the embedded argument position when filler accessibility in hindered can be accounted for in terms of the mechanisms involved in the production of filler-gap dependencies.

In the introduction we discussed the properties of filler-gap dependency constructions and noted that they include a predicate-argument relationship between the filler and a potentially far-away embedded verb. We further argued that, in order to account for the use of gaps in relative clauses, the language production system must be equipped with a mechanism allowing the occurrence of unpronounced - yet implied - arguments when they are embedded under a filler, and forbidding unpronounced arguments in other cases. We then argued that retention of information about the filler is necessary for verifying that the grammatical encoding of the connection between the filler and the gap position is well-formed. From this, our observation of an increased tendency to use resumption when retention is hindered follows

naturally. If the retention of information about the filler is the processing component allowing the generation of an empty argument position, it is not surprising that under circumstances which hinder filler retention speakers would show preference for articulating phonological material in that position. In other words, we propose that since hindered filler retention impeded Hebrew speakers' ability to keep track of the well-formedness of the dependency, they cautiously opted for the safer alternative, which, in addition to satisfying local argument structure demands, is also a grammatical technique for creating filler-gap dependencies in their language.

This view is consistent with existing production accounts for intrusive resumption in syntactic islands, namely, that choices to use a resumptive are related to satisfaction of local subcategorization constraints (Morgan & Wagers, 2018) or local well-formedness (Asudeh, 2004, 2011). Only, with grammaticized resumption in non-island environments, this decision is not accompanied by global ill-formedness or abandonment of the dependency. Accordingly, contexts in which speakers of languages with grammaticized resumption use it as a technique for ensuring satisfaction of argument structure constraints should be less restricted. A comparison of structural choices in Experiment 1 (English) and Experiment 2 (Hebrew) and of Gennari et al. (2012) results (English) and our Experiment 3 (Hebrew) fully support this: in both pairs of experiments the most frequent production choice in Hebrew was resumption, whereas English speakers did not use resumption at all.

Recall that although passivization is rarely used in Hebrew (Berman, 1979, 2008; Bolozky, 1999; Dekel, 2014; Jisa et al., 2002) it is still grammatical. In addition, as reflected in the results of Experiments 2 and 3, speakers do not completely refrain from using it. This raises the following question: if Hebrew speakers have a choice to avoid a challenging dependency by producing a shorter one, why would they not choose this option, and instead continue its production under retention impeding circumstances? Our answer to this question is, in some respects, similar to Berman (1979) and Jisa et al. (2002) accounts for the relative infrequency of Hebrew passives, namely that it is related to the availability of other constructions. Adopting a functional pragmatics perspective, these works attribute the scarcity of passivization to the availability of other constructions with which agent downgrading or another noun's foregrounding can be achieved, hence decreasing the functional load on passives.

We propose to view this from a processing perspective, focusing on cognitive pressures during dependency production. Given the way in which these two structures are linearized, it seems that a decision to passivize demands more advance planning than the production of a resumptive in object position. As a result, it is possible that speakers of languages with grammaticized resumption would show a decreased tendency towards the more cognitively demanding option, simply because their grammar allows a less demanding way for tracking the dependency's well-formedness. Namely, their grammar allows satisfaction of local argument structure demands through grammatical resumption, which, as opposed to intrusive resumption, is not the result of a breakdown in dependency production. Future research could examine this suggestion by assessing the planning demands of passive relative clauses and relative clauses with a resumptive pronoun in object position.

Finally, another possible avenue for future research is the use of non-passive agent-downgrading constructions (e.g., impersonals) by Hebrew speakers in situations where English speakers would use passives (as predicted by Berman, 1979; Jisa et al., 2002). Although the current study did not find evidence in support of this suggestion, it is possible that this strategy would be detected under a different experimental design.

Conclusion

The results of Experiments 1–3 converge to indicate that production

choices in the formation of filler-gap dependencies are modulated by filler-retention demands. The results from English indicate that challenging filler-retention can induce a preference for dependencies that resolve earlier, namely passive relative clauses. The results from Hebrew indicate that when this option for filler-retention moderation is less available, speakers of a language with optional resumption will realize the filler in the embedded position as a resumptive pronoun more often than leaving it unpronounced. These performance patterns are consistent with the view that some form of filler-retention must be an obligatory part of dependency formation in production and that speakers employ cognitive strategies to manage the memory burdens this imposes.

Acknowledgments

Declarations of interest

Funding

Appendix A:. Practice items, settings, characters, verbs and questions used in Experiment 1

Practice 1
Location: record store
Participants: salesclerk; shopper 1 (female); shopper 2 (female); shopper 3 (female)
Events:
The salesclerk yelled at shopper 1.
The salesclerk gossiped about shopper 2.
The salesclerk assisted shopper 3.
Who will never set foot in the store again?
The _____that _____.
Example for good response: The shopper that the salesclerk yelled at.
Example for bad response: The shopper that got yelled at.
Bad because some details from context are missing.

