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# The Interpretation of Atomic and Embedded Disjunctions in Light of scalar implicatures

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## CONTENTS

## Abstract

The disjunctive marker '*or*' is generally assumed in the literature to trigger a scalar implicature computation, namely, interlocutors interpret *'A or B*' as *'A or B but not both'*. This happens since *'A and B*' entails *'A or B*', so, according to Gricean principles, one may infer that if the speaker chose to utter *'A or B*' it is because she believes that *'A and B*' is not true. Consequently, sentences including disjunctions are expected to be processed similarly to other scalar implicatures.

Scalar implicatures are known to be processed slower than equivalent sentences which no such implicature (e.g. *'some giraffes have long necks'* is processed slower than *'all giraffes have long necks'*). One of the consequences of this slow processing is that participants tend to compute scalar implicatures to a lesser extent when they are under time pressure (Bott and Noveck, 2004). An alternative account, however, attribute the observed cost not to the difficulty in scalar implicature computation itself, but merely to the choice between a 'pragmatic' ("false") and a 'logical' ("true") potential responses – a choice which is not relevant for the control sentences in typical equivalent studies (Shetreet et al, 2014). Such a theory would predict a "guessing" pattern between the logical and pragmatic responses for the under-informative sentences under time pressure, contrary to the findings in Bott and Noveck (2004). This gap suggests that there is yet another factor which prevents adults from computing scalar implicatures under time pressure.

In addition, it has been shown that children do not compute scalar implicatures by default (Noveck, 2001; Guasti et al., 2005 among many others). However, children were also shown to interpret disjunctions as conjunctions, rather than assigning them the inclusive reading '*A or B or both'* which is expected if they do not engage in scalar implicature computation (Singh et al. 2013). This was true not only for atomic disjunctions (*'x is A or B*'), which are under-informative in their exclusive reading, but also for more informative structures like disjunctions embedded under a universal quantifier (*'every x is A or B*'). The conjunctive reading of both structures was attributed by Singh et al. (2013) to children's inability to retrieve the lexical item '*and'* as a logically stronger alternative to *or* for the sake of scalar implicature computation.

The current study attempts to link between adults' performance under time pressure and children's performance, and observe whether adults indeed do not compute implicatures under time pressure, or whether they compute them, but without retrieving a logically stronger alternative from the lexicon, on a par with children. To this end, the study examines how adults interpret disjunctive sentences under time pressure.

A group of thirty adult participants evaluated the match between pictures and sentences. Sentences with atomic disjunction were presented with pictures depicting either one item (corresponding to *A* or to *B* – labeled ONE) or with both items (BOTH). Embedded disjunction sentences were presented with four different types of pictures, corresponding to different possible parses of the sentence (following Crnič et al. 2014): (a) a picture corresponding to a distributive inference, where A is true for some characters and B is true for the complement of the set (labeled everyONE); (b) a picture where A is true for the entire set (everySAME); (c) a picture where A is true for the entire set and, in addition, B is true for one character (everyMIX), and (d) a picture where both A and B are true for the entire set (everyBOTH). Half of the participants had a short lag of time to evaluate the pair, and half of them had a longer lag to do so.

Results do not indicate that adults attribute a conjunctive reading to disjunctions, in any time lag. Participants did not significantly accept the BOTH picture as described by an atomic disjunction under time pressure. However, they did accept everyBOTH as matching an embedded disjunction. Further, while participants indeed tended to accept the ONE picture as matching the atomic disjunction to a lesser degree under time pressure, with the embedded disjunction no such trend was observed for the everyONE and everySAME, and a marginal effect was observed for everyMIX .

These findings suggest that adults do not compute implicatures under time pressure. I propose that, under time pressure, rather than accepting anything compatible with the assumed logical denotation of *'or'* (namely an inclusive disjunction), adults seek compatibility with a mental image associated with '*or'* when processing disjunctions.

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# 1. INTRODUCTION

## 1.1 On scalar implicatures and implicature in general

### 1.1.1 What is a scalar implicature?

An implicature is a broad term for various pragmatic phenomena, coined by Grice (1967, 1975) to describe a communicated message which was not literally uttered. This message successfully conveys the desired meaning due to a simple principle of cooperation between the speaker and the addressee. Unlike entailments, implicatures can be canceled in certain contexts. Grice draws a distinction between 'what is said' and the meaning that the speaker tries to convey.

> …a distinction… within the total signification of a remark… between what the speaker has said (in a certain favored and maybe in some degree artificial, sense of 'said'), and what he has implicated (e.g., implied, indicated, suggested, etc.), taking into account the fact that what he has implicated may be either conventionally implicated (implicated by virtue of the meaning of some word or phrase which he has used) or non-conventionally implicated (in which case the specification of implicature falls outside the specification of the conventional meaning of the words used).
>
> (Grice [1967] 1991: 118)

Grice provides four principles, called *maxims*, which guide the speaker to a successful cooperative conversation: quality, quantity, manner and relation. Central to the current investigation is the first part (a) of Grice's Maxim of Quantity in (1).

(1). Maxim of Quantity:

a) Make your contribution as informative as is required (for the current purposes of the exchange).

b) Do not make your contribution more informative than is required.

Much of the recent literature concerning implicatures (especially the psycholinguistic literature discussed in the current study) shifts focus from the message intended by the speaker, to the message inferred by the addressee, contrary to Grice's original definition of implicature (see elaborated discussion in Horn, 2010). This shift in focus is directly addressed by Ariel (2004), who distinguishes between the meaning intended by the speaker (whether by *'what is said'* or an implicature) and the meaning inferred by the speaker, though crucially not necessarily meant (i.e., communicatively intended) by the speaker (TCI – truth compatible inference, for being compatible with the speaker's message). In the remainder of this work, I will adopt the terms customary in the psycholinguistic literature and refer to implicatures as the inferred, rather than the intended, meaning.

A *scalar implicature* (SI henceforth) is a kind of inference in which upon hearing an utterance, the addressee infers that any relevant yet logically stronger proposition is false. For example, in many contexts, an addressee hearing the sentence "*Some of the students received high grades*" will infer that it is not true that all of the students received high grades. This inference is based on the assumption that the speaker is cooperative and opinionated. The addressee assumes that had the speaker believed that all of the students had received high grades, she would have said so.

The name 'scalar implicature' was coined by Larry Horn (1972) to suggest that these inferences involve a scale of lexical items in which one is logically stronger than the other. Uttering a sentence with the weaker lexical item implies that the same utterance with the logically stronger lexical item is false. Such so-called 'Horn-scales' are, for example, <*some*, *all*>, <*or*, *and*>, <*good*, *excellent*> etc., where the right item in the scale is the logically strongest one and entails the item(s) to its left. Two non-trivial assumptions are essential for the derivation of scalar implicatures to work as proposed above:

a) The semantic meaning of certain “scalar” items has a lower bound only. For example, the meaning of *some* is *'some and possibly all'*. This is indeed the canonical view mapping the Aristotelian logical meaning of lexical items to their natural language counterparts.[1]

b) As stated above (and well agreed in the literature), the right item in the scale entails the item(s) to its left. It should be noted, however, that this is not always the case. Pairs in some lexical scales which yield SIs do not stand in logical entailment relations (e.g. <*some*, *all*> - a sentence with *all* does not necessarily entail its parallel with *some*, since the former can be vacuously true while its parallel with *some* will be false), while other pairs that do stand in entailment relations do not normally give rise to SI (e.g. <*fruit*, *banana*> - *banana* entails *fruit*, but the sentence "I ate fruit" does not implicate "I did not eat a banana"). For the purpose of the current work I will overlook the case of vacuousness and assume that *some* and *all* stand in an entailment relation.

### 1.1.2 Scalar implicature as GCI

Scalar implicatures are a type of *generalized conversational implicature* (GCI): implicatures that despite their cancelability, by large arise regardless of context. This is as opposed to PCI (particularized conversational implicature) - a message which the speaker meant to convey, but is only indirectly conveyed. Carston (1988) regards GCI as an *explicature* - a richer version of the Gricean 'what is said'. It is a representation of the speaker-intended proposition, pragmatically derived from her utterance. In order for this representation to provide all the relevant truth conditions, information from the context must be drawn upon, due to ellipses, ambiguities, the presence of deictic items (e.g. *she, there*), etc.

However, the generalization about GCIs has some exceptions to it. In very specific linguistic and non-linguistic contexts, SI inferences are weaker, if they exist at all. Below are several examples of such contexts:

- A logically stronger lexical item may not be negated if it is not perceived as relevant in the context. For example, in some contexts, for a sentence (2a) it

[1] This view is challenged by Bultinck (2005) for cardinals (e.g. Bultnick argues that *five* means 'exactly five' rather than 'five or more'), and Ariel (2015) for *some* and *most* (Ariel proposes that *some* denotes a proper subset).

might be irrelevant if John ate less or more than half of the cookies, but relevant if there are any cookies left. In such a context, (2c) is negated by implicature, but not (2b). Similarly, in a context where it is irrelevant whether there are any cookies left, but only that John knows what the cookies taste like, neither (2b) nor (2c) are negated.

(2) a. John ate some of the cookies.

b. John ate most of the cookies.

c. John ate all of the cookies.

- As mentioned above, one of the key assumptions for the addressee in deriving scalar implicatures, and implicatures in general, is that the speaker is knowledgeable with respect to the state of affairs. Consequently, when there is a good reason to believe the speaker does not know the facts, sometimes the SI reasoning does not take place.

- Different structures may also affect the presence and nature of SI. For example, consider embedding *some* in a downward entailing (DE) environment, as in (3b) (⇝ is used to denote an implicature, and !⇝ denotes the lack of it ).

(3) a. John ate some of the cookies. ⇝ John did not eat all of the cookies

b. John did not eat some of the cookies. !⇝ John ate all of the cookies.

c. John did not eat all of the cookies. ⇝ John ate some of the cookies.

At first glance, (3b) might suggest that SI disappears under this DE construction (Gazdar, 1979). However, considering the nature of the relation between *some* and *all*, one should take into account that under DE, this relation reverses and now *'not some $\psi$'* entails *'not all $\psi$'* and not vice versa (namely, the scale is now <*not all, not some*>) . For this reason, *'not all $\psi$'* implicates that *'not not some $\psi$'*, namely *'some $\psi$'*, is true, as in (3c).

### 1.1.3 A shift from scales to alternatives and exhaustification

Some of recent years' scholars from different schools of SI analysis agree that assuming a lexical "Horn-scale" which is stored in the lexicon is insufficient and problematic, and offer to view the process as based on structurally defined alternatives.

Following Sauerland (2004) and later Katzir (2007), many researchers now represent the alternatives as a set, rather than the classic ordered Horn-Scales (e.g. <*some, all*>). To determine the set of alternative utterances, a function ALT takes a linguistic element (S) and returns a set of elements which are alternatives to S, and are at most as complex. The element S may have another element S' as its alternative if S' is a constituent of S.

For a sentence (4S) each disjunct, (4A) and (4B), is an alternatives.

(4). (S) John ate an apple or a banana.

(A) John ate an apple.

(B) John ate a banana.

(S') John ate an apple and a banana.

A linguistic element may also be in ALT if it was explicitly mentioned in the context. For example, if Sue was said to have been eating an orange, than the utterance *'John ate an orange'* might also be an alternative. A third source for alternatives is the lexicon itself, where some items are logically linked to other items and are contrasted with them when relevant. In this case, *'and'* is retrieved as a logically stronger alternative to '*or'*, making (4S') an alternative. A possible ALT set for *'A or B'* is demonstrated in (5):

(5) ALT(*A or B*) = {'A or B', A, B, 'A and B'}

However, only those of A, B and 'A and B' which are relevant in the context, will actually be considered. So for example, if a context $c^0$ makes the question if John ate both irrelevant, the alternative set should be ALT(S,$c^0$) = {'A or B', A, B}. However, in the case of disjunction, A and B are closed under conjunction, namely, if A is relevant and B is relevant, 'A and B' is also relevant, regardless of the context (e.g. Chierchia, Fox & Spector, 2008). An example for a case where the above is indeed effective is the way *'all'* is pruned from the alternative set in a context where it is irrelevant, for example in example (2) above, in a context where it is irrelevant whether there are any cookies left, but only that John knows what the cookies taste like.

As for SI computation itself, under these approaches it is achieved through the process of exhaustification. First introduced by Groenendijk and Stokhof (1984) for questions and in Rooth (1996) for *only* (cf. Krifka, 1995; Spector, 2003; Chierchia, 2004; van Rooij & Schulz 2004; Fox, 2006), exhaustification is a tool for choosing the appropriate answer/meaning from a defined set of alternatives. For a sentence S, an exhaustification operator *exh* negates the logically stronger alternatives to S.

(6) $exh(S) =$ iff $S \wedge \forall S' \in ALT(S) \wedge (S' \rightarrow S) \wedge \neg(S \rightarrow S'), \neg S'$

The above formula simply means, that for a sentence S, *exh* negates every S' such that S' is an alternative to S, and monotonously entails S.

The exact manner of exhaustification is subject to theoretical debates in the literature. A core disagreement is between a "Neo-Gricean" view and a grammatical one. The two approaches dispute over the division of labor between the semantic and the pragmatic modules. The Neo-Griceans (Levinson 2000; Spector, 2003; Sauerland, 2004 and others, based on Horn, 1972; Gazdar, 1979 and others) assume that a core semantic meaning of the sentence is computed, and only afterwards the pragmatic module negates the alternatives. Central to such a hypothesis is the assumption that the sentence is computed globally (as a whole), and consequently, the 'pragmatic module' assembles a set of alternatives which contains entire sentences (which abide to the above-mentioned guidelines).

(7) $\psi$ = John ate **some** of the cookies.
$\psi'$ = John ate **all** of the cookies.
Let $\psi' \subset \psi$, then $\psi \rightsquigarrow \neg(\psi')$

John did not eat **all** of the cookies. [2]

A grammatical approach (introduced by Chierchia (2004), based on Krifka (1995) and Landman (2000)) suggests a 'localist' view according to which SI computation lies within the semantics and is computed locally in the scope site of the logically weaker word (like *some*).

[2] $\subset$ denotes asymmetrical entailment.

Another view is a hybrid one (Fox, 2006) which suggests that the process indeed lies within the semantics but the choice between the 'exhaustified' meaning (*some but not all*) and the 'logical' one (*some and maybe all*) is done in the pragmatics. As for the semantic meaning of the exhaustification operator *exh*, it functions like a covert *only*, and potentially can take scope over different parts of the sentence, the same way *only* does.[3] The location of *exh* is relevant for more complex structures which involve disjunctions, like embedded disjunctions, which will be the main concern of this thesis, and also *free choice* inferences.

It is important to note that I will not make any attempt in this paper to decide between the neo-Gricean and the grammatical views.

## 1.2 Empirical Studies

This far we have introduced the notion of scalar implicatures and have briefly mentioned several different theories that attempt to explain the mechanism behind it. On the empirical side, recent years' studies have introduced some interesting and not-so-trivial findings about the way we understand utterances which involve lexical items like *some* and *or*.

### 1.2.1 Response time studies

Empirical examination of scalar implicature computation in adults focuses mainly on the processing cost associated with it, as reflected by response time. Many studies have found increased processing time for under-informative sentences, like (2a) above – *'John ate some of the cookies'*, and associate this with a 'pragmatic' reasoning (e.g. inference (3a) – that John did not eat all of the cookies) of such sentences (Bott & Noveck, 2004; Breheny Katsos & Williams, 2006; Chevallier, Noveck, Nazir et al., 2008; Huang & Snedeker, 2009; Bott, Bailey and Grodner, 2012 etc.). This association is twofold.

[3] The sentence "the fireman is holding a hose" can have 3 different meanings, depending on the location of *only* (Paterson & Liversedge, 2006)*:*

a. Only the fireman is holding a hose (and no other person does)
b. The fireman is only holding a hose (and does nothing else with it)
c. The fireman is holding only a hose (and no other object)

First, a longer processing time was measured with sentences which might have involved a pragmatic reasoning with respect to SI, compared to an unambiguous sentence (e.g. (2c)). For example, Huang and Snedeker (2009), in an eye-movement paradigm, showed participants pairs of pictures. In one, a girl has three items (e.g. socks) and a boy has none. In the other, a girl has two items (e.g. soccer balls) and a boy also has the same two items. The authors report that participants shift their look slower to the correct picture when it was described with an under informative description (e.g. "Point to the girl that has some of the socks") rather than an informative one ("Point to the girl that has all of the socks"). They explain that for the under-informative sentence, *'some soc…'* is compatible with both pictures (both the **soc**cer balls and the **soc**ks) while the *'all'*-sentences match only the socks picture, so participants know straight ahead which picture is the correct one and they shift their eyes to it faster.

