

# Implicating in semi-cooperative contexts\*

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**Abstract** Disjunctive sentences like *June visited Frankfurt or Düsseldorf* are commonly understood as conveying that June didn't visit both cities (**EXCLUSIVITY**), and that the speaker doesn't know which of the two cities June visited (**IGNORANCE**). There is a general consensus that these inferences arise as scalar implicatures. The standard pragmatic approach derives **EXCLUSIVITY** and **IGNORANCE** on the basis of the same assumptions and reasoning about the speaker's communicative intentions. This predicts that these two inferences should pattern together: either both of them are derived by the hearer, or neither of them is. This prediction, however, has recently been challenged: in so-called 'semi-cooperative' contexts – contexts where it is presupposed that the speaker won't provide all relevant information available to them (e.g., game situations) – it has been claimed that **EXCLUSIVITY** may arise independently from **IGNORANCE** (Fox 2014, Agyemang 2020). After reviewing existing evidence in favor of this claim, we report on two experiments testing alternative explanations while also looking at novel, presuppositional sentences (e.g., *Bill is not aware that June visited Frankfurt or Düsseldorf*), which have been argued to give rise to similar **EXCLUSIVITY** and **IGNORANCE** inferences (Spector & Sudo 2017, Marty & Romoli 2021b). Our findings offer further experimental evidence in support of the claim of interest and establish that the challenge in question extends to the presupposition level as well. While the challenge raised by semi-cooperative contexts is real, we argue that it may be overcome by refining the standard pragmatic view and, specifically, by generalising the standard assumptions underlying the pragmatic derivation of **EXCLUSIVITY** and **IGNORANCE**. The resulting account is shown to explain why **IGNORANCE** and **EXCLUSIVITY** pattern together in normal cooperative contexts, but not in semi-cooperative ones.

**Keywords:** disjunction, exclusivity, ignorance, scalar implicatures, presuppositions, semi-cooperative contexts, Maxim of Quantity

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## 1 Overview

In ordinary conversations, disjunctive sentences like (1) are commonly understood as conveying the inferences in (1a) and (1b) (Grice 1975, Gazdar 1979, Horn 1972 among many others). Following common terminology, we will refer to these inferences as EXCLUSIVITY and IGNORANCE, respectively.

- (1) June visited Frankfurt or Düsseldorf.
- a. EXCLUSIVITY  
~~> *June didn't visit both Frankfurt and Düsseldorf*
  - b. IGNORANCE  
~~> *The speaker doesn't know which of the two cities June visited*

There is a general consensus that these inferences are not conveyed as part of the literal meaning of sentences like (1), but rather they arise as implicatures. How these implicatures are to be derived is yet much more controversial. Here we focus on the standard pragmatic approach, according to which implicatures are the output of reasoning on the part of the hearer about why the speaker said what she said and why not something else (Grice 1975, Horn 1972, Gazdar 1979, Sauerland 2004, Geurts 2010, Chemla 2010, van Rooij & Schulz 2004, a.o.).

Recently, EXCLUSIVITY and IGNORANCE have been argued to arise at the presupposition level as well. When embedded under a factive verb as in (2), a sentence like (1) gives rise to parallel exclusivity and ignorance inferences at the presupposition level (Gajewski & Sharvit 2012, Spector & Sudo 2017, Marty & Romoli 2021b,a, a.o.). PRESUPPOSED EXCLUSIVITY and PRESUPPOSED IGNORANCE have also been analysed in parallel to the pragmatic approach above (Spector & Sudo 2017).

- (2) Bill is not aware that June visited Frankfurt or Düsseldorf.
- a. PRESUPPOSED EXCLUSIVITY  
~~> *June didn't visit both Frankfurt and Düsseldorf*
  - b. PRESUPPOSED IGNORANCE  
~~> *The speaker doesn't know which of the two cities June visited*

A key feature of the pragmatic approach, which is particularly relevant for us here, has to do with the fact that it derives EXCLUSIVITY and IGNORANCE inferences on the basis of the same assumptions and reasoning. As we discuss, this approach predicts that these two inferences should either be both associated with the sentence or neither of them should.<sup>1</sup> While this prediction aligns well with people's intuitions about the conveyed meaning of sentences like (1) in ordinary contexts, it has been

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<sup>1</sup> More precisely, the prediction is that exclusivity cannot be present unless ignorance also is. We explain this refinement in more detail below.

argued that this prediction is disconfirmed in ‘semi-cooperative’ contexts. That is, in contexts where it is presupposed that the speaker is not going to provide all relevant information that they have. In particular, focusing on game situations like TV game shows, Fox 2014 claims that EXCLUSIVITY may still arise in semi-cooperative contexts, even if IGNORANCE does not. This claim was recently experimentally tested by Agyemang 2020. The results of Agyemang’s study offers some experimental support in favor of Fox’s claim.