Practice 2
Location: crowded restaurant
Participants: owner, diner (male), the owner's son, the owner's daughter
Events:
The owner's son argued with the owner's daughter.
The owner's daughter argued with the owner's son.
The owner argued with the diner.
Who experienced bad service?
The _____, who_____.
Example for good response: The diner, who the owner argued with.
Example for bad response: The owner's son, who the owner's daughter argued with.
Bad because it's incorrect: It wasn't the owner's son.

Experimental items

		Setting	Characters	Verbs	Question
1	res	a university	professor, grad-student 1 (female), grad-student 2 (female), grad-student 3 (female)	complimented, saw, greeted	Who went home feeling the boss's appreciation?
	Nres	a university	professor, grad-student (female), undergrad, janitor (male)		
2	res	a mall	security guard, shopper 1 (male), shopper 2 (male), shopper 3 (male)	interrogated, identified, helped	Who went home believing that people in the service industry are sensitive to others?
	Nres	a mall	security guard, shopper (male), child (male), mother		
3	res	a public company	the CEO, secretary 1 (female), secretary 2 (female), secretary 3 (female)	praised, ignored, snubbed	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a public company	the CEO, secretary (female), file clerk (female), computer technician (male)		
4	res	a newsroom	news editor, journalist 1 (male), journalist 2 (male), journalist 3 (male)	guided, tricked, reviewed	Who would feel comfortable asking for help from an authority figure?
	Nres	a newsroom	news editor, journalist (male), head designer (female), photo editor (male)		
5	res	a supermarket	manager, cashier 1 (female), cashier 2 (female), cashier 3 (female)	comforted, hired, trained	Who would feel comfortable asking for help from an authority figure?
	Nres	a supermarket	manager, cashier (female), bagger (male), stock clerk (female)		
6	res	a restaurant	chef, sue chef 1 (male), sue chef 2 (male), sue chef 3 (male)	defended, corrected, met	Who is most likely to buy the boss a nice gift for Christmas?

	Nres	a restaurant	chef, sue chef (male), hostess, waiter		
7	res	a hospital	physician, nurse 1 (female), nurse 2 (female), nurse 3 (female)	recommended, interviewed, accompanied	Who went home feeling the boss's appreciation?
	Nres	a hospital	physician, nurse (female), x-ray technician (female), pharmacist (male)		
8	res	a sushi place	owner, waiter 1, waiter 2, waiter 3	praised, briefed, delayed	Who went home feeling the boss's appreciation?
	Nres	a sushi place	owner, waiter, busser (male), customer (female)		
9	res	a city hall	department head, cleaner 1 (female), cleaner 2 (female), cleaner 3 (female)	recruited, questioned, reassured	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a city hall	department head, cleaner (female), councilwoman, citizen (male)		
10	res	a zoo	head caregiver, caregiver 1 (male), caregiver 2 (male), caregiver 3 (male)	supported, blocked, educated	Who would feel comfortable asking for help from an authority figure?
	Nres	a zoo	head caregiver, caregiver (male), patron (male), tour guide (female)		
11	res	a factory	assembly-line manager, worker 1 (female), worker 2 (female), worker 3 (female)	motivated, fined, mentioned	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a factory	assembly-line manager, worker (female), cleaner (female), safety inspector (male)		
12	res	the Olympic Village	trainer, runner 1 (male), runner 2 (male), runner 3 (male)	nurtured, worked, drafted	Who would feel comfortable asking for help from an authority figure?
	Nres	the Olympic Village	trainer, runner (male), weightlifter (male), diver (female)		
13	res	a dental clinic	dentist, hygienist 1 (female), hygienist 2 (female), hygienist 3 (female)	backed, watched, introduced	Who went home feeling the boss's appreciation?
	Nres	a dental clinic	dentist, hygienist (female), receptionist (female), patient's father		
14	res	an advertising agency	art-director, designer 1 (male), designer 2 (male), designer 3 (male)	quoted, instructed, focused	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	an advertising agency	art-director, designer (male), jingle writer (male), market research analyst (female)		
15	res	an airplane	pilot, stewardess 1, stewardess 2, stewardess 3	applauded found, sketched	Who went home feeling the boss's appreciation?
	Nres	an airplane	pilot, stewardess, co-pilot (male), frequent flyer (male)		
16	res	a chemistry lab	researcher, assistant 1 (male), assistant 2 (male), assistant 3 (male)	congratulated, confronted, fired	Who went home feeling the boss's appreciation?
	Nres	a chemistry lab	researcher, assistant (male), lab tech (female), janitor (female)		
17	res	a city bus	driver, passenger 1 (female), passenger 2 (female), passenger 3 (female)	complimented, noticed, charged	Who went home believing that people in the service industry are sensitive to others?
	Nres	a city bus	driver, passenger (female), old woman, little boy		
18	res	a rental apartment	owner, tenant 1 (male), tenant 2 (male), tenant 3 (male)	helped, limited, directed	Who would feel comfortable asking for help from an authority figure?
	Nres	a rental apartment	owner, tenant (male), electrician (male), florist (female)		
19	res	a nightclub	bouncer, clubber 1 (female), clubber 2 (female), clubber 3 (female)	encouraged, stopped, tested	Who went home believing that people in the service industry are sensitive to others?
	Nres	a nightclub	bouncer, clubber (female), D.J. (male), photographer (female)		
20	res	a bar	owner, bartender 1 (male), bartender 2 (male), bartender 3 (male)	guided, recruited, suspected	Who would feel comfortable asking for help from an authority figure?
	Nres	a bar	owner, bartender (male), cocktail waitress, delivery guy		
21	res	a swimming pool	lifeguard, swimmer 1 (female), swimmer 2 (female), swimmer 3 (female)	comforted, warned, blocked	Who went home believing that people in the service industry are sensitive to others?
	Nres	a swimming pool	lifeguard, swimmer (female), teenager (female), tourist (male)		
22	res	a yoga class	instructor, student 1 (male), student 2 (male), student 3 (male)	congratulated, embarrassed, adjusted	Who would feel comfortable asking for help from an authority figure?
	Nres	a yoga class	instructor, student (male), trainee (male), junior instructor		
23	res	a banana plantation	farmer, day-worker 1 (female), day-worker 2 (female), day-worker 3 (female)	defended, selected, acknowledged	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a banana plantation	farmer, day-worker (female), cowboy, banker (male)		
24	res	a dry cleaners	manager, cleaner 1 (male), cleaner 2 (male), cleaner 3 (male)	recommended, recorded, doubted	Who went home feeling the boss's appreciation?
	Nres	a dry cleaners	manager, cleaner (male), business man, politician (female)		
25	res	a event production company	producer, waitress 1, waitress 2, waitress 3	encouraged, recognized, skipped	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a event production company	producer, waitress, caterer, band leader		