The same conclusion was reached by Breheny, Katsos and Williams (2006) who showed that the same phrase takes more time to process in a context in which it triggers a scalar implicature (the "upper-bound" context) than in contexts in which it does not (the "lower-bound" context).

> **Upper-bound context**
> John was taking a university course and working at the same time. For the exams he had to study from short and comprehensive sources. Depending on the course, he decided to read the class notes or the summary.
>
> **Lower-bound context**
> John heard that the textbook for Geophysics was very advanced. Nobody understood it properly. He heard that if he wanted to pass the course he should read the class notes or the summary.
>
> (Breheny, Katsos and Williams (2006))

The second type of findings on which the association is built, is that when the time to respond is limited, participants tend to interpret under-informative sentences 'logically'. In one study, Bott and Noveck (2004) have limited the time subjects had to either reject or accept a statement. Participants rejected less *some* statements for *all* situations when under time pressure. So for example, participants accepted under-informative sentences like (8a) 56% of the times when having 3000 ms. to respond, but 72% of the times when the time lag was 900 ms. In contrast, they accepted sentences like (8b) and (8c) 79% of the times, with no effect of the time lag manipulation.

(8). a. some elephants are mammals.
b. some mammals are elephants.
c. all elephants are mammals.

A different analysis of the above findings was offered by Shetreet, Chierchia and Gaab (2014a). They pointed out that the gap in response time between the two utterance types, described above, might be due to a mismatch between the logical truth value and the pragmatic judgment. The authors explain that every evaluation of a *some*-statement potentially involves a scalar implicature computation, in the sense of evaluating also the logically stronger statements in order to negate them. For example, for a sentence like (8b), had all the mammals been elephants, the sentence would have been pragmatically rejected. Acceptance of this statement across the board is because indeed, not all mammals are elephants. Having agreed on this, the difference between (8a) and (8b) is that while the former is 'logically' true but 'pragmatically' false, the latter is true both logically and pragmatically.

Assuming, in accordance with the grammatical approach, that both the 'logical' and the 'pragmatic' interpretations are available to the addressee, it is choosing between the two - rather than computing the 'pragmatic' interpretation' – which might be costly, in contrast with (8b) which involves no such choice. Indeed, in a sentence-picture verification task, the authors found that:

(a) When given a sentence-picture pair which led to a mismatch (5 mice, all holding grapes, and the description is "*some of the mice are holding grapes*"), there was no difference in brain activation between those participants who chose to answer 'logically' (i.e. the sentence matches the picture) or 'pragmatically' (i.e. the sentence does not match the picture).

(b) More brain activation was found in MeFG/ACC (an area in the prefrontal cortex, usually associated with high cognitive functions such as reasoning, cognitive control and answering yes/no questions) in response to the mismatch condition than to a no-mismatch condition (5 mice, 3 of which holding grapes, with the same sentence).

Consequently, the authors concluded that the slower processing time attributed so far to SI computation was actually due to more general higher cognitive skills (deciding between several plausible interpretations) rather than the SI processing itself (retrieving stronger alternatives and negating them).

Given that both the logical and the pragmatic meanings are available, one could assume there is some disambiguation strategy that prevents adults from choosing the logical response (say, preferring the stronger meaning, Chierchia 2004). This would lead to a prediction that adults would be at chance level with under-informative sentences (namely accept or reject them at chance) when a time constraint is present, if they cannot use this strategy under time pressure. However, going back to Bott and Noveck (2004), we see the opposite pattern: with a longer response lag, adults compute SIs 56% of the times (around chance level), and under time pressure their acceptance for under-informative sentences rises to 72%. If so, there must be another factor which prevents adults from reaching the 'pragmatic' interpretation under time pressure.

### 1.2.2 Language acquisition studies

An examination of child comprehension reveals that children (at least on the surface) do not compute scalar implicatures (e.g. Chierchia et al. 2001; Gualmini et al. 2001, Noveck 2001; Crain, 2008 etc.). They accept sentences like *'Some giraffes have long necks*' to be true, at least when no specific manipulation is made. This phenomenon is robust mostly until age 7 (Gedalyovich, 2003) but sometimes even as old as 11 years (Noveck, 2001). Also, it has been shown that this has nothing to do with world knowledge, as children react the same also to actual scenarios, where they can see that in fact *all* is the case (Papafragou & Musolino, 2003).

However, other studies have shown that children reach adult-like inferences when the alternatives are given to them. For example, Papafragou and Tantalou (2004) show that children face difficulty to infer from *some* that *not all*, but when ad hoc alternatives are given, they successfully infer that the stronger claim is not true (for example, *A: Did* *you eat the sandwich? B: I ate the cheese.* Children infer that speaker B did not eat the sandwich).

Barner, Brooks and Bale (2011) have addressed Fox's (2006) claim that *exh* is a covert operator equivalent to *only*. Children were presented with images containing three items (e.g. a cow, a dog and a cat). When shown a picture where all the animals were asleep, they judged a sentence like *some animals are asleep* as true, but *the dog and the cow are asleep* as false. To further examine Fox's (2006) analysis of *exh* as a covert *only*, the authors used the same conditions but also with the word *only* immediately before the target items (e.g. *'only some of the animals are asleep'*). Their findings show uniformity of analysis with or without an overt *only* - children negate stronger alternatives that are lexically overt in the context, but fail to do so for alternatives which require retrieval of items from the lexicon (*all* in this case), regardless of the existence of *'only'*.

In another study (Guasti, Chierchia, Crain, Foppolo, Gualmini et al., 2005), children who were first trained for giving the 'more informative' answer, rejected sentences like *some giraffes have long necks* 52% of the times (similar to adults' rejection rate), while untrained children rejected these sentences only 12% of the times (experiment 2 in their study). Further in the same study, both children and adults were exposed to specific scenarios which (i) supplied specific context to the existential sentence (ii) directly juxtaposed a situation where *some but not all* is true to a situation where *all* is true. This time, children rejected the under-informative sentence 75% of the times, and adults 83% of the times, both rejection rates far greater than adults' in the basic experiment given no context (experiment 4). Both experiments involve some kind of scaffolding. Children's success at computing SIs with scaffolding can be construed as evidence in favor of Fox's (2006) ambiguity view, namely that an under-informative sentence is ambiguous between the logical and pragmatic reading, and that children in fact compute both meanings and are able to select the pragmatic reading under the right circumstances. This is further reinforced by the result of another, somewhat unrelated study. It has been found in ambiguities research (Brodzinsky, Feuer & Owens, 1977) that when children are guided to reflect upon their answer, they perform more adult-like. In this study, children were asked to paraphrase ambiguous sentences. When explicitly asked by the experimenter if there is another meaning, the gap between reflective and impulsive children was significantly smaller than the gap for spontaneous paraphrasing, with both groups reaching more possible meanings.

Following previous assumptions about children's difficulty to use lexical items (e.g. *'and'*, *'all'*) in the generation of alternatives (Papafragou & Tantalou, 2003; Barner & Brooks, 2011), Singh, Wexler, Astle et al. (2013) examined children's responses to atomic disjunctions like *the boy is holding a banana or an apple* and to disjunctions embedded under *every*, like *every boy is holding a banana or an apple*. Children were asked to evaluate the match between sentences and pictures in four conditions:

**ONE** an atomic disjunction describing a picture with a boy holding only one of two items.

**BOTH** an atomic disjunction describing a picture with a boy holding two items.

**everyONE** an embedded disjunction describing a picture of three boys, each holding one item (two holding one item and the third another item).

**everyBOTH** an embedded disjunction describing a picture of three boys, each holding two items (the same items for all the boys).

In their study, children judged both types of disjunctions as false when the boy (or each boy) held only one item (ONE and everyONE), but true when each held both (BOTH and everyBOTH). Namely, the children interpreted the disjunction as a conjunction. The research takes Fox' (2006) exhaustification mechanism and Katzir's (2007) alternatives formation as working hypotheses, and adds the assumption that children cannot retrieve *'and'* from the lexicon in forming the alternative set. By this mechanism, when exhaustifying an atomic disjunction (A or B) without *A and B* in the alternative set, the outcome is a conjunctive reading, namely that *'A and B'* is true and '*only A or only B'* is false.

Given the above account, the authors explain that children reached a conjunctive reading because they were indeed computing implicatures, but without the *'A and B'* alternative. Consequently, they refute a suggestion previously presented in the literature, that children reject disjunctions because it is pragmatically odd to use disjunction when not in a state of ignorance. This may indeed be the situation in the ONE condition. However, the study shows that children interpret the '*or*' sentence conjunctively also with a scenario where it is not odd to use a disjunction (namely the embedded disjunction in everyONE, where each boy is holding one item or the other).[4] When the operator *exh* is located locally in embedded disjunctions (namely, below the universal quantifier), the exhaustification applies on the disjunction but ignores the embedding quantifier, hence the meaning of '*every x is A or B'* is also understood conjunctively. It is worth noting that most children in the study (16 out of the 23) interpreted ONE or everyONE as a mismatch. Thus, these children did not give a logical answer (which would be a match), but rather, by hypothesis, were computing SIs (though with a missing lexical item).

The same may be true for studies that have previously reported that children regularly do not compute SIs (as described at the beginning of the chapter). Leave Gedalyovich (2003), these studies examined the word *some* (e.g. *some giraffes have long necks*). The result, across the board, was that adults computed SIs around 50% of the times, while children almost always had a homogenous response pattern (in this case accepting the logically weaker *some* as true). Without a lexicon based alternative (*ALL giraffes have long necks)*, the ALT(*some*) set is a singleton, thus the operation is vacuous (resulting in *some's* logical meaning - *some and possibly all*). Hence, a childlike computation of the sentence (*all* $\notin$ ALT(*some*)) leads to the same result as no SI computation at all, namely - *some, and possibly all, giraffes have long necks*.

Perhaps a natural reaction for such a study would be to question children's understanding of the coordinator *'or'* to begin with. However, Gualmini, Crain, Meroni et al. (2001) show that children understand the difference between *or* and *and* when embedded under DE environments. They exposed children (mean age 5;3) to a story where *'A and B*' is true, as well as *'only A'* or *'only B'* .

> […] the Easter Bunny has four bunches of flowers, four turtles and two teddy bears. Six girls who were good friends of the Easter Bunny offered to take care of the Easter Bunny's belongings. The girls started to choose what to care for among the flowers, the turtles and the teddy bears. Initially, each girl took one object, except for one girl who took

[4] I personally find it peculiar to assume that (a) children do have a pragmatic module mature enough to reject disjunctions for this reason, but not mature enough to calculate SIs, and (b) that such a factor would not affect the adults who readily judged the atomic disjunction to be true when only one item was held.

both teddy bears. Afterwards three of the girls who had taken only one object decided to take a second object. When all the girls had made their choices, the child subject could see that three girls had taken both a turtle and a bunch of flowers, one girl had only taken a turtle, one girl had only taken a bunch of flowers, and the last girl had taken both of the teddy bears. The Easter Bunny was thankful, and he wanted to make sure that the girls had everything they would need. In particular, he gave some water to the girls who had chosen a turtle and to the girls who had chosen a bunch of flowers. Importantly, the Easter Bunny did not give any water to the girl who had chosen the teddy bears.

(Gualmini, Crain, Meroni et al., 2001)

Children accepted a disjunctive sentence more readily than a conjunctive counterpart (*Every girl who picked a turtle and/or a bunch of flowers received a bottle of water*) as a description of the story (note that the conjunction implicates that each one of the coordinates alone is not true, e.g. that every girl who picked only a turtle received a bottle of water). [5]

Although the conclusion of Singh et al. (2013) with regards to the reason why children perceive disjunction conjunctively may be debated, it receives a strong support from a typological research by Bowler (2014) on Warlpiri. Warlpiri is an Australian language in which there is only one coordinator – MANU. Adult speakers of Warlpiri use their only coordinator MANU to express conjunction in sentences like (9a). In order to communicate a disjunction, a modal construction of "possibly x, possibly y" is used (9b). However, when embedded in a downward entailment context, MANU expresses an inclusive disjunction (9c).

(9) a. Ngapa ka wantimi manu warlpa ka wangkami
water AUX fall.NPST manu wind AUX speak.NPST
Rain is falling and wind is blowing.

b. Gloria marda, Cecilia marda yanu tawunu-kurra=ju
Gloria maybe Cecilia maybe go.PST town-ALL=TOP
'Gloria or Cecilia went to town.'

[5] It is interesting to note that here children have to compute SI in order to get from 'A and B' in the restrictor to 'not A or B'. Is it the case that they compute SI differently in UE and DE?

(lit. 'Maybe Gloria, maybe Cecilia went to town.')

c. Kaji=npa jarntu pakarni manu *window* luwarni, ngula=ju
IRR=2SG.SUBJ dog hit.NPST manu window shoot.NPST that=TOP
Nungarrayi-rli kapi=ngki jirna-wangu-mani.
Nungarrayi-ERG AUX.FUT=2SG.NUBJ scold.NPST
'If you hit the dog or break the window, then Nungarrayi will scold you.'
(Bowler, 2014)

As explained in section 1.1.2, under DE (e.g. the conditional antecedent in (9c)), *'A and B'* is no longer logically stronger than *'A or B'*, hence the scalar implicature computation is not expected to take place.

Bowler suggests that adult speakers of Warlpiri interpret MANU the same way children interpret the disjunctive coordinator in English. Her analysis is similar to the one in Singh et al. (2013) - upon assembling ALT(A∨B), only A and B (but crucially not A∧B) are members of the set. This similarity of *or* interpretation to children's, refutes explanations which attributes children's 'logical' interpretations to an under-developed pragmatic module.

To sum up the above overview:

- Children are capable of exhaustifying logically stronger alternatives. When ALT(S) contains logically stronger alternatives, they are capable of negating the alternatives according to the mechanism offered by Fox (2006).
- By default (e.g. without any special instructions or very specific context) children do not consider logically stronger lexical items when generating alternatives in ALT(S). However, when instructed to consider a specific context, they compute SIs exactly like adults (Papafragou & Tantalou, 2004; Guasti et al., 2005). Considering this as scaffolding may support an ambiguity analysis of SIs, as Fox (2006) suggested.
- Without considering logically stronger lexical items, *'A or B*' is interpreted conjunctively. Additionally, since *some*'s alternative set by default contains only two items ($ALT_{adult}$(*some*) = {some, all}), excluding the stronger alternative *all* results in a singleton {*some*}, and since we cannot negate what is said, only the

logical meaning of *some* (*some but not all*) remains. As a result, children accept logically weaker utterances like *some giraffes have long necks*

# 2 THE CURRENT RESEARCH

## 2.1 The question addressed

To conclude the above section, we can see that:

a. Children do not compute SIs the same way adults do.
   i. They are willing, by default, to accept under-informative *some*-statements as true.
   ii. When asked to be more informative, or when faced with a context which juxtaposes the under-informative statements with stronger alternatives, children more readily reject *some*-statements.
   iii. Children interpret disjunctive statements conjunctively. According to some researchers (e.g. Barner, Brooks and Bale 2011), they do so because they do not consider **lexically based** alternatives (*and*, in this case). Similarly, they have no problem with SIs in which stronger alternatives are present in the context, but only with lexically based ones (e.g. those involving *some*, which require lexical retrieval of *all* and possibly *most*).

b. Adults respond slower to an under-informative statement than to the same statement when it is not under-informative. Consequently, they accept under-informative *some*-statements as true under time pressure.

c. In a language with only one coordinator, adults interpret UE disjunctions conjunctively, just like children do.

As mentioned in section 2, Shetreet et al. (2014a) suggest that adults quickly reach both the logical and pragmatic meanings of under-informative statements. This, however, leaves an open question: why is there a decrease in SI computation under time pressure? It cannot be simply assumed that the logical meaning is the default, since with no given context, the SI is more dominant for children (though computed with a partial alternative set, Singh et al., 2013). If the choice between the two is context dependent, it is less likely that children consider pragmatic factors in their answer more than adults do (in the same study).