Taking Agyemang’s (2020) method and findings as a starting point, our investigation had three goals. First, we aimed to test an alternative explanation for these findings, which derives the exclusivity implication not via any mechanism for scalar implicature but via independent, background assumptions about how such games generally work. For these purposes, we modified Agyemang’s original design so as to mitigate, if not eliminate, the potential role of such background knowledge. We found, however, that EXCLUSIVITY still arises to the same extent, thus strengthening the challenge from semi-cooperative contexts for the standard pragmatic approach. Second, we extended the investigation to presuppositional environments like (2). For these cases as well, we found evidence that PRESUPPOSED EXCLUSIVITY readily arises in the absence of PRESUPPOSED IGNORANCE, thus extending the challenge for the pragmatic approach to the presupposition level. Finally, we took up the challenge raised by these findings for the pragmatic approach and we put forward a solution based on generalising the major assumptions underlying the derivation of IGNORANCE and EXCLUSIVITY on this approach.

The rest of the paper is organised as follows. In Section 2, we discuss in more detail the EXCLUSIVITY and IGNORANCE inferences of disjunction, together with their standard pragmatic account. In Section 3, we present the challenge raised by semi-cooperative contexts, the experimental results from Agyemang (2020) as well as a potential concern of her experimental design. In Section 4, we report on a first experiment which controlled for potential confounds in Agyemang’s study and whose results strengthen Agyemang’s findings and therefore the challenge for the pragmatic approach. In Section 5, we show that a parallel challenge arises at the presupposition level. The corresponding predictions were tested in a second experiment, reported in section 6. In Section 7, we summarise our findings and, in Section 8, we put forward a response to the challenge by outlining a more nuanced pragmatic account which can explain why IGNORANCE and EXCLUSIVITY pattern together in normal cooperative contexts, but not in semi-cooperative context, where EXCLUSIVITY may arise independently from IGNORANCE. We conclude the paper in Section 9 with a discussion of further possible applications and extensions of our proposal.

## 2 The inferences of disjunction

### 2.1 Ignorance and exclusivity

Disjunctive sentences like (1), repeated below, give rise to two main inferences: the EXCLUSIVITY inference in (1a) and the IGNORANCE inference in (1b).

- (1) June visited Frankfurt or Düsseldorf.
- a. EXCLUSIVITY  
*June didn't visit both Frankfurt and Düsseldorf*
  - b. IGNORANCE  
*The speaker doesn't know which of the two cities June visited*

While it is debated how exactly these inferences are to be derived, it is widely agreed that they cannot simply be part of the literal meaning of (1). One of the main arguments supporting this view has to do with the fact that, while both these inferences tend to be robustly associated with (1), they can also be suspended or cancelled. For instance, (1) can be continued as shown in (3), evidencing that EXCLUSIVITY can be suspended/cancelled, or as in (4), evidencing in turn that IGNORANCE can be suspended/cancelled.

- (3) June visited Frankfurt or Düsseldorf. In fact, she might have visited both.
- a. ↗ *June didn't visit both Frankfurt and Düsseldorf*
- (4) June visited Frankfurt or Düsseldorf. But I won't tell you which one.
- a. ↗ *The speaker doesn't know which of the two cities she visited*

Thus, an empirically adequate account of IGNORANCE and EXCLUSIVITY not only has to predict how and when they come to be associated with disjunctive sentences, but also how and when they are suspended or cancelled.

There are two major approaches to these inferences in the literature, the pragmatic and the grammatical approach, both of which derive them as implicatures. In this paper, we focus on the pragmatic approach stemming from Grice's (1975) work and refined and extended over the years (Horn 1972, Gazdar 1979, Sauerland 2004, van Rooij & Schulz 2004, Geurts 2010 among many others). We come back briefly to the alternative grammatical approach in the conclusion.<sup>2</sup>

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<sup>2</sup> For the grammatical approach, see Chierchia 2004, Fox 2007, Chierchia et al. 2012, Meyer 2013, Buccola & Haida 2018, Magri 2009, Marty & Romoli 2021a among others.

## 2.2 The pragmatic approach

The pragmatic approach to EXCLUSIVITY and IGNORANCE derives these inferences as outputs of general pragmatic principles. Specifically, their derivation is hypothesised to rely on two key ingredients: (i) a cooperativity assumption that the speaker will contribute the most informative among the relevant information available to them, and (ii) an additional assumption that the speaker is ‘competent’ with respect to what they did not contribute. The first assumption is generally referred to as the ‘Maxim of Quantity’. We adopt here the formulation in (5) adapted from Fox (2007).

(5) **Maxim of Quantity (MQ)**

If  $\phi$  and  $\psi$  are both relevant to the conversation,  $\psi$  is more informative than  $\phi$ , and  $\psi$  is among the alternatives of  $\phi$ , then if a speaker believes both are true, the speaker should utter  $\psi$  rather than  $\phi$ .