26	res	a choir	leader, singer 1 (female), singer 2 (female), singer 3 (female)	reassured, stopped, imitated	Who would feel comfortable asking for help from an authority figure?
	Nres	a choir	leader, singer (female), accompanist (female), audience member (female)		
27	res	a hair salon	hairdresser, intern 1 (male), intern 2 (male), intern 3 (male)	quoted, interrupted, re-membered	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a hair salon	hairdresser, intern (male), housewife, frat brother		
28	res	a beauty parlor	head cosmetician, costumer 1 (female), costumer 2 (female), costumer 3 (female)	motivated, insulted, slapped	Who went home believing that people in the service industry are sensitive to others?
	Nres	a beauty parlor	head cosmetician , costumer (female), manicurist (male), waxer (female)		
29	res	a therapist's clinic	therapist, patient 1 (female), patient 2 (female), patient 3 (female)	nurtured, mentioned, ma-nipulated	Who would feel comfortable asking for help from an authority figure?
	Nres	a therapist's clinic	therapist, patient (female), receptionist (male), delivery girl		
30	res	a coffee shop	barista, intern 1 (male), intern 2 (male), intern 3 (male)	backed, disregarded, dis-couraged	Who is most likely to buy the boss a nice gift for Christmas?
	Nres	a coffee shop	barista, intern (male), writer (female), hipster (male)		
31	Res	a psychiatric hos-pital	psychiatrist, patient 1 (female), patient 2 (female), patient 3 (female)	applauded, found, exam-ined	Who would feel comfortable asking for help from an authority figure?
	Nres	a psychiatric hos-pital	psychiatrist, patient (female), orderly (female), visitor (female)		
32	Res	a university library	librarian, student 1 (male), student 2 (male), student 3 (male)	supported, shushed, over-heard	Who went home believing that people in the service industry are sensitive to others?
	Nres	a university library	librarian, student (male), professor (male), teaching assistant (female)		

Appendix B:. Practice items and settings, characters, verbs and questions used in Experiment 2

    Practice 1

מיקום: חנות תקליטים

Location: record store

משתתפים: זבנית, קונה א', קונה ב', קונה ג'

Participants: sales-clerk(F), shopper(M) A, shopper(M) B, shopper(M) C

events that took place	אירועים שהתרחשו
The sales-clerk bothered (to) shopper A	הזבנית הציקה לקונה א'
The sales-clerk moved shopper C	הזבנית הזיזה את קונה ג'
The sales-clerk ignored shopper B	הזבנית התעלמה מקונה ב'

שאלה: מי חזר הביתה עם תקליט שהוא לא ממש רצה?

Question: who returned home with a record he didn't really want?

_____ ש _____ ה

תשובה טובה: הקונה שהזבנית הציקה לו

Good answer: the shopper that the sales-clerk bothered (to)-him

תשובה גרועה: האיש שקנה אותם.