The endeavor of the current research is to connect between the above findings, and formulate a simple explanation which can account both for adults and for children, considering it unlikely that the SI computation mechanism itself is different between the two age groups. The proposed hypothesis is that retrieving relevant alternatives from the lexicon is both costly and optional, in the sense that SI computation may be executed without it. Consequently, under various conditions, lexical retrieval is given up. In other words, it is not the case that under time pressure adults answer logically, they just fail to assemble an ALT(S) similar to the one they would assemble it with no time pressure. A mirror view is that children act by default like adults when the latter are under pressure, but when guided to reflect upon their answer, they perform adult-like. Though in none of the studies children were asked to answer quickly, studies do link between inhibitory control abilities and certain linguistic abilities (cf. Martin-Rhee and Bialystok (2008) for code switching in bilinguals, Brodzinsky et al. (1977) for ambiguities detection for impulsive children, where scaffolding has a more robust effect on lexical ambiguities). In addition, Shetreet et al. (2014b) have found a correlation for children between SI computation rates and performance in tasks that involve executive functions, exactly those linked to MeFG/ACC - the area found active in mismatch conditions in Shetreet et al. (2014a).

This hypothesis predicts that:

a. Adults under time pressure will fail to associate *and* with *or* to form a standard $ALT_{adult}(A \vee B)$ set. As a result, they will interpret disjunction as conjunction, in atomic disjunctions and, to some extent, in embedded disjunctions, just like the children in Singh et al. (2013).
b. Children will perform better on SI tasks after training with non-linguistic tasks that involve improving executive functions (e.g. Wisconsin Cards Sorting Test. cf. Dowsett & Livesey, 2000).

This thesis did not empirically test the predictions regarding scaffolding effects for children. An experiment was conducted to test my predictions for adult response patterns.

## 2.2 Experiment

In order to empirically investigate my prediction for adults, I conducted a between-subject response time experiment, which tested the sentence-picture pairs introduced in Singh et al. (2013) under the time-pressure conditions illustrated in Bott and Noveck (2004). In this experiment, adults judged the truth value of atomic and embedded disjunctions as describing situations depicted in pictures.

For convenience, I borrowed the names of these sentence-picture pairs from Singh et al. (2013):

**Table 1: Experimental conditions for atomic disjunction**

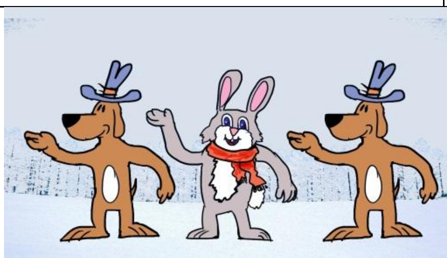
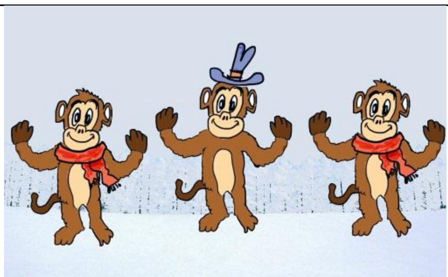
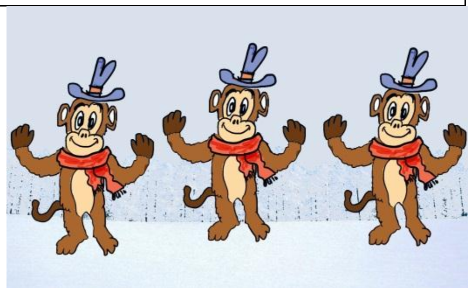
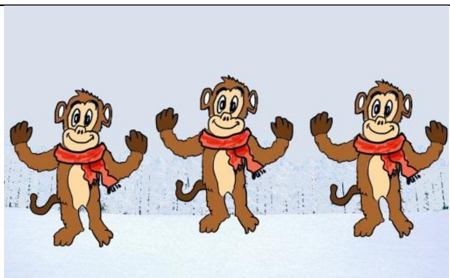
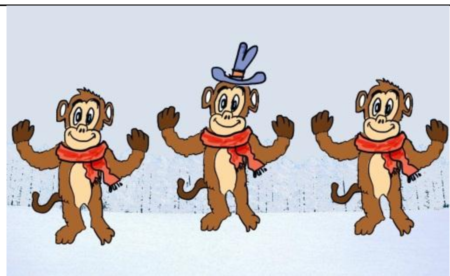
| **Atomic disjunction:** | | |
|---|---|---|
| **LF** | $A(x) \vee B(x)$ | |
| **Test (a)** | *The rabbit is wearing a hat or a scarf.* | |
| **Control (b)** | *The rabbit is wearing a hat and a scarf.* | |
| **Fillers (c)** | *The rabbit is wearing a scarf but/and not a hat.* | |
| **Conditions** | **ONE** | **BOTH** |
| **Description** | The protagonist of the sentence (e.g. rabbit) is holding one item (e.g. wearing a scarf). | The protagonist of the sentence (e.g. rabbit) is holding two items (e.g. wearing a scarf and a hat). |
| **Picture** |  |  |

Table 2: Experimental conditions for embedded disjunctions

| **Embedded disjunction:** | | |
|---|---|---|
| **LF** | $\forall x[A(x) \vee B(x)]$ | |
| **Test (a)** | *Every monkey is wearing a hat or a scarf.* | |
| **Control (b)** | *Every monkey is wearing a hat and a scarf.* | |
| **Fillers (c)** | *Every monkey is wearing a scarf but/and not a hat.* | |
| **Conditions** | **everyONE** | **everyBOTH** |
| **Description** | 3 of the same character, 2 hold the same item, the third a different item. | 3 of the same character and two types of items, all the characters hold the same two items. |
| **Picture** |  |  |
| **Conditions** | **everySAME** | **everyMIX** |
| **Description** | 3 of the same character, each is holding the same item. | 3 of the same character and two types of items, all the characters hold the same item, and one is holding both items. |
| **Picture** |  |  |

everySAME and everyMIX were included in order to have a clearer insight on the reason why adults answer the way they do. These two conditions represent the way '*every x is A or B*' may be interpreted when manipulating the location of *exh* and the alternatives in ALT(S), as thoroughly discussed in Crnič et al. (2015) (cf. appendix A). The children's most common response pattern for embedded disjunction in Singh et al.

(2013), namely a conjunctive interpretation, is explained by the authors to be only possible when the instance(s) of *exh* are located below the universal quantifier. It may be expected that adults have a variety of ways to exhaustify (namely, different ways to locate *exh)*. However,

a. An assumption that children have a parse tree completely different than adults is not (yet) justified.
b. If there is a 'default' parse tree, namely, the one that children choose, and on top of it adults use pragmatic factors to choose different parse trees, it is expected that these factors will be unavailable under time pressure.

For this reason, I predict that at least to some extent adults will parse *'every x is A or B*' the same way children do, and consequently, will interpret the sentence conjunctively.

a. Following Crnič et al. (2015,) in case that participants do not compute SI under time pressure at all (i.e. they do not exhaustify alternatives), we would expect the following pattern (for further explanation see appendix A): Participants will reject everySAME regularly, but will accept it under time pressure (as it is compatible with the logical meaning of *or*).
b. Participants will accept everyMIX more under time pressure than without, since it depends on a very particular parse, but also compatible with *or*'s logical meaning.

### 2.2.1 Participants

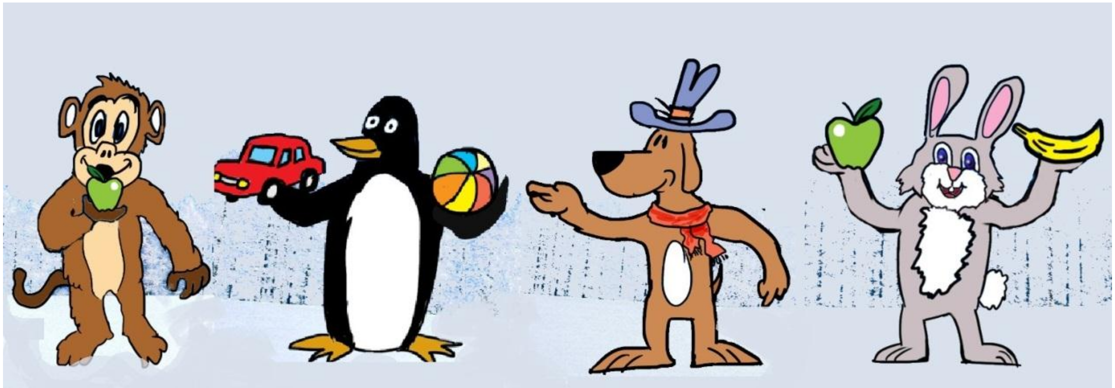
Thirty-six healthy native Hebrew speakers (age 20-33 av. 24.4) participated in the experiment. Of them, 19 were first-year linguistic students (with no substantial background in semantics/pragmatics), who received credit for their participation, and the rest had no linguistic background at all. Participants were randomly assigned to two groups, LongLag and ShortLag, as described in 2.2.3 below. To control for picture acceptability, each group was further divided to group A and group B where each group was exposed to the same pictures but with sentences triggering opposite responses. For example, for a picture where a penguin is wearing a scarf, group A heard "*the penguin is wearing a scarf or a hat*" (true) and group B heard "*the penguin is wearing a scarf and a hat*" (false).

### 2.2.2 Materials

**Pictures** 60 pictures were created. Every picture contains three characters (out of a pool of 4 characters: a monkey, a dog, a rabbit and a penguin), where each character is holding a single item or two items (out of a pool of 3 pairs of items: a banana and an apple, a ball and a toy car, a scarf and a hat). Some of the pictures were shown twice, with different sentences, referring to different characters in it.

For atomic disjunctions there appears one different character which is the protagonist of the sentence (e.g. a dog and two rabbits for *the dog is wearing a hat or a scarf*), and for embedded disjunctions all three are identical (three dogs for *every dog is wearing a scarf or a hat*), so that the visual complexity of the atomic and embedded conditions remains similar. The pictures depicted four different verbs: eating, playing with, wearing and holding (figure 1).

**Figure 1: Sample pictures for the different verbs used in the experiment**



**Sentences** A hundred and twenty sentences were built in sets of three: test (disjunction), control (conjunction) and filler. All sentences in the set corresponded to the same picture. For the test and control sentence, one was always false and the other – true (for example, as a description for the same picture, one sentence would be '*A or B*', while the other would be '*A and B*', so the expected response was not the same). The conditions are described in tables 1 and 2 above. Sentences were divided into lists using a Latin square. In addition, a filler sentence was constructed for each picture with '*and not*' or '*but not'*.

**Fillers**: ha-kelev loveʃ caif aval/ve lo kova

The dog is wearing a scarf but/and not a hat

**Control item:** kol kelev loveʃ caif ve-kova

Every dog is wearing a scarf and a hat

Each participant was asked to evaluate a total of 60 sentence-picture pairs: 20 disjunction sentences, 20 conjunction sentences, and 20 filler sentences, with identical number of predicted 'yes' and 'no' responses.

The predicted response was determined considering full computation of SI for the test sentences (that is, accepting pictures ONE but not BOTH with atomic disjunctions, and accepting everyONE but not everyBOTH with embedded disjunctions). The sentences were recorded in Hebrew and distorted using Audacity software to normalize the length and pitch of the sentences. Every recording spans exactly 2.604 seconds. Extra milliseconds were added to the beginning of files with shorter sentences.

For a full list of sentences and the pictures see appendix B.

### 2.2.3 Procedure

After signing an informed consent, each participant received the following instructions both orally and written:

> “In this experiment you will be exposed to different pictures. Each picture is accompanied by a sentence. You have to decide whether the picture and the sentence match each other or not. If they match, press the green button [pointing], if they do not match, press the red button [pointing]. This experiment measures response time, so please put both your hands on the keyboard throughout the experiment. There is not always a correct answer, so please just answer according to your intuition.”

The experiment was conducted using E-Prime software installed on a Toshiba laptop. The sentences were heard using headphones.

Each participant was first trained using two practice sessions, in which 9 control, unambiguous items were presented. The first block of 9 sentences measured response time for control sentences. Then, a time limit for response was individually set for each participant. The rationale is that unambiguous sentences take less time to process, so the average response time in the practice session represents the time it takes for each individual to process a sentence with no ambiguity solving. The average response time in the first practice session was used for participants in the short lag group, and extra 3 seconds were given for participants in the long lag condition. A “too slow!” buzz (lasting 0.608 seconds) was presented whenever a participant failed to answer within their individual time frame.

After the first practice session, each participant had the same practice items (though randomly shuffled), but this time with the limited response window (average for short lag / average +3 seconds for long lag).

### 2.2.4 Predictions

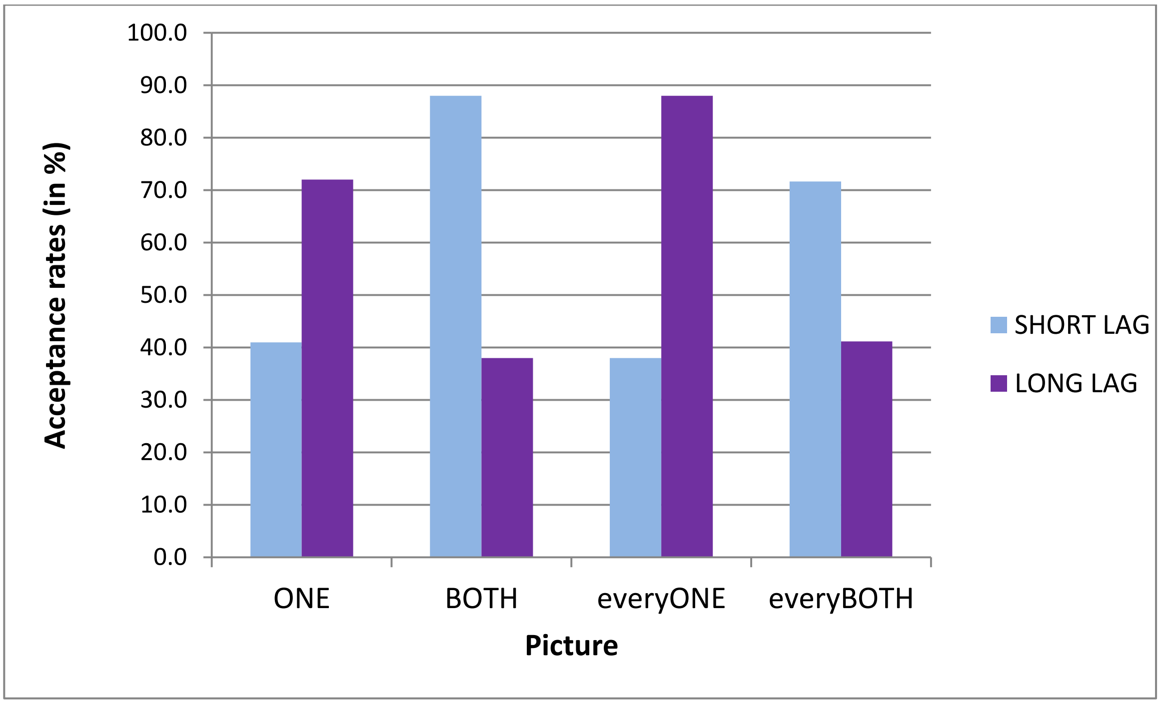
If indeed adults fail to fully retrieve lexical items into ALT(AvB) under time pressure, we would expect the results in Table 3, with respect to the test sentences. The predictions for the control, conjunctive sentences were that they will not significantly change under time pressure. For the moment I state no predictions for everySAME and everyMIX, but only evaluate adults' performance with respect to the conditions introduced in Singh et al. (2013).

**Table 3: Expected results**

| | condition | Long lag | Short lag |
|---|---|---|---|
| 1 | ONE | true | false |
| 2 | BOTH | false | true |
| 3 | everyONE | true | false |
| 4 | everyBOTH | false | true |

For pictures in which only one item is relevant per character (1, 3), a disjunctive description is predicted to be accepted with no time pressure, but to be rejected under time pressure, when the disjunction is perceived conjunctively. In contrast, pictures 2 and 4 are predicted to be normally rejected without time pressure (at least 50% of the times, as in other studies) and fully accepted under time pressure.