The second assumption is sometimes referred to as the ‘opinionated speaker’ assumption or, for short, ‘opinionatedness’. In a nutshell, this assumption states that the speaker has an opinion about the more informative alternative sentences that she could have, but didn’t utter. Concretely, if  $\psi$  is one such alternative, then opinionatedness gives us that the speaker’s epistemic state towards  $\psi$  is settled: either the speaker believes that  $\psi$  is true, or else she believes that  $\psi$  is false (Sauerland 2004, van Rooij & Schulz 2004 among others). We may write this more compactly as in (6), where  $B_s(\psi)$  indicates that the speaker  $s$  believes  $\psi$ .<sup>3</sup>

(6) **Opinionatedness:**  $B_s(\psi) \vee B_s(\neg\psi)$

With these two ingredients in place, implicatures can be derived as follows. Suppose that a speaker  $s$  uttered a statement  $\phi$  in a context where it would have been relevant and more informative to utter some alternative  $\psi$  to  $\phi$ . First, on the assumption that  $s$  obeyed MQ, the hearer reasons that, since  $s$  did not utter  $\psi$ , it must not be the case that  $s$  believes  $\psi$  to be true, that is,  $\neg B_s(\psi)$ . This first type of implicatures is generally called ‘primary implicatures’ (Sauerland 2004, Horn 1989, Soames 1989 among many others). Second, if the hearer further assumes that  $s$  is opinionated about  $\psi$ , then she will derive the stronger, ‘secondary’ implicature that  $s$  in fact believes that  $\psi$  is false, that is,  $B_s(\neg\psi)$ .

To illustrate now how MQ and opinionatedness derives EXCLUSIVITY and IGNORANCE from disjunctive statements, consider again the sentence in (1), together

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<sup>3</sup> Here and throughout, we neglect the distinction between object language and metalanguage for better readability, unless there is a potential confusion. Operators like  $B_s$  are meant to be propositional operators, so  $B_s(\phi)$  is to be understood as  $s$  believes *the proposition denoted by  $\phi$* .

with the alternatives to (1) in (7).<sup>4</sup>

$$(7) \quad \left\{ \begin{array}{ll} \text{June visited Frankfurt} & p \\ \text{June visited Düsseldorf} & q \\ \text{June visited Frankfurt and Düsseldorf} & (p \wedge q) \end{array} \right\}$$

Since all three alternatives to (1) in (7) are stronger than (1), applying MQ delivers the three primary implicatures in (8): (i) it's not true that the speaker believes that June visited Frankfurt, (ii) it's not true that she believes that June visited Düsseldorf, and (iii) it's not true that she believes that June visited both cities.

$$(8) \quad \neg B_s(p), \neg B_s(q), \neg B_s(p \wedge q) \qquad \text{PRIMARY IMPLICATURES}$$

From the primary implicatures in (8), and the Quality assumption that the speaker believes what she said, IGNORANCE follows: the speaker doesn't know whether June visited Frankfurt and doesn't know whether June visited Düsseldorf.

$$(9) \quad \neg B_s(p) \wedge \neg B_s(q) \wedge \neg B_s(\neg p) \wedge \neg B_s(\neg q) \qquad \text{IGNORANCE}$$

Finally, the primary implicature about the conjunctive alternative, unlike the other two, can be strengthened via an opinionatedness assumption, giving rise to the secondary EXCLUSIVITY implicature in (10): the speaker believes that June didn't visit both Frankfurt and Düsseldorf.<sup>5</sup>

$$(10) \quad B_s(\neg(p \wedge q)) \qquad \text{EXCLUSIVITY}$$

In sum, the standard pragmatic approach accounts for the generation of IGNORANCE and EXCLUSIVITY inferences in ordinary, cooperative contexts. Crucially, on this approach, both inferences are derived on the basis of the primary implicatures arising from the application of MQ. This predicts a close link between these two inferences and, in particular, it predicts that neither of them should arise if MQ is not assumed to be in force among the interlocutors.

$$(11) \quad \textbf{Prediction:} \text{ Ignorance and exclusivity inferences should be suspended altogether if MQ is not active in the context.}$$

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<sup>4</sup> For discussion on theories of alternatives for implicature computation see Katzir 2007, Breheny et al. 2018 among others.

<sup>5</sup> We mention here that the primary implicatures about the independent disjuncts ( $p, q$ ) can never be strengthened because strengthening either of them would then contradict the primary implicature about the other (see Sauerland 2004, Fox 2007).

### 3 The challenge from semi-cooperative contexts

Grice (1989) himself already observed that IGNORANCE inferences normally drawn from sentences like (1) are cancelled in ‘semi-cooperative’ contexts, that is, in contexts where it is presupposed that the speaker is not going to provide all relevant information available to them. Specifically, Grice observed that, in the context of a treasure hunt, a speaker who is known to know the exact location of the prize can still felicitously utter a sentence like (12).

(12) The prize is either in the garden or in the attic.

