

# Embedded Disjunctions and the Best Response Paradigm

**Introduction.** Theories of implicature make different predictions concerning the inferences arising from sentences with multiple scalar items. The current study investigates the complex sentences with embedded disjunctions presented in (1).

- (1) a) All of the girls found their red or their blue marble.  
b) Some of the girls found their red or their blue marble.  
c) All of the girls found their red, their blue, or their green marble.  
d) Some of the girls found their red, their blue, or their green marble.

In particular, we test the status of the following four types of implicature in a situation where the speaker is known to know the state of the world:

- (A) the embedded exclusive reading of disjunction, e.g. for (1a) the implicature *all either r or b*;  
(B) the global implicature from (1b) and (1d) to none  $r \wedge b$ , none  $r \wedge g$ , and none  $b \wedge g$ ;  
(C) the exhaustive implicature from (1a) and (1b) to *none found their green marble*;  
(D) the *existence implicature* of the embedded disjunctions, for example from (1a) all  $(r \vee b)$  to some  $r \wedge$  some  $b$ .

Existence implicature (D) are stronger than so-called *ignorance* implicature, which only require that *it is possible that* some  $r$  and that some  $b$ . This stronger type could be expected if the speaker knows the exact state of affairs.

Theories make different predictions concerning these types of implicature. For example, Chierchia (2004) predicts (A) and a weaker version of (B), e.g. (1b)  $+>$  (some  $r \vee b$  and  $\neg$ all  $r \vee b$ ) but does not address (D). Franke (2009) predicts (A) and (B), and Sauerland (2004) (B) and for (1a) a weaker version of (A) ( $\neg$ all  $r \wedge b$ ). None of the theories predicts (C), and (D) is only explained by (Sauerland, 2004). This is only a sample of the theories about embedded implicature that could be considered (e.g. Asher, 2013; Chierchia et al., 2012; Benz, 2012; Potts et al., 2015), but none of them could make specific enough predictions, or cover all types of implicature.

We present clear experimental evidence for all four types of implicature with a paradigm that is based on a game theoretical design (*best response paradigm*). In contrast to previous experimental studies (e.g. Geurts and Poussoulous, 2009; Chemla and Spector, 2011), our paradigm provides an organic setting that avoids meta-linguistic judgment.

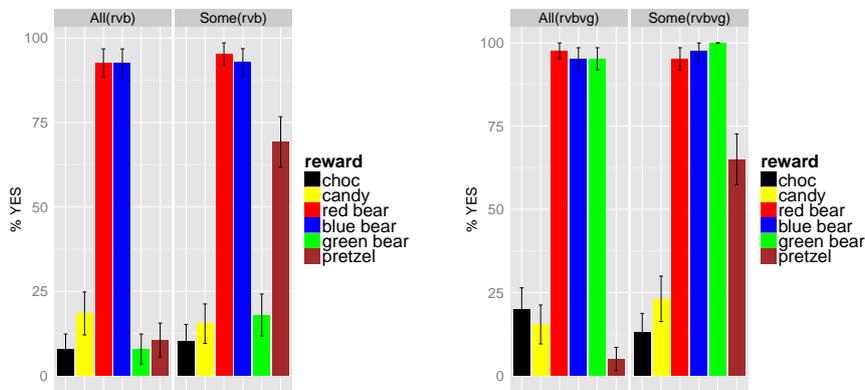
**Experiment: Best response paradigm.** *Methods:* The experimental scenario involves four sisters each owning a set of three special edition marbles, consisting of a blue, red, and a green marble. These marbles get lost while the girls are playing. Participants are told that the mother of the girls wants to reward them depending on how many marbles they find. A girl gets (i) chocolate if she finds all 3 of her marbles, (ii) a hard candy if she finds 2 of her marbles and if she finds only 1 of her marbles, she gets (iii) a red gummy bear for a red marble, a blue gummy bear for a blue marble, and a green gummy bear for a green marble. If she finds none of her 4 marbles, she gets (iv) a pretzel stick as a consolation prize.

The task of the participants is to buy sweets for the four girls depending on the statements the mother utters. For example, if the mother says ‘*No girl found any of her marbles*’ participants should only buy pretzel sticks. Participants were asked to give binary responses (yes/no) for each of the six types of sweets: chocolate, candy, red, blue, and green gummy bears, and pretzel sticks.

We tested the four sentences presented in (1) (with 2 instances), together with 21 filler items such as sentences like ‘*All of the girls found all of their marbles*’. If subjects draw the implicatures (A)–(D), then their expected response pattern is that shown in (2).

	condition	choc.	candy	red b.	blue b.	green b.	pretzel
	(1a) All ( $r \vee b$ )	no	no	yes	yes	no	no
(2)	(1b) Some ( $r \vee b$ )	no	no	yes	yes	no	yes
	(1c) All $r \vee b \vee g$	no	no	yes	yes	yes	no
	(1d) Some $r \vee b \vee g$	no	no	yes	yes	yes	yes

*Results:* The graph below shows the mean % of YES responses across critical conditions for each reward type (n = 20). Responses were analyzed with two mixed effects models demonstrating main effects of reward type, quantifier condition (*all* vs. *some*) and interactions of the two factors. As can be seen from the table, participant’s responses were consistent with all four implicatures listed in (A)–(D).



**Conclusions.** The results of our study provide clear evidence that participants compute implicatures (A)–(D) for sentences with embedded disjunctions. As shown in the introduction, none of the existing theories can account for all these implicatures. However, as we will argue, the implicatures are dependent on context specific parameters, most importantly that the speaker is known to know the exact state of the world, and that the given task makes all meaning differences relevant. An explanation should therefore be expected from interactional theories that can make context specific predictions about implicature.

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