Bad answer: the man who bought them

סיבה: לא נעשה שימוש בפרטים הרלוונטיים הנתונים בהקשר

Reason: the relevant details provided by the context weren't used

Practice 2

מיקום: מסעדה סינית ברחוב אלנבי

Location: Chinese restaurant on Allenby Street

משתתפים: מלצר, סועדת, בנו של המלצר, בתו של המלצר

Participants: waiter, diner(F), the waiter's son, the waiter's daughter

אירועים שהתרחשו

The waiter's daughter screamed at the waiter's son	בתו של המלצר צעקה על בנו של המלצר
The waiter's son screamed at the waiter's daughter	בנו של המלצר צעק על בתו של המלצר
The waiter screamed at the diner	המלצר צעק על הסועדת

מי חוותה שירות גרוע?

Who experienced bad service?

ה _____ , שכאמור _____

תשובה טובה: הסועדת, שכאמור המלצר צעק עליה

Good answer: the diner, that-as-mentioned, the waiter screamed at her

תשובה גרועה: הבת של המלצר, שכאמור, הבן של המלצר צעק עליה.

Bad answer: the waiter's daughter, that-as-mentioned the waiter's son screamed at her

סיבה: התשובה לא מתאימה לקריטריון שהוצג בשאלה, לא מדובר כאן בשירות גרוע.

Reason: the answer does not match the question, this wasn't about bad service

Experimental items

		Setting	Characters		Verbs		Question	
1	Res	a university	,מרצֶה	a professor(M),	,ליטף, העדיף	petted,	למי	To which
			,'סטודנטית א	student(F) A,	עקף	favored,	מהמשתתפים	participant
			,'סטודנטית ב	student(F) B,		passed-by	תמליצו	would you
			'סטודנטית ג	student(F) C			להגיש	recommend to
	Nres		,מרצֶה	a professor(M),			תלונה	complain to
			,סטודנטית	student(F) , son of the			לוועדת	the discipline
			בנו של	professor, daughter of			?המשמעת	committee?
			המרצה, בתו	the professor				
			של המרצה					
2	Res	a mall	,מאבטחת	security guard(F),	,צבטה, זיהתה	pinched,	למי	To which
			,'לקוח א	costumer(M) A,	הכניסה	identified,	מהמשתתפים	participant
			,'לקוח ב	costumer(M) B,		let-in	תמליצו	would you
			'לקוח ג	costumer(M) C			להגיש	recommend to
	Nres		,מאבטחת	security guard(F),			תלונה	complain to
			לקוח, נכדתה	costumer, security			לוועדת	the discipline
			,של המאבטחת	guard's granddaughter,			?המשמעת	committee?

			נכדה של המאבטחת	security guard's grandson				
3	Res	government owned company	מנכ״ל, פקידה א', פקידה ב', פקידה ג'	CEO, secretary(F) A, secretary(F) B, secretary(F) C	נישק, מידר, טיפח	kissed, excluded, nurtured	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		מנכ״ל, פקידה, נכדתו של המנכ״ל, נכדו של המנכ״ל	CEO, secretary(F), CEO's granddaughter, CEO's grandson				
4	Res	newspaper headquarters	עורכת, כתב א', כתב ב', כתב ג'	editor(F), reporter(M) A, reporter(M) B, reporter(M) C	הפנה, אתגרה, ביקרה	groped, challenged, criticized	מי חווה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		עורכת, כתב, בתה של העורכת, בנה של העורכת	editor(F), reporter(M), editor's daughter, editor's son				
5	Res	a supermarket	מנהל משמרת, קופאית א', קופאית ב', קופאית ג'	manager(M), cashier(F) A, cashier(F) B, cashier(F) C	דחף, הרגיע, דמיין	pushed, clamed, imagined	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		מנהל משמרת, קופאית, בנו של מנהל המשמרת, בתו של מנהל המשמרת	manager(M), cashier(F), manager's son, manager's daughter				

6	Res	a restaurant	שפית, סו-שף א', סו-שף ב', סו-שף ג'	chef(F), sue-chef(M) A, sue-shed(M) B, sue-chef(M) C	הכתה, עודדה, דובבה	hit, encouraged, induced-to-speak	למי מהמשתתפים תמליצו להגיש תלונה לוועדת המשמעת?	To which participant would you recommend to complain to the discipline committee?
	Nres		שפית, סו-שף, נכדה של השפית, נכדתה של השפית	chef(F), sue-chef(M), chef's granddaughter, chef's grandson				
7	Res	a hospital	רופא, אחות א', אחות ב', אחות ג'	doctor(M), nurse(F) A, nurse(F) B, nurse(F) C	גיפף, ראיין, ליווה	fondled, interviewed, accompanied	למי מהמשתתפים תמליצו להגיש תלונה לוועדת המשמעת?	To which participant would you recommend to complain to the discipline committee?
	Nres		רופא, אחות, אשתו של הרופא, המאהבת של הרופא	doctor(M), nurse(F), doctor's wife, doctor's daughter				
8	Res	a sushi-bar	בעלים, מלצרית א', מלצרית ב', מלצרית ג'	owner, waitress A, waitress B, waitress C	הפשיט, הכשיר, עיכב	stripped, trained, stalled	מי חוותה התנהגות לא נאותה של בעל סמכות?	Who experienced inappropriate behavior of an authority figure?
	Nres		בעלים, מלצרית, אשתו של הבעלים, המאהבת של הבעלים	owner, waitress, owner's wife, owner's lover				
9	Res	city hall	מנהלת אגף, מנקה א', מנקה ב', מנקה ג'	department manager(F), cleaner(M) A, cleaner(M) B, cleaner(M) C	רחרחה, שיבצה, תשאלה	sniffed, assigned, questioned	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?