Crucially, if the utterance in (12) were associated with IGNORANCE, it would be perceived as pragmatically odd, as IGNORANCE directly contradicts the contextual assumption that the speaker knows where the prize is. To exemplify this point further, consider for instance the sentence in (13). Intuitively, one cannot felicitously utter such a sentence in an ordinary conversation, at least under normal circumstances. The reason is that the IGNORANCE inferences arising from (13) as a result of MQ being active in such contexts would conflict with the natural assumption that people are knowledgeable about personal facts like the place where they were born. Taken together, the felicity of (12) and the contrast between (12) and (13) show that the ignorance inferences normally associated with disjunctive sentences are readily suspended in semi-cooperative contexts, unlike in ordinary conversations.

(13) #I was born in Bergen or in Oslo.

As Fox (2014) discusses, one straightforward way to account for these observations on the pragmatic approach is to assume that MQ is not active in non-fully cooperative situations, precisely because, in such cases, speakers are not taken to be sharing all the relevant information they have.<sup>6</sup> This line of explanation would account for the felicity of (12) in Grice’s treasure hunt scenario and, more generally, for the absence of IGNORANCE inferences in semi-cooperative contexts.

Fox (2014), however, points out a challenge for the pragmatic view in claiming that, in contexts where IGNORANCE implicatures are suspended, EXCLUSIVITY implicatures can still arise. Before presenting Fox’s arguments, let us start with some brief methodological considerations. As Fox himself remarks, cases like the one discussed by Grice cannot be used to evaluate the empirical validity of this claim:

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<sup>6</sup> See Meyer 2013 for a more nuanced proposal on how to account for these facts within a pragmatic approach, without assuming that MQ is not active in these contexts. As Meyer discusses, however, the challenge below remains under the approach she outlines. In the final section, we will suggest a pragmatic account of the challenge based on the idea that MQ is in fact active in semi-cooperative contexts.

while (12) certainly gives rise to an exclusive interpretation, this interpretation arguably arises from our understanding that there is a unique prize, together with the assumption that the prize in question cannot be in two places at the same time. In other words, from an utterance of (12), one would conclude that the relevant prize cannot be both in the attic and in the garden, independent of any form of scalar reasoning. Thus, in order to offer a suitable testing ground for his claim, Fox proposes to look at game show contexts like the one in (14):

(14) **Fox's (2014) Game Show Scenario**

There are 100 boxes and five of them contain a million dollars each (the rest of the boxes are empty). The show's host knows the identity of the five boxes, but will, of course, not disclose this information. At any point, contestants can take the risk of choosing a box. At various points, hints are provided by the host, with the common understanding that these reveal only part of the relevant information available to the host.

Fox observes that, in the above context, a sentence like (15) can be felicitously uttered, as a hint, by a host who is known to know which boxes contain money. As discussed above, the fact that (15) is felicitous is telling us that IGNORANCE implicatures are suspended in this context, exactly as in (12). Crucially, Fox argues that the EXCLUSIVITY implicature associated with (15) remains available.

(15) Host: There is money in box 20 or 25.

- a. ↗*The host doesn't know in which box there is money*
- b. ↗*There isn't money in both of the boxes*

In support of this intuition, Fox notes for instance that our understanding of (15) contrasts with that of its variant in (16), where EXCLUSIVITY is semantically blocked by the addition of 'or both'. Taken at face value, this contrast suggests that (15) can indeed be strengthened by means of an EXCLUSIVITY implicature, unlike (16).

(16) Host: There is money in box 20 or 25 or both.

- a. ↗*The host doesn't know in which box there is money*
- b. ↗*There isn't money in both of the boxes*

Fox (2014) also argues that, unlike (16), (15) would be perceived as a misleading hint if it turned out there is money in both boxes. In particular, Fox suggests that, in the case of (15), participants would be justified to respond to the host as shown in (17), whereas such a response would of course not be justified in the case of (15).

(17) What you said was wrong. You said there was money in box 20 OR box 25.  
But there was money in both boxes.

Agyemang (2020) offers experimental data backing up Fox's observations. In Agyemang's study, participants were asked to imagine that they were participating in a money game show. The general setup of the game was similar to Fox's original scenario above, as illustrated in (18). Every scenario followed the same narrative: first, the host gives a hint to one of the contestants; next, that contestant picks one of the boxes and finds out what's inside; finally, the participant in the experiment is told that she is the next contestant and she is asked to choose between two possible courses of action. For what is most relevant to us, in the disjunction trials, the experiment manipulated the type of hints given to the first contestant — it involved either an OR sentence like (15), or an OR-BOTH sentence like (16) — and the nature of the previous outcome — either the first contestant found money, or they didn't. The task involved a forced choice between the option to choose the alternative box that the first contestant didn't pick and the option to choose 'any other box'.