**Figure 2 : Predictions**




My first aim was to replicate previous studies which investigated *some-all*, using *or-and.*

I first wanted to test if disjunctions yield the same effect as some-sentences in Bott and Noveck's (2004) experiment. That is, if the under-informative sentences, namely BOTH and everyBOTH described by disjunctions, are accepted more under time pressure than with no pressure.

The unique contribution of this paper is in investigating the acceptance rates of ONE and everyONE. First, I aim to test if everyONE and ONE are accepted significantly less under time pressure. If they are, this means that adults indeed interpret disjunctions as conjunctions under time pressure, presumably due to their inability to retrieve '*A and B'* as an alternative to *'A or B'*.

In case adults do interpret disjunctions conjunctively, everyMIX and everySAME are predicted to be rejected under time pressure, since they do not depict a situation where each and every one of the characters is holding both items (the image suitable for an embedded conjunction). Conversely, high acceptance rates for everySAME and everyMIX under time pressure may indicate that SI was not computed at all; hence everything compatible with the logical form is accepted.

Further, Condition*Lag interactions can reveal not only how participants accept each picture-sentence pair under time pressure, but also their overall behavior under time pressure, if their preference for one reading over another changes. Specifically, a 'conjunctive reading' as described in Singh et al. (2013) should not only result in accepting BOTH more under time pressure than without time pressure, but in "switching" preference between ONE for BOTH and everyONE for everyBOTH. A mere rejection of ONE/everyONE or acceptance of BOTH/everyBOTH (without the interaction) may have explanations other than the one presented in Singh et al. (namely, that the absence of '*A and B'* from ALT('*A or B*') results in a conjunctive reading, assuming a local exhaustification when the disjunction is embedded under *every* – see appendix A for elaboration).

# 3 RESULTS

Out of 75 control sentences, 7 were below 85% accuracy. Since control sentences were unambiguous and not predicted to elicit any difficulty, I took such low accuracy to indicate a problem with these specific sentences, which were therefore excluded from further analysis.

Participants were included in the analysis if they had above 95% accuracy in the control sentences (excluding the above) in the LongLag group, and above 85% accuracy for ShortLag group (the different cutoffs were selected to maintain a similar number of participants in both groups). This resulted in the exclusion of two participants from each group. One additional participant was excluded for technical reasons.

All in all, the control sentences did not seem to be affected by the time-pressure manipulation. Table 4 and Figure 3 show the rates of *True* responses (participants who accepted a disjunctive description for the given picture) for the test sentences in each condition.

Independent-samples two-tailed t-tests were conducted to compare acceptance rates in the long lag and short lag conditions for the experimental sentences. A significant difference was found in ONE, with a decrease in acceptance in the short lag ($p = 0.03$) and everyBOTH, with an increased acceptance rates in the short lag ($p = 0.03$), as shown in Table 4.

**Figure 3: Acceptance rates**

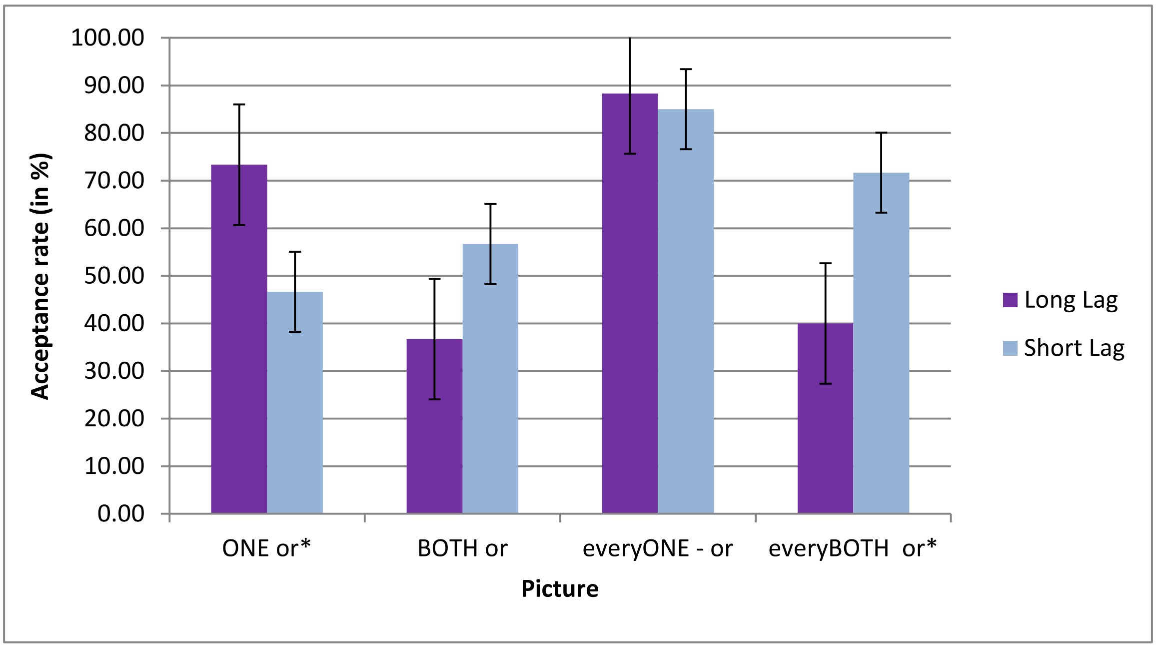
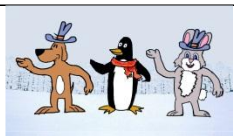
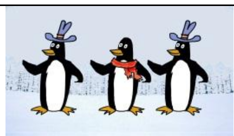
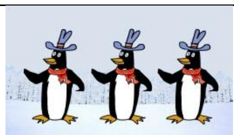
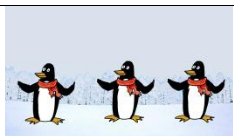
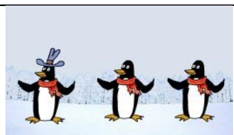
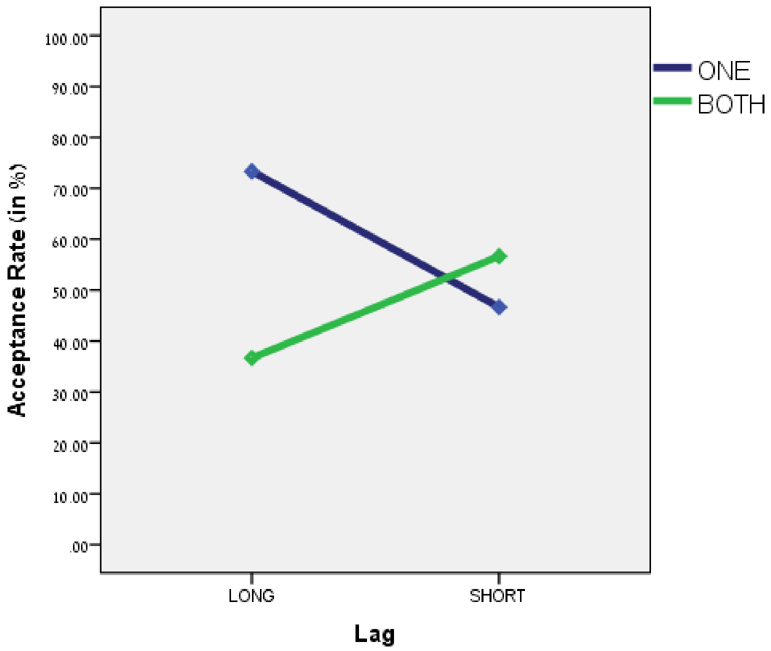


**Table 4: Percentage (standard deviation) of True responses in the different conditions**

| Sentence type | name | picture | Long Lag | Short Lag | P |
|---|---|---|---|---|---|
| Atomic disjunction *The penguin is wearing a hat or a scarf* | ONE |  | 73.33 (32) | 46.7 (32.6) | 0.03* |
| | BOTH |  | 36.67 (44.2) | 56.7 (40.6) | 0.21 |
| Disjunction embedded under *every:* *Every penguin is wearing a hat or a scarf* | everyONE |  | 88.3 (18.58) | 85.0 (24.6) | 0.68 |
| | everyBOTH |  | 40 (43.1) | 71.7 (33.9) | 0.03* |
| | everySAME |  | 70 (45.5) | 53.3 (48.1) | 0.34 |
| | everyMIX |  | 76.67 (41.69) | 46.7 (48.1) | 0.08 |

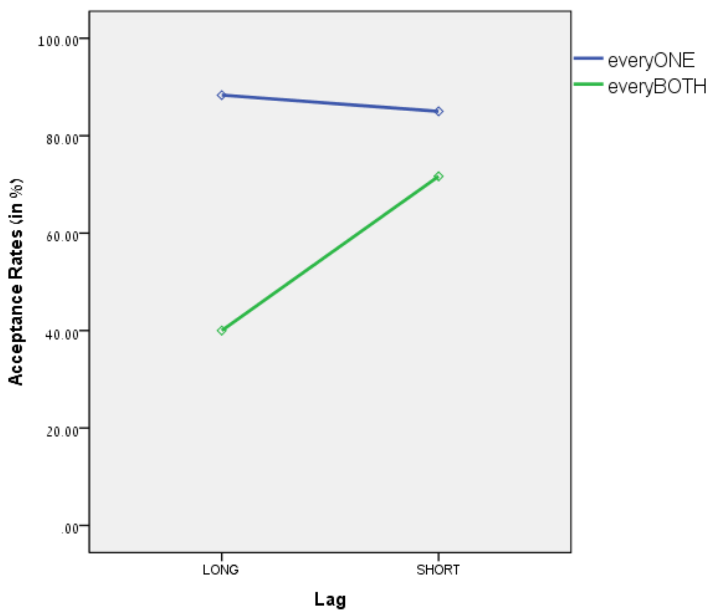
A Repeated-measures ANOVA revealed a signifsicant interaction between condition (ONE/BOTH) and lag (Long/Short) ($F = 8.99$; $p = .006$), as shown in Figure 3. In the long lag group, a preference is apparent for ONE over BOTH as matching the sentence *"x is A or B"* (ONE: M = 73.33; BOTH: M = 36.67, $p = 0.01$), but no such preference is apparent in the short lag (ONE: M = 46.7; BOTH: M=56.7; $p=0.46$).

**Figure 4 : Acceptance rates of main disjunctions**




A similar pattern was found for embedded disjunctions. Participants in the long lag group preferred everyONE over everyBOTH as suitable for an embedded disjunction '*every x is A or B*' ($p < .001$). This difference was not observed under time pressure, where, though acceptance rates were still higher for everyONE than for everyBOTH, this preference was not significant ($p = 0.23$).

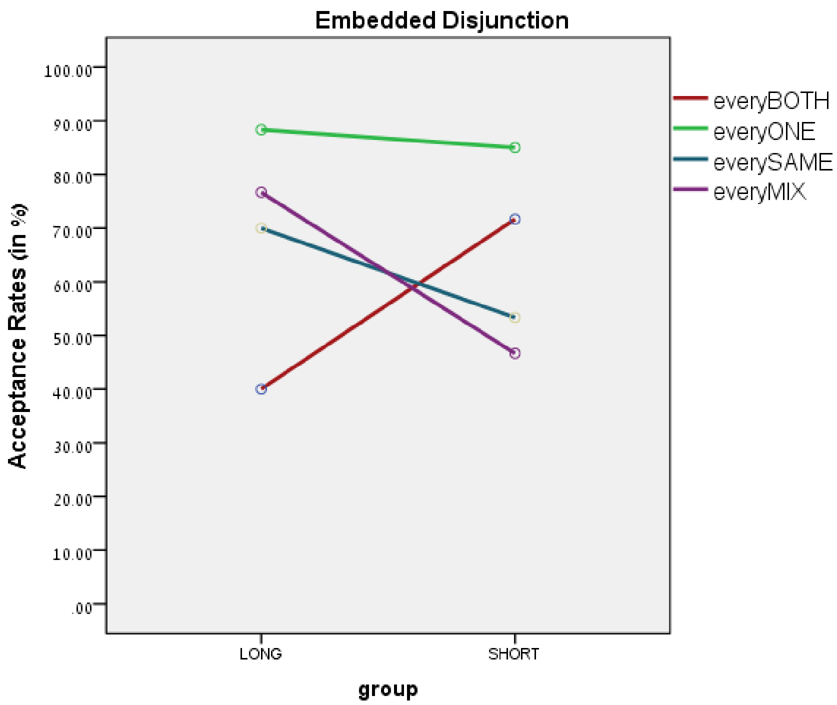
**Figure 5 : Acceptance rates of everyONE and everyBOTH**



Data were also collected for everySAME and everyMIX in order to shed more light on how adults interpret embedded disjunctions. Participants generally tended to disfavor everySAME in the long lag group, accepting it only 70% of the times (SD = 45.51) – a little less than they accepted the ONE condition (M=73.3). However, with more similarity in trend to everyONE than to ONE, participants did not significantly change their choice under time pressure (Short Lag M=53.3%, SD=48.05%; t(29) = 0.493, p = 0.34).

Lastly, everyMIX was accepted in a lower rate under time pressure, and this trend approached significance (Long: M = 76.67%, SD = 41.69%; Short: M = 46.67%, SD = 48.08%. p = 0.08). The results to this condition should be considered carefully however, since participants were rather confused by this picture, as can be evidenced by their scoring only 83.3% accuracy in the relevant control sentences, as opposed to an average of 95.3% accuracy on all other control (*and*) conditions (in the short lag condition).

**Figure 6 : Acceptance rates of embedded disjunctions**

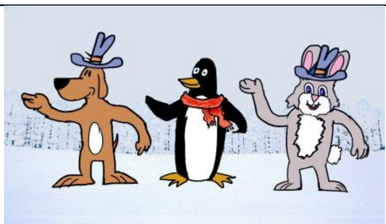
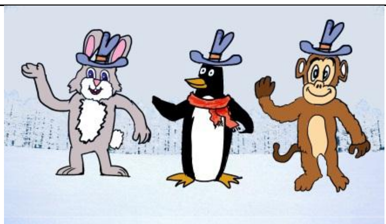
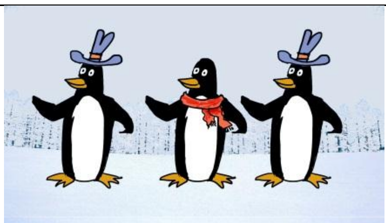
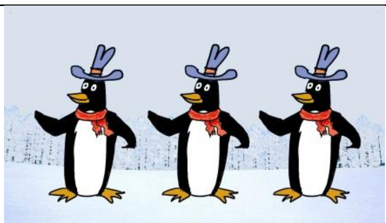
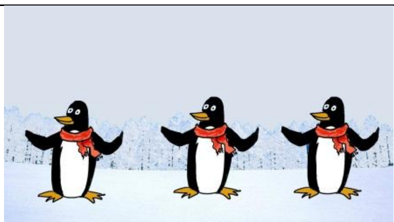
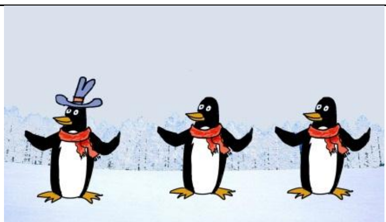


# 4 DISCUSSION

The current study aimed to reveal the cause of an observed cost of scalar implicature computation. Studies have shown that adult participants process utterances involving SIs slower than utterances with no SI triggers (e.g. sentences with *all*, or sentences with *some* referring to a proper subset). It has been previously claimed that children do not compute scalar implicatures (Noveck 2001, among others). However, later studies explain children's seeming reluctance to compute these implicatures by appealing to difficulty with lexical retrieval, specifically of logically stronger lexically-based alternatives (e.g. *all* as an alternative to *some*) (Barner, Brooks and Bale, 2011). Singh et al. (2013) use this explanation to account for children's understanding of *or*. In their study, children perceived disjunctive sentences (whether atomic or embedded under *every*) as conjunctions, a result of exhaustifying a disjunctive sentence without the conjunctive marker *'and'* in the alternative set. Given these results, I hypothesized that the costly process in adult SI computation is the retrieval of lexically based alternatives. Consequently, under time pressure adults are expected to respond the way children do, namely, with a conjunctive reading of *or*.