	Nres		מנהלת אגף, בנה של מנהלת האגף, בתה של מנהלת האגף, מנקה	department manager(F), cleaner(M), manager's son, manager's daughter				
10	Res	a zoo	מטפלת ראשית, מאכיל א', מאכיל ב', מאכיל ג	head caregiver(F), feeder(M) A, feeder(M) B, feeder(M) C	דגדגה, הסתירה, חינכה	tickled, hid, educated	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		מטפלת ראשית, מאכיל, נכדה של המטפלת, נכדתה של המטפלת	head caregiver(F), feeder(M), head caregiver's grandson, head caregiver's granddaughter				
11	Res	a factory	מנהל פס-ייצור, פועלת א', פועלת ב', פועלת ג'	assembly-line manager(M), worker(F) A, worker(F) B, worker(F) C	ליקק, הילל, הזכיר	licked, praised, mentioned	מי חוותה התנהגות לא נאותה של בעל סמכות?	who experienced harassment by an authority figure?
	Nres		מנהל פס-ייצור, פועלת, אשתו של המנהל, המאהבת של המנהל	assembly-line manager(M), worker(F), manager's wife, manager's lover				
12	Res	a gym	מאמנת, אצן א', אצן ב', אצן ג'	coach(F), runner(M) A, runner(M) B, runner(M) C	מזמזה, הריצה, בירכה	necked, ran, congratulated	מי חווה הטרדה	Who experienced harassment by

#		Setting	Characters (Hebrew)	Characters (English)	Verbs (Hebrew)	Verbs (English)	Question (Hebrew)	Question (English)
	Nres		מאמנת, אצן, בעלה של המאמנת, המאהב של המאמנת	coach(F), runner(M), coach's husband, coach's lover			במסגרת יחסי מרות?	an authority figure?
13	Res	a dental clinic	רופא שיניים, שינית א', שינית ב', שינית ג'	dentist(M), hygienist(F) A, hygienist(F) B, hygienist(F) C	תפס, שכר, הציג	grabbed, hired, introduced	מי חווה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		רופא שיניים, שינית, בנו של רופא השיניים, בתו של רופא השיניים	dentist(M), hygienist(F), dentist's son, dentist's daughter				
14	Res	advertising agency	ארט-דיירקטורית, גרפיקאי א', גרפיקאי ב', גרפיקאי ג'	art-director(F), designer(M) A, designer(M) B, designer(M) C	טלטלה, מיקדה, תיקנה	shook, focused, corrected	למי מהמשתתפים תמליצו להגיש תלונה לוועדת המשמעת?	To which participant would you recommend to complain to the discipline committee?
	Nres		ארט-דיירקטורית, גרפיקאי, נכדה של הארט-דיירקטורית, נכדתה של הארט-דיירקטורית	art-director(F), designer(M), art director's grandson, art-director granddaughter				

#		Setting	Hebrew participants	Participants	Hebrew verbs	Verbs	Hebrew question	Question
15	Res	an airplane	טייס, דיילת א', דיילת ב', דיילת ג,	pilot(M), Stewardess A, Stewardess B., Stewardess C	נשך, שירת, צייר	bit, served, painted	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		טייס, דיילת, המאהבת של הטייס, אשתו של הטייס	pilot(M), Stewardess, pilot's lover, pilot's wife				
16	Res	a lab	חוקרת, לבורנט א', לבורנט ב', לבורנט ג'	researcher(F), lab assistant(M) A, lab assistant(M) B, lab assistant(M) C	חיבקה, תגמלה, פיטרה	hugged, rewarded, fired	מי חווה התנהגות לא נאותה של בעלת סמכות?	Who experienced harassment by an authority figure?
	Nres		חוקרת, לבורנט, בנה של החוקרת, בתה של החוקרת	researcher(F), lab assistant(M), researcher's son, researcher's daughter				
17	Res	a bus	נהג, נוסעת א', נוסעת ב', נוסעת ג'	driver(M), passenger(F) A, passenger(F) B, passenger(F) C	ליטף, הציל, הוריד	caressed, saved, dropped-of	למי מהמשתתפים תמליצו להגיש תלונה לוועדת המשמעת?	To which participant would you recommend to complain to the discipline committee?
	Nres		נהג, נוסעת, נכדתו של הנהג, נכדו של הנהג	driver(M), passenger(F), driver's granddaughter, driver's grandson				
18	Res	a rental apartment	בעלת הדירה, דייר א', דייר ב', דייר ג'	landlady, resident(M) A, resident(M) B, resident(M) C	צבטה, הגבילה, כיוונה	pinched, limited, directed	מי חווה התנהגות לא נאותה של בעלת סמכות?	Who experienced inappropriate behavior of an authority figure?
	Nres		בעלת הדירה, דייר, בנה של בעלת הדירה,	landlady, resident(M), landlady's son, landlady's daughter				