(18) **Agyemang's (2020) Experimental Item Design**

Your task is to choose a numbered box. There are 100 numbered boxes in total and five of them contain a million dollar prize. The host tells the first contestant that there is money in {**box 20 or 25 (OR)** / **box 20 or 25, or both (OR-BOTH)**}. This contestant picks box 20 and {**finds a million dollars there (WON)** / **discovers that the box is empty (LOST)**}. Imagine you are the next contestant in this game. The host does not give you any new hints. Which action are you most likely to take?

- a. Choose box 25.
- b. Choose another box.

As expected, when the contestant before them *lost*, participants unanimously chose the alternative box (i.e., box 25) independent of the type of hints they had received. Crucially, however, Agyemang's results show that, when the contestant before them *won*, participants were significantly less likely to choose the alternative box after receiving an OR hint than after receiving its OR-BOTH variant (39% vs. 22%). Taken at face value, these findings support the idea that, in contexts where IGNORANCE is suspended, sentences like (15) can still give rise to EXCLUSIVITY, in line with Fox's claim, but contra the prediction of the pragmatic approach.

We argue, however, that Agyemang's experimental results can receive another explanation. Specifically, we observe that the EXCLUSIVITY inference associated with (15) may not arise as an implicature in these scenarios, but rather follow from implicit assumptions as to how money-based games usually work. Thus for instance, participants may assume that, in order to preserve or increase the interest of the show, the game actions most favoured by a hint should not all lead to a winning outcome, unless the hint in question explicitly states that this option is

on the table. In the present case, since the game actions most favored by (15) are ‘choosing box 20’ and ‘choosing box 25’, one would thus conclude that only one of these two actions actually leads to a winning outcome and, therefore, that there isn’t money in both boxes. By contrast, the use of ‘or both’ in (16) explicitly states that both courses of action could be favourable and can be thus interpreted as signalling that the former assumption is temporarily suspended. As far as we can see, this alternative explanation, based on the simple assumption that game shows usually don’t give money away, would account for the contrast between (15), where this assumption would lead to some form of EXCLUSIVITY inference, and its variant in (16), where this effect would be mitigated by the explicit use of ‘or both’.

#### 4 Experiment 1: Refining the challenge

Experiment 1 investigated the alternative explanation to Agyemang’s findings that we outlined above. Building on Agyemang’s materials and method, this experiment replicated Agyemang’s disjunction conditions and compared them to novel control conditions featuring a slime-based game show in place of a money-based one. A schematic description of the MONEY and SLIME conditions is provided in Table 1

The SLIME conditions were designed to control for the potential confound that we identified in Agyemang’s study. Specifically, by adding these control conditions, we aimed to test whether the contrast between OR and OR-BOTH hints that Agyemang (2020) found in the MONEY conditions reproduces with game set-ups which, *a priori*, do not support the kind of game-related assumptions that would give rise to exclusive interpretations independent of any form of scalar reasoning. We hypothesised that, if the contrast at hand is driven, partly or entirely, by such implicit assumptions, it should reduce, or even disappear, in the SLIME conditions. On the other hand, if exclusive interpretations are derived by means of a scalar implicature in these game show contexts, the contrast at hand should not be affected by our experimental manipulation of the game setup.

##### 4.1 Participants

202 participants (average age 34 yrs; 126 female) were recruited online using Prolific (country of residence: UK; country of birth: UK; first language: English; minimum prior approval rate: 90%). Participants were paid £0.7 for their participation and average completion time was about 4-5 minutes (£10/hr). All participants gave written informed consent to the processing of their information for the purposes of this study, which was approved by the UCL Research Ethics Committee. All data were collected and stored in accordance with the provisions of Data Protection Act 2018, the UK’s implementation of the General Data Protection Regulation

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**A. MONEY conditions (replication of Agyemang, 2020)**

There are 100 numbered boxes in total, and 5 of them contain a million dollar prize. The host tells the first contestant that there is money in {**box 20 or box 25 (OR) / box 20 or box 25, or both (OR-BOTH)**}}. The contestant picks box 20 and {**finds a million dollars (WON) / does not win any money (LOST)**}.

Imagine you are the next contestant in this game. The host does not give you any more information. Which action are you most likely to take?

Choose box 25	Choose any other box
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**B. SLIME conditions (novel controls)**

There are 100 numbered boxes in total, and 5 of them are associated with slime. The host warns the first celebrity that slime is associated with {**box 20 or box 25 (OR) / box 20 or box 25, or both (OR-BOTH)**}}. The celebrity picks box 20 and {**nothing happens (WON) / is slimed (LOST)**}.

Imagine you are the next contestant in this game. The host does not give you any more information. Which action are you most likely to take?

Choose box 25	Choose any other box
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**Table 1** Schematic description of the experimental items used in (A) the MONEY and (B) the SLIME conditions in Experiment 1.

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## 4.2 Material and Method

The materials and method used in the experiment were similar to those used in [Agyemang \(2020\)](#) with one exception: in addition to Agyemang's MONEY scenarios, participants were presented with novel SLIME scenarios featuring a new game show involving a different game mechanics. The structure of the SLIME scenarios was entirely parallel to that of the MONEY scenarios adapted from [Agyemang \(2020\)](#), as illustrated in Table 1.