In the previous chapters I presented an experiment which aimed to test this hypothesis. Participants were exposed to sentence-picture pairs which resembled the conditions in Singh et al. (2013) (with two additional conditions unique to this work). They had to evaluate for each pair if the sentence matched the picture, where half of the participants operated under time pressure. The experiment had 6 test conditions:

**Table 5: Sentence-picture pairs**

| name | Picture | Sentence type |
|---|---|---|
| ONE |  | 'Atomic' disjunction<br>*The penguin is wearing a hat or a scarf* |
| BOTH |  | |
| everyONE |  | Disjunction embedded under *every:*<br>*Every penguin is wearing a hat or a scarf* |
| everyBOTH |  | |
| everySAME |  | |
| everyMIX |  | |

I predicted that conditions ONE and everyONE would be accepted to a lesser degree when under time pressure, while BOTH and everyBOTH would be accepted more under time pressure, as the BOTH pictures correspond to a conjunctive interpretation (e.g. *every penguin is wearing a scarf and a hat*) while the ONE pictures do not.

My first aim was to observe if disjunctions yield the same effect as *some*-sentences in Bott and Noveck's (2004) experiment, namely that adults do not compute implicatures under time pressure, and consequently reach the logical meaning of a sentence. In our case, this predicts that participants should accept the atomic and embedded disjunctions as describing the pictures BOTH and everyBOTH respectively. The results were replicated only with respect to everyBOTH, but not so much for BOTH: While everyBOTH was accepted significantly more under time pressure, the attitude towards BOTH changed only slightly, from rejection to agnosticism. I return to discuss this difference between atomic and embedded disjunctions below.

Mainly, this study sought to show resemblance between children's understanding of '*or*' (Singh et al. 2013) and the way adults interpret the same structures under time pressure. Namely, the prediction was that adults would show a conjunctive reading of '*or*', ultimately resulting in acceptance of BOTH/everyBOTH, and rejection of ONE/everyONE under time pressure. Although ONE was indeed rejected to a larger degree under time pressure, the hypothesis was refuted[6], with everyONE steadily accepted almost across the board (both with the long and the short lags).

There seems, therefore, to be quite a difference between atomic and embedded disjunctions. While embedded disjunctions behave similar to what was found so far regarding *some~all* (acceptance of under-informative sentences only under time pressure), the situation is more complicated for atomic disjunctions – while in the

[6] One might suggest that adults under time pressure indeed do not retrieve lexical alternatives, namely do not have *'and'* as an alternative to *'or'*, but that their parse tree for embedded disjunction is different than children's. In order to achieve a conjunctive reading, every exhaustification operator must appear locally below the universal quantifier (see appendix A). One option is that adults have a variety of ways to locate *exh*, perhaps manipulated by context. Such an explanation has several faults in it:

1. Such a scenario would have resulted at least partially in some degree of rejection of everyONE under time pressure.
2. Suppose that the 'global' parse was the default one, one should account for the reason why children prefer almost exclusively a 'local' parse which contradict this 'default' one.
3. A conjunctive reading should not only result in rejection of everyONE, but also in acceptance of BOTH/everyBOTH. Had *'A and B'* been absent from ALT(*A or B*), we would have seen an increased acceptance also in BOTH. The results show that although participants tend to reject BOTH less under time pressure than with no pressure, its acceptance stays at chance level, suggesting they may not object to it, but certainly not parse the sentence as *'A and B'*.

long lag participants preferred ONE over BOTH, they were agnostic about the choice under time pressure.

One possible explanation for ONE's decreased acceptance is that this type of picture can be better described by an atomic sentence with no disjunction at all (e.g. *the dog is wearing a scarf*). In contrast, everyONE has no better utterance to describe it,[7] other than the given disjunction. To test this hypothesis, I observed how participants reacted to a picture like everySAME with an embedded disjunction. The picture everySAME shows three characters of the same type, all holding the same kind of item. Similar to everyONE, it is logically compatible with an embedded disjunction. Similar to ONE, it is best described by using only one of the disjuncts (e.g. *every dog is wearing a scarf*). Consequently, we would expect everySAME to normally have low acceptance rates. These are expected to rise under time pressure as the picture is compatible with the logical meaning of the embedded disjunction.

The results show that this scenario did not take place. everySAME was fairly acceptable with no time pressure (roughly to the same extent as ONE), and stayed relatively steady under time pressure. We therefore see that the attempt to account for the results based on the notion that under time pressure, participants resort to the logical answer, fails.

The accepted Neo-Gricean claim is that scalar implicature computation is costly, hence (a) takes longer to compute, and (b) is not computed under time pressure. As we can see, this claim does not predict the current results. Note that the Neo-Gricean hypothesis presupposes that the default meaning is the logical interpretation of the sentences in question: the meaning of '*some'* (prior to SI computation) is '*some and perhaps all*'; the meaning of *'A or B'* is '*A or B or both'*. I would like to question this presupposition. Note that in fact, resorting to a core 'logical' meaning of *or*, namely an inclusive one, would have resulted in relative acceptance of all conditions in the experiment under time pressure. However, leave everyBOTH, the trend is, if anything, quite the other way around, with decease in acceptance of ONE and everyMIX under time pressure, and no significant change for BOTH and everySAME - all compatible with the inclusive meaning of *'or'*.

[7] Which is at most as complex

I suggest that under time pressure SIs are indeed not computed (as first claimed in Bott and Noveck 2004). However, when SI is not computed, adults attribute to the sentence the most salient meaning available. Importantly, the salient meaning of *'or'* is not necessarily the semantic/logic one, but the meaning more frequent in day-to-day conversations. The current study has very limited tools to evaluate what exactly qualifies as a frequent day-to-day use of *'or'*, including intuition and comparison between the different conditions observed. The nature of the most salient meaning available for '*or*' may best be gauged in usage-based research. Ariel and Mauri (in press), a Corpus-based study, aims to explore how *or* is used. They propose 6 prominent readings (explicatures) which speakers intend to express by using a disjunction. The contrast between inclusivity and exclusivity, as currently defined, does not play a role in any of these explicated meanings. Moreover, while the exclusive *or* (committing to only one disjunct) is taken in the literature to be the default, stronger, enriched meaning (though not the semantic meaning), in the actual corpus Ariel and Mauri's *Narrowed* and *Choice* readings, which are the closest to 'exclusive' constitute in that *'one of X and Y'* is intended, has marginal presence (12.2%).

Let us look at the different sentence types in the experiment (i.e. atomic and embedded disjunctions) and try to characterize their salient meanings. For the sake of the current argument, I will assume that this salient meaning of a sentence has a corresponding "mental image".

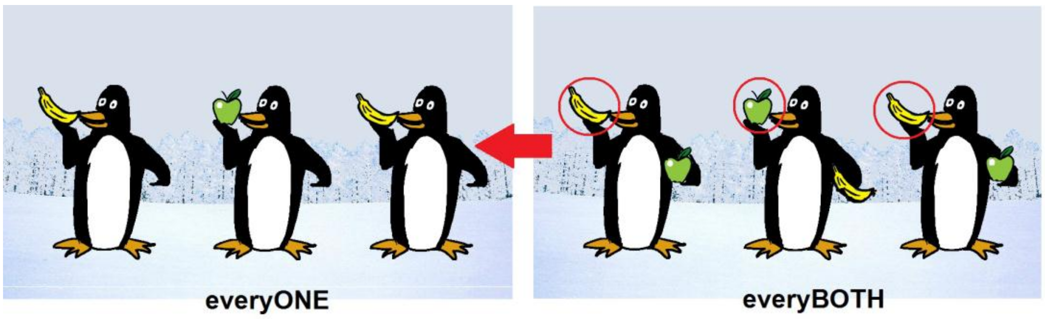
First I will address embedded disjunctions, e.g "*every dog is wearing a hat or a scarf*". The intuitive mental image that seems to be associated with this sentence is a group of dogs where some dogs wear hats, some wear scarves, but no dog either wears none or both. This is the *distributive inference* (Crnič, 2014).

The distributive inference (DI henceforth) does not include the sort of uncertainty inherent to the atomic disjunction or to everySAME (*'one of the disjuncts is true, I don't know which*'). Following the quality maxim by Grice, the addressee assumes that the speaker is opinionated and speaking the truth, hence the motivation is to eliminate ignorance inferences as much as possible (Fox, 2006).

Out of the pictures in the current experiment, the everyONE picture fits this mental image of the embedded disjunction perfectly. And indeed, both in the longer and the shorter lags, participants accepted this picture to fit an embedded disjunction, with the lowest rate of rejections among all the conditions. This is compatible with my hypothesis that under time pressure, participants resort to the salient reading of the sentence.

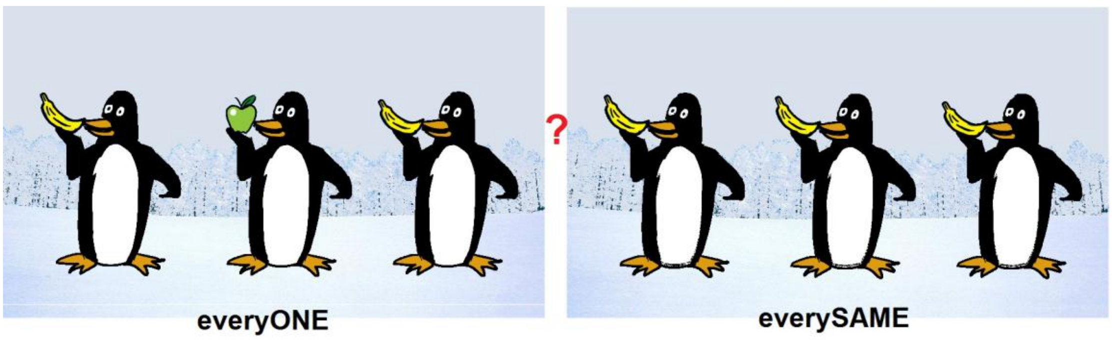
How can we explain the high acceptance rate of everyBOTH under time pressure? I suggest that participants tended to accept the picture as described by the sentence since this picture is compatible with the distributive mental image described above for embedded disjunctions. This can be observed in Figure 7. The distributive inference where each character is holding a different item is contained within the everyBOTH picture.

Figure 7: everyONE as visually "contained" in everyBOTH




In contrast, this requirement is not fulfilled in everySAME, where only one item is present, as seen in Figure 8.

Figure 8: everyONE is not visually contained in everySAME.




If everySAME is not compatible with everyONE, how is it not rejected? Probably it is because they simply represent two different interpretations of the disjunction, independent from each other. While everyONE corresponds to a distributive reading of the sentence (namely, that the banana and the apples are distributed among the penguins) the everySAME picture corresponds to a collective reading, where the choice between A and B applies for the entire group.

The semantic structure of DI is roughly similar to the one claimed to be exhibited by 'free choice' (FC henceforth) (cf. Kratzer and Shimoyama, 2002, Alonso-Ovalle, 2005, Fox, 2006 for similarities between SI and FC). 'Free choice' is a type of inference where a disjunction embedded under a modal existential operator (*can, may, permitted* etc.) is interpreted as a possibility of both disjuncts and a grant to choose between them (e.g. '*you may eat the cake or the ice cream*'). In FC, permitted accessible worlds are distributed between A and B (such that in some permitted worlds A is true and in some B is true - Kratzer and Shimoyama, 2002), and so do the characters in the distributive inference. Despite the similarities between SI and FC (disappearance under DE etc.), Chemla and Bott (2014) have found that unlike SI, FC computation tends to stay stable under time pressure. They have contrasted the FC interpretation with an interpretation where only one disjunct is permitted, but we don't know which, such that all permitted accessible worlds are assigned to a single disjunct. This interpretation and FC can be roughly depicted as everySAME and everyONE respectively (where each character is a "permitted world"). The authors found that the proportion of participants who understood the test sentences as 'free choice' did not change under time pressure. In other words, the same number of participants interpreted the sentence as 'free choice' under time pressure, and the same goes for the number of participants who interpreted the sentence 'logically' (the authors defined the 'only one disjunct is true' as the logical interpretation). Similarly, in the current study, the proportion of participants who accepted everySAME and everyONE did not change under time pressure.

A potential problem with the proposed model is its inability to explain the trend demonstrated for everyMIX – a picture that is compatible with everyONE, but still rejected under time pressure (though not significantly), unlike other images. However, it is also worth noting that participants were uneasy with the everyMIX image in general. Control sentences presented with this picture reached the lowest rates of accuracy both in the long and in the short lag. Perhaps a qualitative investigation can be helpful in determining exactly why participants are reluctant to accept everyMIX.

For the atomic disjunctions the picture is a bit more complicated. As thoroughly discussed in Fox (2006), an atomic disjunction often leads to infer ignorance of the speaker with regards to which one of the disjuncts is true (or an irrelevance of such a choice). In a case as this, it is difficult to think of a mental image corresponding to an atomic sentence with *'or.'* Under time pressure, the addressee does not compute SI, but has no mental image for the given sentence either. With no mental image at hand, all the participant is left with is the logical, inclusive interpretation, which can describe either a picture where A is true, B is true, or both A and B are true. The participant has to guess whether the sentence matches the picture or not. Indeed, results for both the ONE and the BOTH conditions in the short lag show a guessing paradigm (46.7% and 56.7%, respectively).

However, when having the time to compute SIs, the contrast between ONE and BOTH emerges. In this case, *"the penguin is playing with a toy car or a ball*" is a good description for ONE, but not for BOTH, since it is under-informative in the latter case.

If adults are perfectly capable to make a decision based on a mental image, what is the motivation of computing SI in the long lag? It is possible that when having enough time, participants may try to extract a context when it is absent or minimal (as in the experiment), search for a meaning appropriate for the context, and eventually compute an implicature, if found fit. Ultimately, their choice is comprised of different considerations, among them, the likelihood of the interpretation (based on frequency), the strength of the utterance (based on SI computation), perhaps complexity (cf. Matsumoto, 1995 and Katzir, 2007), the given context (or lack of it), etc. The current experiment asked the participant to evaluate various sentence-picture pairs, where the sentences were quite similar except for the logical operator: *or, some, not*. It is possible that this caused participants to contrast the three logical operators to some extent when processing the sentences (even if not asked to), enhancing a computation of SIs. The lack of any other contextual clues (for what they are asked about), gives a very high weight for the consideration of preferring the stronger operator.

In contrast, when participants operate under time pressure, they might choose other methods for processing. Not necessarily because the before-mentioned are costly operations by themselves, but that under pressure, choice making might be made more 'heuristically' and less thoroughly weighted with every cognitive and discursive tool at hand. This point is in line with Shetreet et al. (2014a), who claimed that SI computation by itself is not costly.

A theory involving a mental image must account for two other sets of facts: the case of *'some'* and children's interpretation of *'or'* (and for that matter, of *'some'* as well). It is likely that a mental image, if one exists, is formed as a result of usage and exposure, much like prototypes. This may explain why children's answers are quite different from adults'. With no sufficient mental image, and poor consideration of context (either for their inability to track any or for the experiment design), children compute SI, and they do it, by default, without a stronger lexical item. With the sufficient context (Papafragou & Tantalou, 2003; Guasti et al., 2005), children are able to include the logically stronger lexical item in the alternative set and have an adult-like response. This is in contrast with the previous notion that children need the context or scaffolding in order to compute the implicature in the first place. Consider the following example (10), where a four year-old child inappropriately computes an implicature for a scale she already masters – numbers (Barner and Bachrach, 2010). The child ends up with an interpretation of two as 'exactly two', which is inappropriate to the context.

10. Elia (4): Mom, I want a candy! I didn't eat candies today.
    Mom: Elia, uncle Eli said that you already ate two candies at the party. This is enough!
    Elia: No mom, it's not true at all! I didn’t eat two candies. I ate only three.
    (originally Hebrew, yeladimem.com, 2016)

The case of *'some'* may be more debatable. It is not trivial to justify why the mental image for *'some'* would be the one corresponding to either the strengthened (*not all*) or the 'logical' (*maybe all*) interpretations. Regarding everyONE, what makes it the mental image (and not any pure logical interpretation of an embedded disjunction) might be a recurring SI computation in day-to-day conversations. everyONE's compatibility with the distributive interpretation on one hand, and with every possible exhaustification parse (which is not true - neither for everyBOTH, everySAME nor for everyMIX – see appendix A) on the other hand, makes this interpretation valid in a maximum number of contexts (assuming that different parses are a product of different contexts). Accordingly, we would have expected the mental image of *'some'* to be derived in the same way, resulting in '*some but not all*'.