			Hebrew names	English roles	Hebrew verbs	English verbs	Hebrew question	English question
			בתה של בעלת הדירה					
19	Res	a club	שומר סף, בליינית א', בליינית ב', בליינית ג'	bouncer(M), patron(F) A, patron(F) B, patron(F) C	נישק, עצר, בחן	kissed, stopped, examined	מי חווה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		שומר סף, בליינית, נכדו של שומר הסף, נכדו של שומר הסף	bouncer(M), patron(F), bouncer's grandson, bouncer's granddaughter				
20	Res	a pub	בעלת עסק, בארמן א', בארמן ב', בארמן ג'	owner(F), bartender(M) A, bartender(M) B, bartender(M) C	חפנה, גייסה, הבינה	groped, drafted, understood	מי חווה התנהגות לא נאותה של בעלת סמכות?	Who experienced inappropriate behavior of an authority figure?
	Nres		בעלת עסק, בארמן, בתה של בעלת היסק, בנה של בעלת העסק	owner(F), bartender(M), owner's daughter, owner's son				
21	Res	a swimming pool	מציל, מתרחצת א', מתרחצת ב', מתרחצת ג'	lifeguard(M), bather(F) A, bather(F) B, bather(F) C	גיפף, הסיע, פגש	fondled, drove, met	מי חוותה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		מציל, מתרחצת, אשת המציל, מאהבתו של המציל	lifeguard(M), bather(F), lifeguard's wife, lifeguard's lover				

			Hebrew participants	English participants	Hebrew verbs	English verbs	Hebrew question	English question
22	Res	a yoga class	מדריכת יוגה, מתרגל א', מתרגל ב', מתרגל ג'	instructor(F), student(M) A, student(M) B, student(M) C	היכתה, שיבחה, העסיקה	hit, praised, hired	מי חווה התנהגות לא נאותה של בעלת סמכות?	Who experienced inappropriate behavior of an authority figure?
	Nres		מדריכת יוגה, מתרגל, נכדה של מדריכת היוגה, נכדתה של מדריכת היוגה	instructor(F), student(M), instructor's grandson, instructor's granddaughter				
23	Res	a banana plantation	חקלאי, עובדת א', עובדת ב', עובדת ג'	farmer(M), worker(F) A, worker(F) B, worker(F) C	דחף, בחר, ראה	pushed, chose, saw	מי חווה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		חקלאי, עובדת, נכדתו של החקלאי, נכדו של החקלאי	farmer(M), worker(F), famer's granddaughter, farmer's grandson				
24	Res	a laundry place	מנהלת המכבסה, כובס א', כובס ב', כובס ג'	manager(F) washer(M) A, washer(M) B, washer(M) C	רחרחה, הקליטה, תחקרה	sniffed, recorded, questioned	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		מנהלת מכבסה, כובס, נכדתה של מנהלת המכבסה, נכדה של	manager(F) washer(M) A, manager's granddaughter, manager's grandson				

מנהלת
המכבסה

#		Scenario	Characters (Hebrew)	Characters (English)	Verbs (Hebrew)	Verbs (English)	Question (Hebrew)	Question (English)
25	Res	a wedding venue	מפיק חתונות, מלצרית א', מלצרית ב', מלצרית ג'	wedding planner(M), waitress A, waitress B, waitress C	הפשיט,ציטט, שכח	stripped, quoted, forgot	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		מפיק חתונות, מלצרית, אשתו של מפיק החתונות, המאהבת של מפיק החתונות	wedding planner(M), waitress, planner's wife, planner's lover				
26	Res	a state choir	מנהלת המקהלה, זמר א, זמר ב', זמר ג'	choir manager(F), singer(M) A, singer(M) B, singer(M) C	דגדגה, הפסיקה, קידמה	tickled, stopped, promoted	למי מהמשתתפים תמליצו להגיש תלונה לוועדת המשמעת?	To which participant would you recommend to complain to the discipline committee?
	Nres		מנהלת המקהלה, זמר, בנה של מנהלת המקהלה, בתה של מנהלת המקהלה	choir manager(F), singer, manager's son, manager's daughter				
27	Res	a branch of a hairstyling chain	ספר, חופפת א', חופפת ב', חופפת ג'	hairdresser(M), washer(F) A, washer(F) B, washer(F) C	ליקק,העיר, זכר	licked, woke, remembered	למי מהמשתתפים כדאי לפנות לנציב פניות העובדים?	Which participant should turn to the workers' representative?
	Nres		ספר, חופפת, אשת הספר,	hairdresser(M), washer, hairdresser's				