In the SLIME scenarios, participants were asked to imagine that they were celebrities participating in a game show in which contestants have to choose an item (e.g., a box) from a set of options, some of which are associated with slime. The logic of the game is fairly simple: if a contestant picks a wrong item, they have a tank of slime poured on them and leave the game; otherwise, they can leave the game without being slimed (see Appendix A for instructions). In place of a hint about which boxes may have money in them, the host gave the first

celebrity/contestant a hint, in the form of a warning, about which boxes may be associated with slime, as illustrated in (19) and (20).

- (19) HOST: Slime is associated with box 20 or box 25.
- a. *↗ The host doesn't know which box slime is associated with*
  - b. *↔ Slime isn't associated with both of the boxes* ?
- (20) HOST: Slime is associated with box 20 or box 25 or both.
- a. *↗ The host doesn't know which box slime is associated with*
  - b. *↗ Slime isn't associated with both of the boxes*

The mechanics of the SLIME game differed from that of the MONEY game along two critical dimensions. First, in contrast to the MONEY game, the SLIME game makes it so that, on the sole basis of the host's hint (i.e., without knowing the outcome of the first contestant's pick), contestants do not have any incentive for choosing either of the two items mentioned by the host. In fact, in these scenarios, participants should reason that the game action most favored by the host's hint is precisely that of choosing any other item so as to stay away from the slime as much as possible. Second, while money-based shows don't give money away, slime-based shows are rather known for pouring slime anyway on contestants, especially celebrities, to provide entertainment for the audience. As a result, the SLIME scenarios should make it more difficult for participants to entertain the sort of game-related assumptions required to derive EXCLUSIVITY independent of any form of scalar reasoning. In particular, the slime scenarios offer no clear contextual ground for contestants to assume that, in principle, slime could not be associated with both of the items that the host warned them about or at least, these scenarios should weaken the likelihood that the same background assumptions apply.

Experimental conditions were created by crossing the type of Game that subjects were taking part in (MONEY vs. SLIME), the type of Hint given by the host (OR vs. OR-BOTH) and the Outcome of the previous contestant's action (LOST vs. WON). The Game and the Hint factors were manipulated between subjects while the Outcome factor was manipulated within subjects, resulting in 4 sets of 2 conditions (i.e., MONEY-OR, MONEY-OR-BOTH, SLIME-OR, SLIME-OR-BOTH). The linking hypothesis was the same as in Agyemang (2020) with the only difference that, for the SLIME conditions, the game situations giving rise to the control and to the target cases were reversed compared to the MONEY conditions: control cases corresponded to situations where the previous contestant won while target cases corresponded to situations where she lost. Specifically, in situations where the previous contestant didn't get slimed, subjects should deduce that slime is associated with the alternative box and, consequently, they should choose the 'any other box' option, independent of whether EXCLUSIVITY is absent or present. However, in situations where the

previous contestant got slimed, subjects should choose the ‘any other box’ option only if they reason that slime can still be associated with the alternative box, that is, only if EXCLUSIVITY is absent; otherwise, they should choose the alternative box.

Following Agyemang (2020), the contents of the MONEY and SLIME scenarios were varied by changing the type and the number of objects presented to contestants. There were two basic setups for each game. One setup involved 100 boxes with 5% naive probability to win money/get slimed. This corresponds to the setup illustrated in Table 1. The other setup involved a 6-sided die with 50% naive probability chance to win money/get slimed. Each condition was instantiated in both setups giving rise to a total of 4 test items per experimental session. In addition to the test trials, subjects completed 4 filler items whose contents were adapted to the Game condition that they were assigned (i.e., MONEY or SLIME). The scenarios in these trials were constructed in a similar way as those used in the test trials, but they involved different kinds of objects (i.e., doors and jerseys) and the hint in them used a numeral expression in place of a disjunction (e.g., *There is {money/slime} associated with at least one door with a number less than 3*). These trials were included in the study in order to increase variability of the scenario set and were not considered for analysis.

### 4.3 Procedure

The experiment was run as an online survey using Gorilla Experiment Builder. At the start of the survey, participants were pseudo-randomly assigned one of the four sets of conditions so as to reach an even number of participants for each set (MONEY-OR: 50, MONEY-OR-BOTH: 50, SLIME-OR: 51, SLIME-OR-BOTH: 51), and they received instructions corresponding to the Game condition they were assigned (see Appendix A for detail). Participants were introduced in the instructions to the general setup of the game show that they were taking part in. After the instructions, participants completed 8 trials (4 test and 4 filler items). Trials were presented in random order, with a 3000 ms interstimulus interval. For each trial, participants were asked to decide, based on the host’s hint and the outcome of the first contestant’s action, which of two actions they were most likely to take: they could either choose the alternative option, or else choose ‘any other’ option. Participants gave their answers by clicking one of two response buttons. Items remained on the screen until participants gave their answer.