This is not necessarily the case, however. First, while the logical interpretation of *'or'* includes ignorance inferences, which enhances SI computation, this is not so for *'some'*, which can exist in a perfectly opinionated utterance even without computing SI. Moreover, the study by Bott and Noveck (2004) refuted this hypothesis, as laid down by Levinson (1983, 2000). Levinson hypothesized that the strengthened interpretation of *'some'* is a default inference, and that it arises automatically, regardless of any context. Bott and Noveck (2004) refuted this claim by showing that under time pressure adults do not reject *'some'* descriptions to *'all'* situations. In contrast, Ariel (2015) offers an interpretation of *'most'* in which it is a proper subset bigger than half. Consequently, *'less than all'* is part of the encoded meaning, but the shift from *'less than all'* to *'not all'* requires an extra step, perhaps a cognitively costly one. Accordingly, even if *'some'* is coded in the lexicon as a proper subset, its rejection as describing the entire set is indeed a product of a further "step".

Further research is needed, however, to determine the nature of the 'mental image' assumed in this study (for *'A or B'*, *'every x is A or B'*, and also for *'some'*), and whether it indeed operates as claimed. Other methodologies would be helpful in this point:

a. A qualitative study may reveal why adults accept or reject the pictures as they do, simply by asking them.
b. The current study, as many in the field of scalar implicatures, investigates comprehension. A production study may reveal what adults have in mind upon exposure to under-informative sentences. This can be done simply by drawing a matching picture. This is relevant both for *'or'* and for *'some'*. My intuition would be that adults' coded meaning for *some* involves plurality.
c. If plurality is indeed a part of the mental image for *'some'*, it would be interesting to replicate Bott and Noveck's (2004) study once more, this time with only one item true (e.g. '*some of the mice are holding grapes'* when only one mouse is holding grapes – semantically compatible with the existential quantifier, but not compatible with the proposed mental image of '*some of*').

d. It can be useful to depict (as much as possible) each of the six readings proposed by Ariel and Mauri (in press), as presented above, and observe if participants' acceptance rates for each picture correspond to its frequency in the corpus, as was collected by them.

# 5. CONCLUSION

This study demonstrated how adults interpret different disjunctions from a perspective of scalar implicature computation. Previously, scalar implicatures had been shown to be computed relatively slowly (Huang and Snedeker, 2009), or not at all under time pressure (Bott and Noveck, 2004). Furthermore, children were initially claimed to not compute scalar implicatures (Noveck, 2001 among others), but later research suggested that they compute them different from adults, i.e. not retrieving logically stronger alternatives from the lexicon (e.g. *'and'* for *'or').*

The current study aimed to observe whether it is the case that under time pressure, adults compute implicatures similarly to children, namely without the relevant stronger lexical items. Following Singh et al. (2013), such a computation should result in a conjunctive interpretation of *'or'*.

The data collected in the experiment refute this hypothesis, and show no evidence for such a conjunctive reading in adults under time pressure. It seems that participants do not compute scalar implicatures under time pressure after all. Nevertheless, when examining various pictures potentially matching a disjunction embedded under *'every'*, it does not seem as though participants interpret the given disjunction logically either. This point is strengthened also by the fact that participants did not accept the atomic disjunction as matching a conjunctive picture across the board (as would be expected for a logical inclusive interpretation), but rather tended to guess the answer.

I argue that unlike children, adults follow a certain 'mental image' they have for each linguistic structure; when evaluating sentence-picture pairs under time pressure, they seek compatibility with this 'mental image.' For the embedded disjunction, the mental image would be closest to a distributive reading (depicted by 'everyONE' in this study). In contrast, the atomic disjunction has no such 'mental image.' Following Fox's (2006) concept of *or*'s inherent ignorance inference, interpreting an atomic *or* necessarily involves guessing.

Yet, a claim about any 'mental image' must be strongly based on further research to reveal if the interpretations assumed in this study to fit this image indeed function as such. Further, it is important to see if a 'mental image' based heuristic is in use with other scalar implicatures, and also in other domains associated with a cognitive cost.

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# APPENDIX A

## Exhaustification of atomic and embedded disjunctions according to Fox (2006)

### Part 1: Recursive exhaustification of a disjunction (Fox, 2006)

The exhaustification mechanism for SI computation (Fox, 2006) - a disjunction *'A or B'* (such as *the dog is wearing a scarf or a hat*) is processed as exclusive (*the dog is wearing a scarf or a hat but not both*) in the following manner:

1. A set of alternatives to S is assembled contextually (cf. Sauerland 2004; Katzir, 2007): ALT( A ∨ B ) = { A ∨ B , A, B, A ∧ B }
2. A function *exh* takes the set ALT(A ∨ B) and negates innocently excludable alternatives. A subset is innocently excludable iff:

    a) it does not contain what is said ( A ∨ B )
    b) it does not contain superfluous alternatives, such as B (in A ∨ B, randomly negating B leaves A to be necessarily true, counter to intuition).
    c) it does not contain different alternatives that together comprise what is said ({A,B}).

    The set of innocently excludable alternatives is assembled in the following manner: items in ALT(A∨B) are grouped in Maximal Consistent Exclusion subsets - such that all the alternatives in each maximal subset can be negated while maintaining consistency with A ∨ B. All Maximal Consistent Exclusion subsets intersect into an innocently excludable maximal subset, whose elements are eventually negated.

    **Maximal Consistent Exclusion for A ∨ B**: {A, A ∧ B}, {B, A ∧ B}
    **Innocently excludable maximal sets for A ∨ B:** {A ∧ B}

Thus, the first exhaustification negates $A \wedge B$. Along with *what is said* (in this case $A \vee B$), the outcome is $\nabla$ (an exclusive *or*).

**Result of first exhaustification:** $[[exh(ALT_{adult}(A \vee B))(A \vee B)]]$
$\leftrightarrow (A \vee B) \wedge \neg (A \wedge B) \leftrightarrow \mathbf{A \nabla B}$

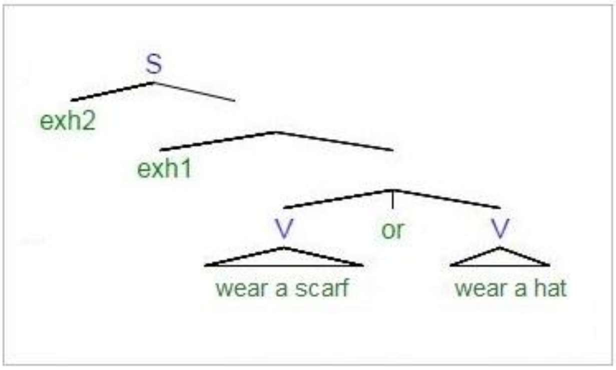
3. Since the result in step (2) still leads to ignorance inferences (the addressee infers that the speaker is ignorant with respect to which of A and B is true), the process iterates. Another operator *exh* is added at root level[8] so it operates on each of the nodes, including the first *exh*. If so, the items in the current ALT (that are eventually meant to be negated) are: the exhaustification of *A* (exh(A)), the exhaustification of *B* (exh(B)) and the exhaustification of *A or B* (*exh(*$A \vee B$), which we already know to be $A \nabla B$). In a context where B is a relevant alternative for A (and it is, for it appears in the same structure), exhaustification of A negates it.[9] Thus, the outcome of exh(A) is '*only A*' ('*A and not B*'). The same goes for exh(B), which results in '*only B*'.

   ALT(*exh*($A \vee B$)) = { $A \vee B$ , *exh*(A), *exh*(B), *exh*($A \vee B$)} →
   ALT(*exh*($A \vee B$)) = { $A \vee B$, $A \wedge \neg B$, $B \wedge \neg A$, $A \nabla B$ }

   Now that we know what each of the elements in ALT(exh($A \vee B$)) means, we can negate them.

[8] The exact position of *exh* in different linguistic structures is of much debate. See Singh et al. (2013), Crnič et al. (2014) among others.
[9] *'A and B'* is also a stronger alternative but the outcome is the same as simply negating B, hence this step is redundant and I will ignore it.

Figure 9 : Parse tree of atomic disjunction (A or B)




$$[[(exh(ALT_{adult}( A \vee B ))( A \vee B ))( A \vee B )]] \leftrightarrow$$

$$exh(A \vee B) \wedge \neg\, exh(A) \wedge \neg\, exh(B) \leftrightarrow$$

$$exh( A \vee B ) \leftrightarrow ( A \nabla B )$$

$$\neg\, exh(A) \leftrightarrow \neg ( A \wedge \neg B )$$

$$\neg\, exh(B) \leftrightarrow \neg ( B \wedge \neg A )$$

$$\Rightarrow$$

$(A \nabla B) \wedge \neg (A \wedge \neg B) \wedge \neg (\neg A \wedge B) \leftrightarrow$ vacuous (only true when the domain is empty)

Since the second exhaustification is vacuous, the addressee is left with the same meaning of the first operation, namely $A\nabla B$, as predicted.

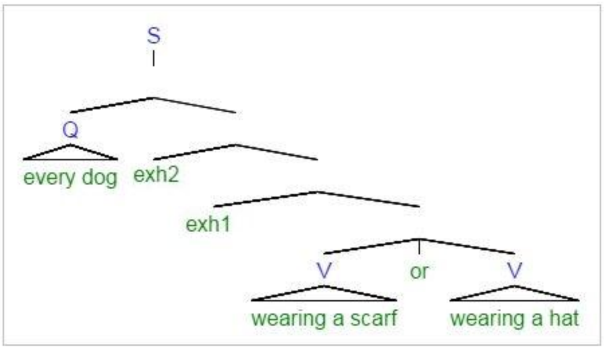
Placing both instances of *exh* at root level yields the desired results for adult interpretation of embedded disjunctions as distributive (everyONE in this study), and also for free-choice inferences. However, certain readings of embedded disjunctions are not fully explained with such a parse. Specifically, the conjunctive reading children get in Singh et al.'s (2013) study, and certain possible situations, discussed in Crnič et al. (2014), which might be described with an embedded disjunction. Two of the situations are represented in this work by the names everyMIX and everySAME, illustrated bellow:

Figure 10 : everyMIX (on the left) and everySAME (on the right)

## Part 2: embedded disjunctions with child alternatives

**Singh et al. (2013)** claim that for the majority of the children, not only did they prune $A \wedge B$ from the alternative set for $A \vee B$, but also that in order to yield a conjunctive reading of *'every x is A or B'*, the instance(s) of *exh* must be located below the universal quantifier. Such a parse is illustrated below:

Figure 11 : Parse tree for an embedded disjunction (every x is A or B) with 'local' exhaustification




A recursive exhaustification following Fox (2006) with such a parse is given below with ALT($A \vee B$) = {$A\vee B$, A, B} (in both instances of *exh*).

**Maximal Consistent Exclusion for $A \vee B$**: {A}, {B}

As opposed to adults, where the MCEs are {A, $A \wedge B$} and {B, $A \wedge B$}, here there is no $A \wedge B$ since it is not in ALT to begin with.

**Innocently excludable maximal sets for $A \vee B$:** $\{A\} \cap \{B\} = \varnothing$

First exhaustification is superfluous (in the sense that it leads to no change):

$[[exh(ALT_{child}(A \vee B))(A \vee B)]] \leftrightarrow (A \vee B)$

Since the first operation of *exh* still leads to ignorance inference, the exhaustification iterates, this time with *exh* applying to each of the alternatives.

ALT(*exh*($A \vee B$)) = {*exh*($A \vee B$), *exh*(A), *exh*(B)} $\rightarrow$

ALT(*exh*($A \vee B$)) = $\{A \vee B, A \wedge \neg B, B \wedge \neg A\}$

$Exh_2 = exh\,(A \vee B) \wedge \neg\, exh(A) \wedge \neg\, exh(B)$

$Exh_2 = A \vee B \wedge \neg (A \wedge \neg B) \wedge \neg (B \wedge \neg A) \leftrightarrow A \wedge B$

Since all other options for a true disjunctions were negated (the lighter gray rows), we are left only with the conjunctive meaning, namely, the one where both A and B are true.

**Table 6: Truth table for 'or'**

| | A | B | $A \vee B$ |
|---|---|---|---|
| **$A \wedge B$** | **T** | **T** | **T** |
| $A \wedge \neg B$ | T | F | T |
| $B \wedge \neg A$ | F | T | T |
| | F | F | F |

As for the embedded disjunction, it is embedded under the universal quantifier:

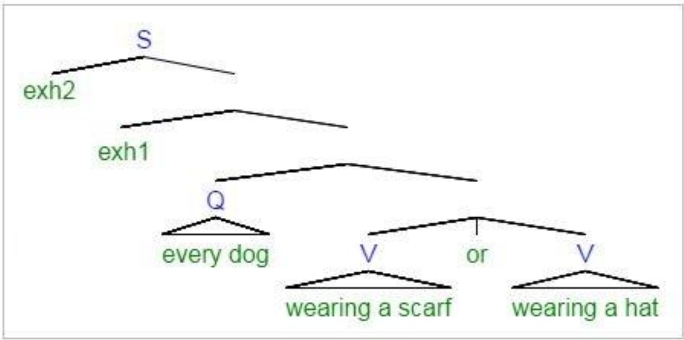
S = $\forall$(*exh*$_2$) = $\boldsymbol{\forall x[A(x) \wedge B(x)]}$

In this interpretation, it is true for every dog (x) that it wears both a scarf (A) and a hat (B).

It is worth mentioning, that such a parse is impossible according to the Neo-Gricean approach, whose claim is that the entire sentence is negated (i.e. all instances of *exh* are always at root level – above the universal quantifier).

A parse with both instances of *exh* above the quantifier would lead to an interpretation compatible with everyONE, regardless of whether $A \wedge B$ is in the alternative set or not:

**Figure 12 : Parse tree for an embedded disjunction (every x is A or B) with 'global' exhaustification**




ALT(∀(A ∨ B)) = {∀ (A∨B), ∀A, ∀B} (in both instances of *exh*)

**Maximal Consistent Exclusion for A ∨ B**: {∀A}, {∀B}

Since both ∀A and ∀B can be safely negated together (as the sentence can be true with only some A and some B), they can be innocently excluded (negated).

**Innocently excludable maximal sets for A ∨ B:** {∀A, ∀B}

First[10] exhaustification:

$[[exh(\mathrm{ALT}_{\mathrm{child}}(\forall[A \vee B]))(A \vee B)]] \leftrightarrow \forall(A \vee B) \wedge \neg(\forall A) \wedge \neg(\forall B)$

Notice that this kind of parsing rules out everySAME and everyMIX, since a situation where "every x is A" is negated.

$\leftrightarrow \forall(A \vee B) \wedge \exists\neg(A) \wedge \exists\neg(B)$

Since for every x, if it is either A or B, if there exists an x which is not A, it is surely B, and vice versa – if there exists an x which is not B, it is surely A. Consequently, there exists a dog which is wearing a scarf (A(x)) and there exists a dog which is wearing a hat (B(x)), and there is no dog which is wearing neither.

$\leftrightarrow \exists x[A(x)] \wedge \exists x[B(x)] \wedge \neg\exists x[\neg B(x) \wedge \neg A(x)]$

[10] A second exhaustification here is superfluous, since the first one leads to an opinionated interpretation. The existence of *exh* in this position is therefore under debate.

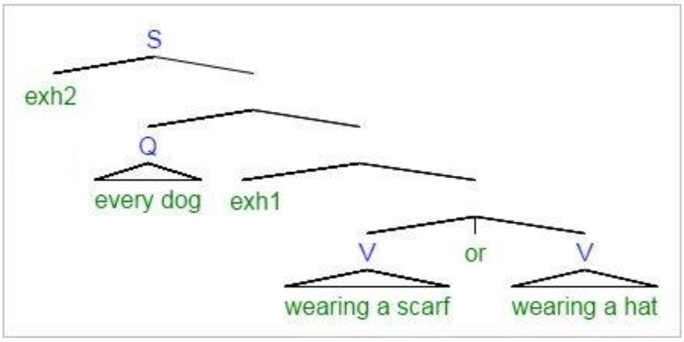
The two optional pictures for such a parse are everyONE and everyBOTH.