			המאהבת של הספר	wife, hairdresser's lover				
28	Res	a beauty parlor	קוסמטיקאית, לקוח א', לקוח ב', לקוח ג'	cosmetician(F), costumer(M) A, costumer(M) B, costumer(M) C	מזמזה,הדריכה, איפרה	necked, guided, put-makeup-on	מי חווה התנהגות לא נאותה של בעלת סמכות?	Who experienced inappropriate behavior of an authority figure?
	Nres		קוסמטיקאית, לקוח, בעלה של הקוסמטיקאית, המאהב של הקוסמטיקאית	cosmetician(F), costumer(M), cosmetician's husband, cosmetician's husband				
29	Res	a clinic	פסיכולוג, מטופלת א', מטופלת ב', מטופלת ג'	therapist(M), patient(F) A, patient(F) B, patient(F) C	תפס, אזכר, דרבן	grabbed, mentioned, motivated	מי חוותה התנהגות לא נאותה של בעל סמכות?	Who experienced inappropriate behavior of an authority figure?
	Nres		פסיכולוג, מטופלת, בנו של הפסיכולוג, בתו של הפסיכולוג	therapist(M), patient(F), therapist's son, therapist's daughter				
30	Res	a coffee shop	בריסטה, מתלמד א', מתלמד ב', מתלמד ג'	barista, intern(M) A, intern(M) B, intern(M) C	טלטלה, סקרה, אימנה	shook, made-curios, trained	מי חווה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		בריסטה, מתלמד, נכדתה של הבריסטה,	barista, intern(M), barista's granddaughter, barista's grandson				

			נכדה של הבריסטה					
31	Res	a psychiatric hospital	פסיכיאטר, מאושפזת א', מאושפזת ב', מאושפזת ג'	psychiatrist(M), inpatient(F) A, inpatient(F) B, inpatient(F) C	נשך, חיפש, בדק	bit, sought, examined	מי חווה הטרדה במסגרת יחסי מרות?	Who experienced harassment by an authority figure?
	Nres		פסיכיאטר, מאושפזת, אשת הפסיכיאטר, המאהבת של הפסיכיאטר	psychiatrist(M), inpatient(F), psychiatrist's wife, psychiatrist's lover				
32	Res	a university library	ספרנית, סטודנט א', סטודנט ב', סטודנט ג'	librarian(F), student(M) A, student(M) B, student(M) C	חיבקה, לימדה, שמעה	hugged, taught, heard	למי מהמשתתפים תמליצו להגיש תלונה לוועדת המשמעת?	To which participant would you recommend to complain to the discipline committee?
	Nres		ספרנית, סטודנט, בנה של הספרנית, בתה של הספרנית	librarian(F), student(M), librarian's son, librarian's daughter				

Appendix C:. Practice items, verbs and questions used in Experiment 3 (for all pictures, see supplementary material).

<u>*Practice 1*</u>

סוטר/ת

Slap

Figure C1. Picture used in Practice 1, Experiment 3.

מי מחזיקה זר לבן?

Who is holding a white bouquet?

ה _____ ש _____

תשובה טובה: הכלֹה שהמכשפה סוטרת לה

Good answer: the bride that the witch is slapping her

תשובה גרועה: הכלה שעומדת ליד המכשפה.

Bad answer: the bride standing next to the witch

סיבה: לֹא נעשה שימוש בפועל הנתון

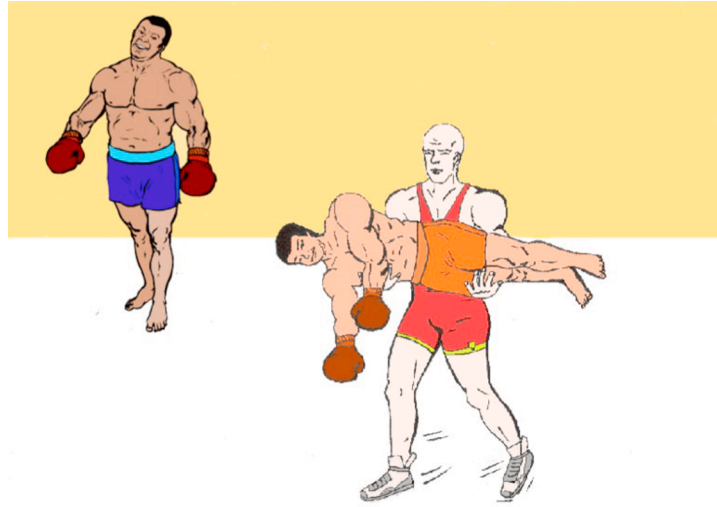Reason: the given verb wasn't used

Practice 2

נושא/ת

Carry

Figure C2. Picture used in Practice 2, Experiment 3.