### 4.4 Data processing

Only responses to the test items were considered for data treatment and analyses. Responses in the MONEY and SLIME conditions were coded in reference to the

response type expected in their corresponding control cases, in accordance with our linking hypothesis. That is, in the MONEY conditions, ‘alternative box’ responses were assigned the value 1 and ‘any other box’ responses the value 0; by contrast, in the SLIME conditions, ‘any other box’ responses were assigned the value 1 and ‘alternative box’ responses the value 0. This coding scheme was used to make the mapping between game situations and response type uniform across conditions. The main benefit of this coding scheme is that, by cancelling out superficial differences between the MONEY and SLIME conditions, it reduces the risk of detecting theoretically irrelevant contrasts in our analyses.

Due to a clerical error in the preparation of the materials, some participants in the SLIME game only saw instances of the control (WON) cases for the 6-sided die setup. In order to preserve a balanced design for hypothesis tests, all responses associated with this game setup were excluded from analyses.

## 4.5 Data analyses

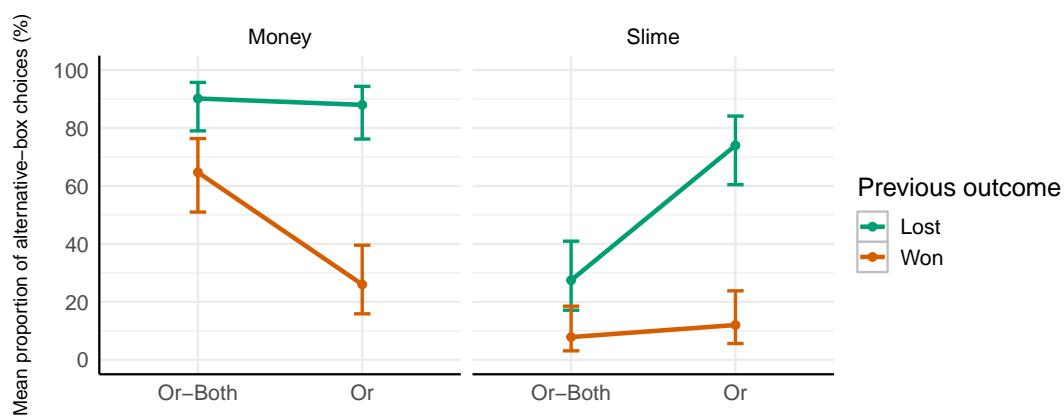
We analyzed our data through model comparisons of binomial linear models. The full model modelled response type likelihood in the target cases as a function of the type of Game (dummy-coded), the type of Hint (dummy-coded) and the interaction between the two. Analyses were conducted using the R statistics program [R Core Team \(2021\)](#).  $\chi^2$  values and  $p$ -values were obtained by performing likelihood ratio tests in which the deviance of the full model containing the main effect or interaction term of theoretical interest was compared to another model without it (Type III SS), using the `car` package. Post-hoc pairwise comparisons were performed based on the estimated marginal means from the full model using the `emmeans` package. Finally,  $p$ -values were adjusted using the Bonferroni correction method for multiple comparisons.

## 4.6 Results

Figure 1 gives the mean proportion of ‘alternative’ box choices as a function of the experimental condition. In the MONEY game, control cases corresponded to situations where the previous contestant lost and target cases to situations where she won (left panel). This mapping was reversed in the SLIME game (right panel).

### 4.6.1 Control cases

Participants’ responses in the control cases were as expected. In the MONEY game, participants uniformly chose the alternative box whenever the contestant before them lost ( $M_s \geq 88\%$ ) whereas, in the SLIME game, they largely disregarded the



**Figure 1** Mean proportion of ‘alternative-box’ choices in the MONEY and SLIME conditions of Experiment 1 as a function of the type of Hint (OR-BOTH vs. OR) and the Outcome of the previous contestant’s pick (LOST vs. WON). Error bars represent 95% binomial confidence intervals. The contrast between OR and OR-BOTH reproduces in the SLIME conditions.

alternative box whenever the contestant before them won ( $M_s \leq 12\%$ ), favoring instead the ‘any other box’ option. These results show that participants correctly understood the instructions associated with each game show and, in particular, that they had no issue determining the most favorable course of action in situations where it was possible to conclude with certainty that there was money or slime associated with the alternative box.

#### 4.6.2 Target cases

The coefficients of the full model are given in Table 2. The comparison between the full model and its nested variant missing the main-effect term for Hint was significant ( $\chi^2(1) = 9.71$ , adjusted  $p < 0.01$ ), meaning that the type of Hint affected participants’ responses in the target cases, such that they selected the response type associated with EXCLUSIVITY more often after getting OR hints than after OR-BOTH hints. No other model comparisons were significant (all  $\chi^2$ s  $< 0.77$ , all adjusted  $p$ s = 1). Thus, there is no evidence in our data that the type of Game, independently or in interaction with the type of Hint, had any influence on participant’s behavior.