The same parse with adult alternatives (including '*A and B*' in ALT(*A or B*)) simply negates everyBOTH as well, so it is compatible only with everyONE.

## Part 3: parsing of "Every x is A or B" with one global and one local *exh*

Crnič et al. (2014) introduced a parse with one *exh* below the quantifier and one above it, where the lower one lacks AΛB in ALT(AVB). Their justification for such a parse is the possibility of describing a picture like everyMIX with an embedded disjunction.

**Figure 13 Parse tree for an embedded disjunction (every x is A or B) with both local and global exhaustifications**




ALT(A ∨ B) = {(A∨B), A, B} (in the first *exh*)

**Maximal Consistent Exclusion for A ∨ B**: {A}, {B}

**Innocently excludable maximal sets for A ∨ B: ∅**

First exhaustification is superfluous (in the sense that it leads to no change):
[[*exh(*ALT( A ∨ B ))( A ∨ B )]] ↔ (A ∨ B)

Since the first operation of *exh* still leads to ignorance inference, the exhaustification iterates, this time with *exh* applying to each of the alternatives. However, as opposed to the children's parse in the previous section, here the alternatives of the second iteration include the quantifier:

ALT(∀(exh(A ∨ B ))) = {∀(*exh*(A ∨ B)), ∀(*exh*(A)), ∀(*exh*(B))}
ALT(∀(exh(A ∨ B ))) = {∀ (A ⩒ B), ∀(A Λ ¬B), ∀(B Λ ¬A)}
The second exhautification negates each of the items in the set.

$[[exh_2(\text{ALT}(\forall(exh(A \vee B)))(A \vee B)]] =$

$(\forall(exh(A \vee B))) \wedge \neg(\forall(exh(A))) \wedge \neg(\forall(exh(B)))$

$\leftrightarrow \forall (A \nabla B) \wedge \neg(\forall(A \wedge \neg B)) \wedge \neg(\forall(B \wedge \neg A))$

As opposed to the 'global' parse, here '*every x is A'* is not negated by itself, but rather *'every x is **only** A'* is negated.

$\leftrightarrow \forall (A \nabla B) \wedge \exists(A) \wedge \exists(B)$

And yet, each one of the items still needs to be true. This outcome allows that all the dogs are wearing hats (all A) as long as at least one of them is also wearing a scarf (everyMIX but crucially not everySAME). Also, $\forall$ (A $\nabla$ B) rules out everyBOTH. However, note that the last bit applies only when the higher *exh* has "adult" alternatives.

# APPENDIX B – MATERIAL

## Sentences and picture numbers

Table 7 : Sentences and pairing (group A)

| Gloss | Sentences (group A) - Hebrew | Pic. number | Picture-sentence pair |
|---|---|---|---|
| The penguin is playing with a car and a ball | הפינגווין משחק במכונית ובכדור | 17 | BOTH - and |
| The monkey is wearing a scarf and a hat | הקוף לובש צעיף וכובע | 2 | BOTH - and |
| The dog is playing with a ball and a car | הכלב משחק בכדור ובמכונית | 23 | BOTH - and |
| The rabbit puts a hat and a scarf | הארנב שם כובע וצעיף | 29 | BOTH - and |
| The dog is playing with a ball and not with a car | הכלב משחק בכדור ולא במכונית | 23 | BOTH - and not |
| The monkey is playing with a car and not with a ball | הקוף משחק במכונית ולא בכדור | 5 | BOTH - and not |
| The rabbit is playing with a car but not a ball | הארנב משחק במכונית אבל לא בכדור | 11 | BOTH - but not |
| The penguin is holding a banana but not an apple | הפינגווין מחזיק בננה אבל לא תפוח | 32 | BOTH - but not |
| The penguin is wearing a scarf or a hat | הפינגווין לובש כובע או צעיף | 14 | BOTH - or |
| The dog is holding a banana or an apple | הכלב מחזיק בננה או תפוח | 35 | BOTH - or |
| The monkey is playing with a car or a ball | הקוף משחק בכדור או במכונית | 5 | BOTH - or |
| The rabbit is wearing a scarf or a hat | הארנב לובש צעיף או כובע | 8 | BOTH - or |
| Every rabbit is playing with a car and a ball | כל ארנב משחק במכונית ובכדור | 39 | everyBOTH - and |
| Every penguin is wearing a scarf and a hat | כל פינגווין לובש צעיף וכובע | 40 | everyBOTH - and |
| Every dog is playing with a ball and a car | כל כלב משחק בכדור ובמכונית | 42 | everyBOTH - and |
| Every rabbit is holding a banana and an apple | כל ארנב מחזיק בננה ותפוח | 46 | everyBOTH - and |
| Every rabbit is wearing a scarf and not a hat | כל ארנב לובש צעיף ולא כובע | 38 | everyBOTH - and not |
| Every penguin is playing with a car and not a ball | כל פינגווין משחק במכונית ולא בכדור | 41 | everyBOTH - and not |
| Every dog is holding a banana but not an apple | כל כלב מחזיק בננה אבל לא תפוח | 36 | everyBOTH - but not |

| | | | |
|---|---|---|---|
| Every monkey is playing with a car but not a ball | כל קוף משחק בכדור אבל לא במכונית | 37 | everyBOTH - but not |
| Every monkey is playing with a car or a ball | כל קוף משחק במכונית או בכדור | 37 | everyBOTH - or |
| Every dog is wearing a scarf or a hat | כל כלב לובש כובע או צעיף | 43 | everyBOTH - or |
| Every penguin is holding a banana or an apple | כל פינגווין מחזיק תפוח או בננה | 45 | everyBOTH - or |
| Every rabbit is holding a banana or an apple | כל ארנב מחזיק בננה או תפוח | 46 | everyBOTH - or |
| Every monkey is eating a banana and an apple | כל קוף אוכל בננה ותפוח | 27 | everyONE - and |
| Every dog is playing with a car and a ball | כל כלב משחק במכונית ובכדור | 4 | everyONE - and |
| Every monkey is playing with a ball and a car | כל קוף משחק בכדור ובמכונית | 6 | everyONE - and |
| Every rabbit is wearing a scarf and a hat | כל ארנב לובש צעיף וכובע | 9 | everyONE - and |
| Every penguin is holding a banana and not an apple | כל פינגווין מחזיק בננה ולא תפוח | 26 | everyONE - and not |
| Every dog is putting on a hat and not a scarf | כל כלב שם כובע ולא צעיף | 29 | everyONE - and not |
| Every dog is playing with a ball but not a car | כל כלב משחק בכדור אבל לא במכונית | 16 | everyONE - but not |
| Every monkey is eating a banana but not an apple | כל קוף אוכל בננה אבל לא תפוח | 34 | everyONE - but not |
| Every rabbit is playing with a ball or a car | כל ארנב משחק בכדור או במכונית | 12 | everyONE - or |
| Every dog is playing with a car or a ball | כל כלב משחק בכדור או במכונית | 24 | everyONE - or |
| Every monkey is wearing a scarf or a hat | כל קוף לובש צעיף או כובע | 3 | everyONE - or |
| Every penguin is eating a banana or an apple | כל פינגווין אוכל בננה או תפוח | 33 | everyONE - or |
| The penguin is wearing a scarf and a hat | הפינגווין שם כובע וצעיף | 19 | ONE - and |
| The dog is playing with a car and a ball | הכלב משחק בכדור ובמכונית | 22 | ONE - and |
| The rabbit is holding a banana and an apple | הארנב מחזיק בננה ותפוח | 28 | ONE - and |
| The monkey is eating a banana and an apple | הקוף אוכל תפוח ובננה | 35 | ONE - and |
| The monkey is wearing a hat and not a scarf | הקוף חובש כובע ולא צעיף | 1 | ONE - and not |
| The rabbit is wearing a scarf and not a hat | הארנב לובש צעיף ולא כובע | 7 | ONE - and not |

| | | | |
|---|---|---|---|
| The penguin is wearing a scarf but not a hat | הפינגווין לובש צעיף אבל לא כובע | 13 | ONE - but not |
| The dog is wearing a hat but not a scarf | הכלב חובש כובע אבל לא צעיף | 20 | ONE - but not |
| The rabbit is playing with a car or a ball | הארנב משחק במכונית או בכדור | 10 | ONE - or |
| The dog is wearing a scarf or a hat | הכלב לובש צעיף או כובע | 13 | ONE - or |
| The monkey is eating a banana or an apple | הקוף אוכל בננה או תפוח | 25 | ONE - or |
| The penguin is holding a banana or an apple | הפינגוין מחזיק תפוח או בננה | 31 | ONE - or |
| Every penguin is holding a banana and an apple | כל פינגוין מחזיק בננה ותפוח | 54 | everyMIX - and |
| Every rabbit is holding a banana and an apple | כל ארנב מחזיק תפוח ובננה | 55 | everyMIX - and |
| Every dog is playing with a car and a ball | כל כלב משחק במכונית ובכדור | 59 | everyMIX - and |
| Every monkey is wearing a scarf or a hat | כל קוף לובש צעיף או כובע | 57 | everyMIX - or |
| Every rabbit is holding a banana and an apple | כל ארנב מחזיק בננה ותפוח | 56 | everySAME - and |
| Every monkey is wearing a scarf and a hat | כל קוף לובש צעיף וכובע | 58 | everySAME - and |
| Every dog is wearing a hat and not a scarf | כל כלב לובש כובע ולא צעיף | 51 | everySAME - and not |
| Every monkey is playing with a car and not a ball | כל קוף משחק במכונית ולא בכדור | 50 | everySAME - and not |
| Every penguin is wearing a scarf but not a hat | כל פינגווין לובש צעיף אבל לא כובע | 52 | everySAME - but not |
| Every penguin is holding a banana or an apple | כל פינגוין מחזיק תפוח או בננה | 53 | everySAME – or |
| Every dog is playing with a car or a ball | כל כלב משחק במכונית או בכדור | 60 | everySAME – or |

**Table 8 : Sentences and pairing (group B)**

| gloss | Sentences (group B) – Hebrew | Pic. number | Picture-sentence pair |
|---|---|---|---|
| The penguin is wearing a scarf and a hat | הפינגוין לובש כובע וצעיף | B14 | BOTH – and |
| The dog is holding a banana and an apple | הכלב מחזיק בננה ותפוח | B35 | BOTH – and |
| The monkey is playing with a car and a ball | הקוף משחק בכדור ובמכונית | B5 | BOTH – and |
| The rabbit is wearing a scarf and a hat | הארנב לובש צעיף וכובע | B8 | BOTH – and |
| The monkey is playing with a car and not a ball | הקוף משחק בכדור ולא במכונית | B5 | BOTH - and not |
| The dog is playing with a car but not a ball | הכלב משחק במכונית אבל לא בכדור | B23 | BOTH - but not |
| The rabbit is playing with a ball but not a car | הארנב משחק בכדור אבל לא במכונית | B11 | BOTH - but not |
| The penguin is holding an apple but not a banana | הפינגוין מחזיק תפוח אבל לא בננה | B32 | BOTH - but not |
| The penguin is playing with a car or a ball | הפינגוין משחק במכונית או בכדור | B17 | BOTH - or |
| The monkey is wearing a scarf or a hat | הקוף לובש צעיף או כובע | B2 | BOTH - or |
| The dog is playing with a car or a ball | הכלב משחק בכדור או במכונית | B23 | BOTH - or |
| The rabbit is putting on a scarf or a hat | הארנב שם כובע או צעיף | B29 | BOTH - or |
| Every monkey is playing with a car and a ball | כל קוף משחק במכונית ובכדור | B37 | everyBOTH - and |
| Every dog is wearing a scarf and a hat | כל כלב לובש כובע וצעיף | B43 | everyBOTH - and |
| Every penguin is holding an apple and a banana | כל פינגוין מחזיק תפוח ובננה | B45 | everyBOTH - and |
| Every rabbit is holding a banana and an apple | כל ארנב מחזיק בננה ותפוח | B46 | everyBOTH - and |
| Every rabbit is wearing a hat and not a scarf | כל ארנב חובש כובע ולא צעיף | B38 | everyBOTH - and not |
| Every penguin is playing with a ball and not a car | כל פינגוין משחק בכדור ולא במכונית | B41 | everyBOTH - and not |
| Every dog is holding an apple but not a banana | כל כלב מחזיק תפוח אבל לא בננה | B36 | everyBOTH - but not |
| Every monkey is playing with a car but not a ball | כל קוף משחק במכונית אבל לא בכדור | B37 | everyBOTH - but not |
| Every rabbit is playing with a car or a ball | כל ארנב משחק במכונית או בכדור | B39 | everyBOTH - or |

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|---|---|---|---|
| Every penguin is wearing a scarf or a hat | כל פינגוין לובש צעיף או כובע | B40 | everyBOTH - or |
| Every dog is playing with a car or a ball | כל כלב משחק בכדור או במכונית | B42 | everyBOTH - or |
| Every rabbit is holding a banana and or an apple | כל ארנב מחזיק בננה או תפוח | B46 | everyBOTH - or |
| Every penguin is holding an apple and a banana | כל פינגוין מחזיק תפוח ובננה | B54 | everyMIX - and |
| Every monkey is wearing a scarf and a hat | כל קוף לובש צעיף וכובע | B57 | everyMIX - and |
| Every rabbit is holding a banana or an apple | כל ארנב מחזיק בננה  או תפוח | B55 | everyMIX - or |
| Every dog is playing with a car or a ball | כל כלב משחק במכונית או בכדור | B59 | everyMIX - or |
| Every rabbit is playing with a car and a ball | כל ארנב משחק בכדור ובמכונית | B12 | everyONE - and |
| Every dog is playing with a car and a ball | כל כלב משחק בכדור ובמכונית | B24 | everyONE - and |
| Every monkey is wearing a scarf and a hat | כל קוף לובש צעיף וכובע | B3 | everyONE - and |
| Every penguin is eating a banana and an apple | כל פינגוין אוכל בננה ותפוח | B33 | everyONE - and |
| Every penguin is holding a banana and not an apple | כל פינגוין מחזיק בננה ולא תפוח | B26 | everyONE - and not |
| Every dog is wearing a hat and not a scarf | כל כלב שם כובע ולא צעיף | B29 | everyONE - and not |
| Every dog is playing with a car but not a ball | כל כלב משחק בכדור אבל לא במכונית | B16 | everyONE - but not |
| Every monkey is eating a banana but not an apple | כל קוף אוכל בננה אבל לא תפוח | B34 | everyONE - but not |
| Every monkey is eating a banana or an apple | כל קוף אוכל בננה או תפוח | B27 | everyONE - or |
| Every dog is playing with a car or a ball | כל כלב משחק במכונית או בכדור | B4 | everyONE - or |
| Every monkey is playing with a car or a ball | כל קוף משחק בכדור או במכונית | B6 | everyONE - or |
| Every rabbit is wearing a scarf or a hat | כל ארנב לובש צעיף או כובע | B9 | everyONE - or |
| Every rabbit is holding a banana and an apple | כל ארנב מחזיק תפוח ובננה | B56 | everySAME - and |
| Every penguin is holding an apple and a banana | כל פינגווין מחזיק תפוח ובננה | B53 | everySAME - and |
| Every dog is playing with a car and a ball | כל כלב משחק במכונית ובכדור | B60 | everySAME - and |
| Every dog is wearing a scarf and not a hat | כל כלב לובש צעיף ולא כובע | B51 | everySAME - and not |
| Every monkey is playing with a ball | כל קוף משחק בכדור ולא במכונית | B50 | everySAME - and not |