למי יש אוברול אדום?

Who has red overalls?

ל _____ שׁ _____

תשובה טובה: האיש שנושא את המתאגרף

Good answer: (to) the man who carries the boxer

תשובה גרועה: המתאגרף שעומד ברקע.

Bad answer: the boxer standing in the background

סיבה: תשובה לא נכונה

Reason: wrong answer

Experimental items

		Verb		question	
1	Anmt	צבט/ה	*pinched*	מי לובש בגד ים סגול?	Who is wearing a purple bathing suit?
	Inan	צבט/ה	*pinched*	מה בתמונה צהוב?	What is yellow in the picture?
2	Anmt	צילמ/ה	*photographed*	מי לובשת ז'אקט ורוד?	Who is wearing a pink jacket?
	Inan	צילמ/ה	*photographed*	מה בתמונה צהוב?	What is yellow in the picture?
3	Anmt	דחפ/ה	*pushed*	מי לובשת שמלה אדומה?	Who is wearing a red dress?

	Inan	דחפ/ה	*pushed*	מה בתמונה סגול?	What in the picture is purple?
4	Anmt	היכה/תה	*hit*	מי לובש חולצה אפורה?	Who is wearing a gray shirt?
	Inan	היכה/תה	*hit*	מה בתמונה כתום?	What in the picture is orange?
5	Anmt	הרימ/ה	*lifted*	למי יש שיער חום?	Who has brown hair?
	Inan	הרימ/ה	*lifted*	מה בתמונה כסוף?	What in the picture in silver?
6	Anmt	הרטיב/ה	*got-wet (transitive)*	מי לובש בגדים כחולים?	Who is wearing blue clothes?
	Inan	הרטיב/ה	*got-wet (transitive)*	מה בתמונה אדום?	What in the picture is red?
7	Anmt	החזיק/ה	*held*	מי לובשת סווטשירט ורוד בוהק?	who is wearing a bright pink sweatshirt
	Inan	החזיק/ה	*held*	מה בתמונה ירוק?	What in the picture in green?
8	Anmt	קשר/ה	*tied*	מי לובש סוודר אדום?	Who is wearing a red sweater?
	Inan	קשר/ה	*tied*	מה בתמונה שחור?	What in the picture is black?
9	Anmt	ליקק/ה	*licked*	מי לובש אוברול כחול?	Who is wearing blue overalls?
	Inan	ליקק/ה	*licked*	מה בתמונה אדום?	What in the picture in red?

10	Anmt	מצא/ה	*found*	למי יש פרווה חומה?	Who has brown fur?
	Inan	מצא/ה	*found*	מה בתמונה צהוב?	What is yellow in the picture?
11	Anmt	משכ/ה	*pulled*	למי יש חליפת טריינינג באפור בהיר?	Who has a light gray sweat suit?
	Inan	משכ/ה	*pulled*	מה בתמונה כחול?	what is blue in the picture
12	Anmt	ליטפ/ה	*petted/caressed*	למי יש מעיל שחור?	Who has a black coat?
	Inan	ליטפ/ה	*petted/caressed*	מה בתמונה ירוק?	What is green in the picture?
13	anmt	סחב/ה	*carried*	מי חובש כובע צהוב?	Who is wearing a yellow hat?
	Inan	סחב/ה	*carried*	מה בתמונה אדום?	What in the picture is red?
14	anmt	נשכ/ה	*bit*	למי יש בגד ים סגול?	Who has a purple bathing suit?
	Inan	נשכ/ה	*bit*	מה בתמונה צהוב?	What is yellow in the picture?
15	anmt	נישק/ה	*kissed*	למי יש שיער בלונדיני?	Who has blond hair?
	Inan	נישק/ה	*kissed*	מה בתמונה זהוב?	What is golden in the picture?
16	anmt	צבע/ה	*painted*	למי יש אימונית אדומה?	Who has a red sweat suit?

	Inan	צבע/ה	*painted*	מה בתמונה אפור?	What is gray in the picture?
17	anmt	הבריש/ה	*brushed*	למי יש פרווה לבנה?	Who has white fur?
	Inan	הבריש/ה	*brushed*	מה בתמונה כתום?	What is orange in the picture?
18	anmt	תפס/ה	*caught*	למי יש חולצת טריקו כתומה?	Who has an orange t-shirt?
	Inan	תפס/ה	*caught*	מה בתמונה אדום?	what is red in the picture
19	anmt	חיבק/ה	*hugged*	למי יש מקטורן ירוק?	Who has a green jacket?
	Inan	חיבק/ה	*hugged*	מה בתמונה לבן?	What is white in the picture?
20	anmt	חורר/ה	*pierced*	למי יש חולצה אפורה?	Who has a gray shirt?
	Inan	חורר/ה	*pierced*	מה בתמונה כחול ואדום?	What in the picture in blue and red?

Appendix D. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jml.2019.02.005.

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