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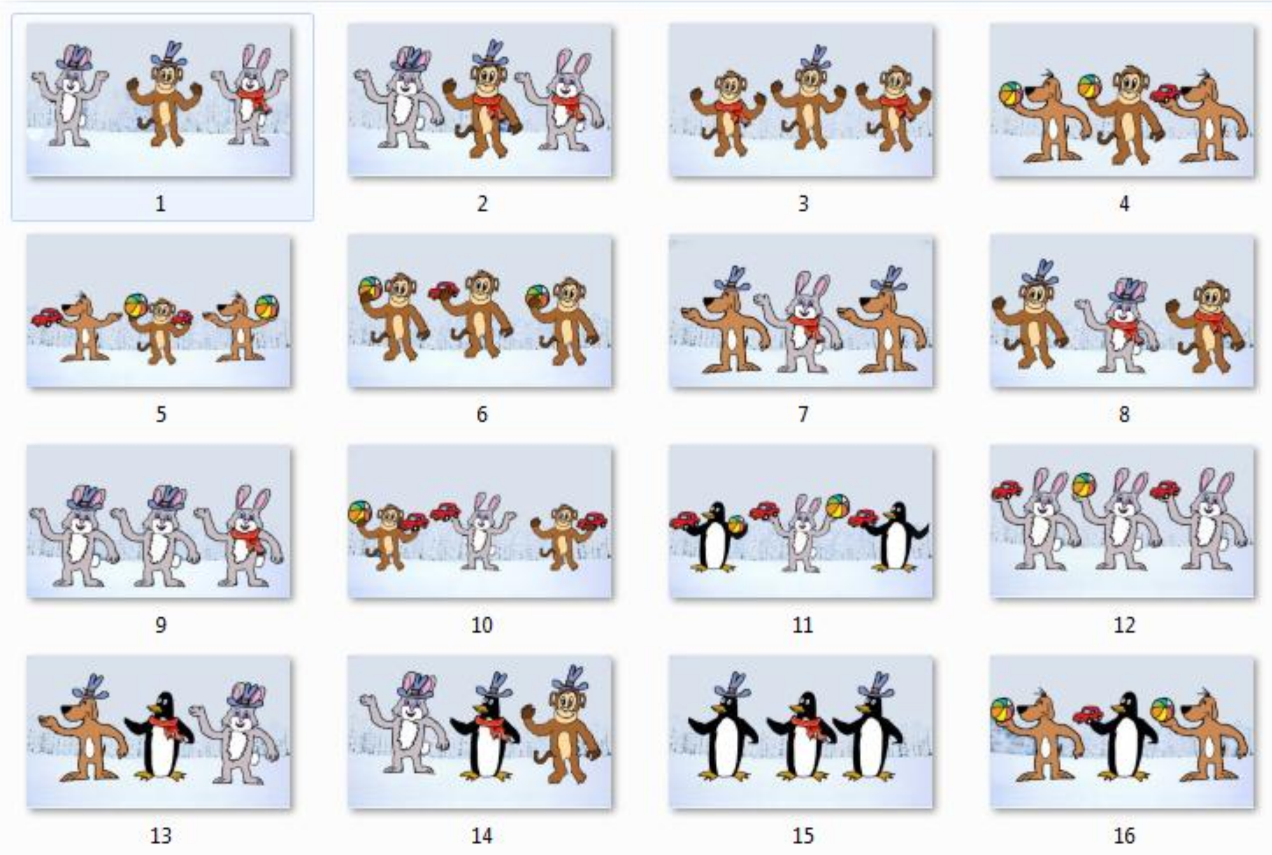
|---|---|---|---|
| and not a car | | | |
| Every penguin is wearing a hat but not a scarf | כל פינגווין לובש כובע אבל  לא צעיף | B52 | everySAME - but not |
| Every monkey is wearing a scarf or a hat | כל קוף לובש צעיף או כובע | B58 | everySAME - or |
| The rabbit is playing with a car and a ball | הארנב משחק במכונית ובכדור | B10 | ONE - and |
| The dog is wearing a scarf and a hat | הכלב לובש צעיף וכובע | B13 | ONE - and |
| The monkey is eating a banana and an apple | הקוף אוכל בננה ותפוח | B25 | ONE - and |
| The penguin is holding a banana and an apple | הפינגווין מחזיק תפוח ובננה | B31 | ONE - and |
| The monkey is wearing a hat and not a scarf | הקוף חובש כובע ולא צעיף | B1 | ONE - and not |
| The rabbit is wearing a scarf and not a hat | הארנב לובש צעיף ולא כובע | B7 | ONE - and not |
| The penguin is wearing a scarf but not a hat | הפינגווין לובש צעיף אבל לא כובע | B13 | ONE - but not |
| The dog is wearing a hat but not | הכלב חובש כובע אבל לא צעיף | B20 | ONE - but not |
| The penguin is wearing a scarf or a hat | הפינגווין שם כובע או צעיף | B19 | ONE - or |
| The dog is playing with a car or a ball | הכלב משחק בכדור או במכונית | B22 | ONE - or |
| The rabbit is holding a banana or an apple | הארנב מחזיק בננה  או תפוח | B28 | ONE – or |
| The monkey is eating a banana or an apple | הקוף אוכל תפוח או בננה | B35 | ONE – or |

## Pictures

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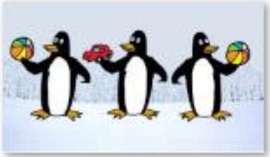
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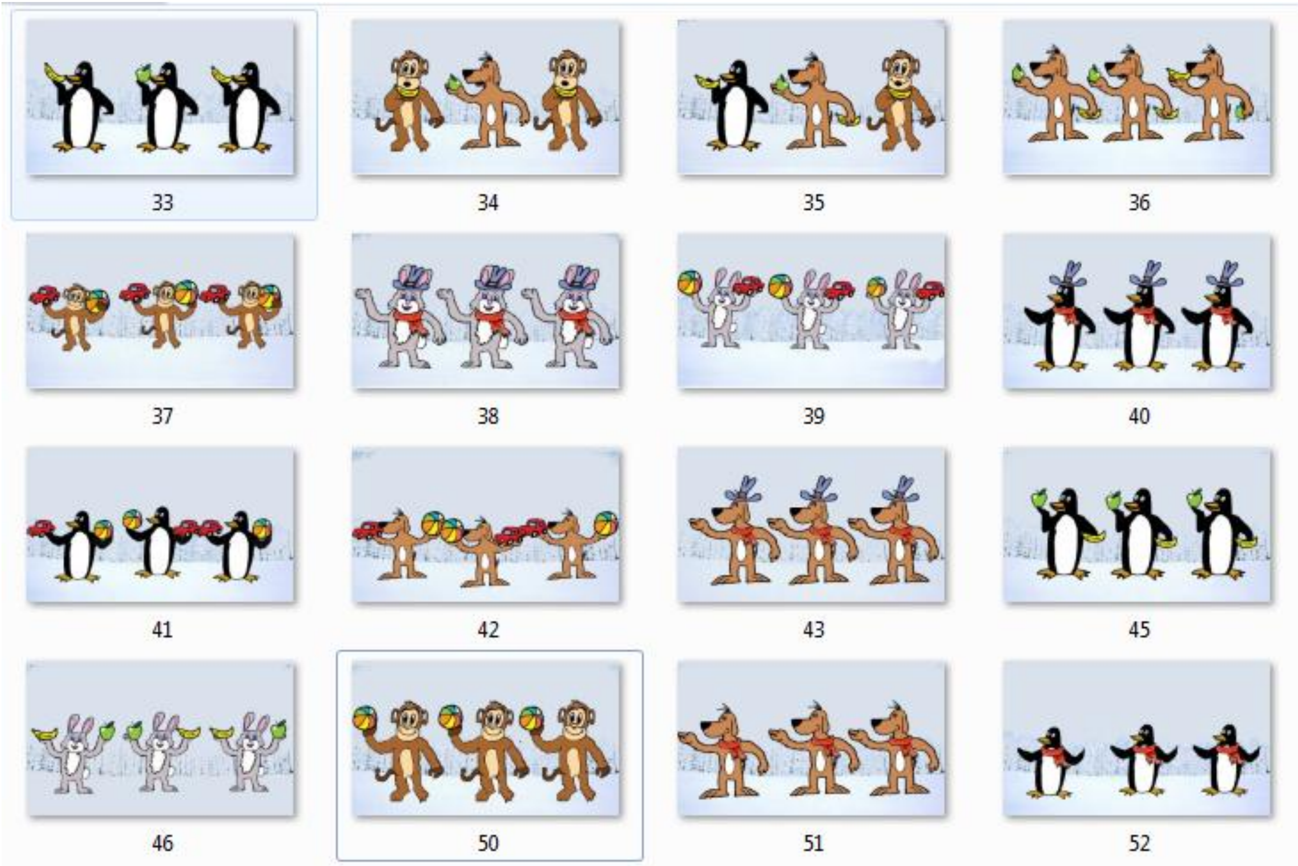
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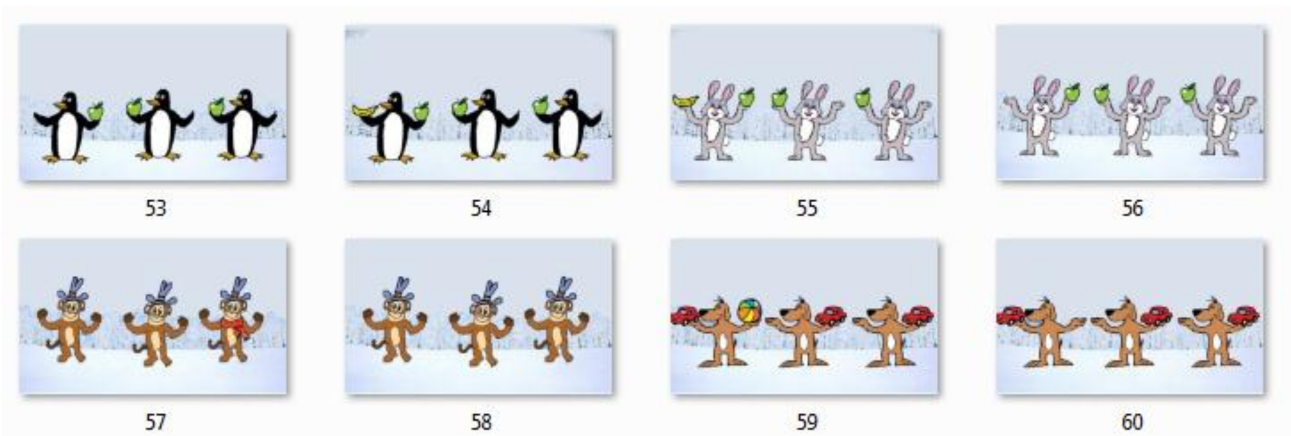
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## תקציר

סמן הדיסיונקציה "או" נחשב כטריגר לחישוב אימפליקטורה סקאלרית. כלומר, דוברים מפרשים את המבע "א או ב" בתור "א או ב אבל לא שניהם יחד". לפי עקרונות גרייסיאנים, משום ש"וגם" גורר את "או", הנמען מניח שאם הדוברת בחרה להביע את המבע החלש יותר "א או ב", זה מפני שהיא מאמינה שהמבע החזק "א וגם ב" שקרי. כתוצאה מכך, יש לשער כי הידוע לגבי עיבוד של משפטים הכוללים אימפליקטורות סקאלריות, יהיה נכון גם לגבי דיסיונקציות.

הספרות הפסיכובלשנית מייחסת לאימפליקטורות סקאלריות זמן עיבוד ארוך יותר מאשר למשפטים מקבילים שאינם מצריכים חישוב אימפליקטורה סקלארית (למשל, "לחלק מהג'ירפות יש צוואר ארוך" יעובד לאט יותר מאשר "לכל הג'ירפות יש צוואר ארוך"). כתוצאה, דוברים נוטים לחשב מלכתחילה אימפליקטורות סקלאריות פחות כאשר הם נתונים תחת לחץ זמן (Bott and Noveck, 2004). הסבר שונה לתופעה אינו מייחס את ה"עלות" העיבודית לקושי לחשב אימפליקטורה סקלארית, אלא דווקא לבחירה בין מענה לוגי ("אמת") לבין מענה פרגמטי ("שקר") – בחירה שאינה רלוונטית עבור משפטי הביקורת במחקר טיפוסי מקביל (Shetreet et al, 2014). הסבר שכזה כשהוא לבדו, מנבא דפוס מענה של ניחוש תחת לחץ זמן, זאת בניגוד לממצאים שהתקבלו במחקר של Noveck ו-Bott. מפער זה נובע כי ככל הנראה קיים גורם נוסף המונע מדוברים לחשב אימפליקטורה תחת לחץ זמן.

בנוסף, נמצא כי כברירת מחדל ילדים לא מחשבים אימפליקטורות סקלאריות (Noveck 2001; Guasti et al., 2005 בין היתר). יחד עם זאת, נמצא גם כי ילדים מפרשים דיסיונקציה בתור קוניונקציה במקום לפרשן כדיסיונקציה אינקלוסיבית (כלומר "א וגם ב" במקום "א או ב או שניהם"), כפי שהיה מצופה ללא חישוב אימפליקטורה (Singh et al. 2013). הדבר נכון לא רק לגבי דיסיונקציה אטומית ("X הוא א או ב") אלא גם לגבי דיסיונקציה המשועבדת תחת כמת כולל ("כל X הוא א או ב"). הכותבים ייחסו את הקרי הקוניונקטיבי לחוסר היכולת של ילדים לאחזר את "וגם" (החזק יותר לוגית מאשר "או") מהלקסיקון לשם חישוב אימפליקטורה סקלארית.

מטרת המחקר הנוכחי הינה לקשר בין דפוס המענה של מבוגרים תחת לחץ זמן, לבין דפוס המענה של ילדים. המחקר מנסה להעריך האמנם מבוגרים לא מחשבים אימפליקטורות כלל תחת לחץ זמן, או שמא הם אכן מחשבים את האימפליקטורה אך, כמו ילדים, לא מאחזרים את הפריט הלקסיקלי החזק יותר תחת לחץ זמן. לשם כך, המחקר בוחן כיצד מבוגרים מפרשים משפטי דיסיונקציה תחת לחץ זמן.

קבוצה בת שלושים משתתפות ומשתתפים בוגרים נתבקשו להעריך את מידת ההתאמה בין צמדי תמונה ומשפט. משפטים עם דיסיונקציה אטומית הוצגו יחד עם (א) תמונה בה נמצא פריט אחד – א' או ב' (תמונה הנקראת ONE); או (ב) תמונה עם שני הפריטים (BOTH). משפטים עם דיסיוקנציה משועבדת הוצגו עם ארבעה סוגי תמונות, התואמות לאופני הגזירה השונים של המשפט )לפי Crnič et al. 2014): (א) תמונה התואמת "קרי דיסטריביוטיבי" בה עבור חלק

מהדמויות א׳ אמיתי ועבור שאר הדמויות ב׳ אמיתי (everyONE); (ב) תמונה בה א׳ (וא׳ בלבד) אמיתי עבור כל הדמויות (everySAME); (ג) תמונה בה א׳ אמיתי עבור כל הדמויות ובנוסף לכך ב׳ אמיתי עבור דמות אחת בלבד (everyMIX); ו-(ד) תמונה בה גם א׳ וגם ב׳ אמיתיות עבור כל הדמויות. לחצי מהנבדקים היה זמן מענה קצר ולחצי מהנבדקים זמן ארוך למענה.

תוצאות הניסוי אינן מצביעות על כך שנבדקים מייחסים קרי קוניונקטיבי לדיסיונקציות תחת לחץ זמן. הנבדקים לא קיבלו את תמונהBOTH עם משפט דיסיונקטיבי באופן מובהק. יחד עם זאת, הם כן קיבלו את תנאי everyBOTH יותר בנוכחות הדיסיונקציה המשועבדת. יתרה מכך, על אף שנבדקים אכן קיבלו את תנאי ONE פחות, לחץ הזמן לא השפיע כלל על everyONE או על everySAME, אלא רק במידה מסוימת על everyMIX.

מממצאים אלו ניכר כי מבוגרים אכן לא מחשבים אימפליקטורה סקלארית תחת לחץ זמן, אך עם זאת אין הדבר אומר שהם מקבלים כל מה שעקבי עם המשמעות הלוגית המיוחסת בספרות ל-״או״ (כלומר זו של דיסיונקציה אינקלוסיבית). לשיטתי, במקום זאת מבוגרים תחת לחץ זמן מחפשים עקביות עם תמונה מנטלית המקושרת ל-״או״.

אוניברסיטת תל-אביב
הפקולטה למדעי הרוח ע״ש לסטר וסאלי אנטין
החוג לבלשנות

# על השתמעותן של דיסיונקציות אטומיות ומשועבדות בראי אימפליקטורות סקלאריות

חיבור זה הוגש כעבודת גמר לקראת התואר
״מוסמך אוניברסיטה״ - M.A. באוניברסיטת ת״א

על ידי
**שובל שדה**

העבודה הוכנה בהדרכת:
**ד״ר איה מלצר-אשר**

**אוקטובר 2016**