The established effect of Hint was investigated further in a post-hoc analysis by comparing the estimated marginal means for the two levels of the Hint factor in the full model and calculating Cohen’s  $d$ . Results revealed that the estimated mean for OR was significantly different from the estimated mean for OR-BOTH in both the

MONEY conditions ( $\beta = 0.95$ , SE = 0.31, adjusted  $p < .01$ ,  $d = 0.87$ ) and the SLIME conditions ( $\beta = 1.25$ , SE = 0.32, adjusted  $p < .001$ ,  $d = 1.15$ ). Overall, participants selected the response type associated with EXCLUSIVITY at least twice more often in the OR than in the OR-BOTH conditions, both in the MONEY game (74% vs. 36%) and in the SLIME game (74% vs. 24%). In sum, the decrease in alternative-box choices in the target MONEY conditions observable in Figure 1 (orange line, left panel) is proportionally equivalent to the increase in alternative-box choices in the target SLIME conditions (green line, right panel).

Coefficient	Estimate	Standard error	95% CI
Intercept	1.23	0.23	[0.78, 1.72]
Hint	-0.95	0.31	[-1.57, -0.35]
Game	0.30	0.35	[-0.37, 1]
Hint:Game	-0.30	0.45	[-1.20, 0.57]

**Table 2** Coefficients of the full model with the 95% CIs for the (beta) estimates.

#### 4.7 Discussion

The contribution of Experiment 1 is twofold. First of all, the results replicate Agyemang’s main findings in showing that, in the MONEY conditions, participants chose the ‘any other box’ option significantly more often after receiving OR hints than after receiving OR-BOTH hints, when the first contestant found money in one of the two boxes. As explained, these results are accounted for if we assume that OR hints are more likely to give rise to EXCLUSIVITY inferences than their OR-BOTH variants in these game scenarios, consistent with Fox’s original claim.

Second, the results show that the contrast between OR and OR-BOTH reproduces in other gaming contexts in which the likelihood that EXCLUSIVITY arises through background assumptions is weakened by the logic of the game. Specifically, in the novel SLIME conditions, we found that participants were far more likely to choose the ‘alternative-box’ option after hearing OR than OR-BOTH when the contestant before them got slimed after choosing one of the two boxes. The size of the Hint effect in these conditions was large and, if anything, larger than that in the MONEY conditions. Finally, it bears emphasising that we found no evidence in our data that the type of Game affected participant’s reasoning in our task one way or the other. We take the results of these comparisons to provide further empirical evidence that disjunctive hints may readily give rise to EXCLUSIVITY inferences and to show that these inferences are unlikely to arise on the sole basis of background assumptions, i.e., independent of any form of scalar reasoning.

Taken together, the present findings confirm and strengthen the challenge raised by semi-cooperative contexts for the standard pragmatic approach. We come back to discussing the implications of our results in Section 7. Before that, we move to investigate the corresponding inferences at the presupposition level and we show that the challenge extends to this level as well.

## 5 Presuppositional semi-cooperative contexts

### 5.1 Presupposed ignorance and exclusivity

As is well-known, factive sentences like (21) are associated with an inference suggesting that the complement clause of the matrix verb is true.

- (21) Bill is aware that June went abroad.  
 $\rightsquigarrow \textit{June went abroad}$

As evidenced in (22), this factive inference shows the prototypical behaviour of presuppositions in ‘projecting’ out of entailment-cancelling embedding such as negation and questions. That is, (22a) and (22b) are associated with the same factive inference as (21) (Karttunen 1973, 1974, Soames 1982, Heim 1982 and much subsequent work).

- (22) Bill is not aware that June went abroad.  
 $\rightsquigarrow \textit{June went abroad}$
- (23) Is Bill aware that June went abroad?  
 $\rightsquigarrow \textit{June went abroad}$

In recent years, EXCLUSIVITY and IGNORANCE have been argued to arise at the presupposition level as well. In particular, it has been claimed that, when a sentence like (1) is embedded under a factive predicate like *be (un-)aware*, as in (24), it gives rise to parallel EXCLUSIVITY and IGNORANCE inferences at the presupposition level (Gajewski & Sharvit 2012, Spector & Sudo 2017, Marty & Romoli 2021a, a.o.).

- (24) Bill is aware that June visited Frankfurt or Düsseldorf.
- |    |   |             |
|----|---|-------------|
| a. | $\rightsquigarrow \textit{June didn't visit both Frankfurt and Düsseldorf}$ | EXCLUSIVITY |
| b. | $\rightsquigarrow \textit{The speaker doesn't know which of the two}$       | IGNORANCE   |

The presuppositional nature of these inferences is evidenced by their projection behaviour: (2) and (25) give rise to the same inferences as (24).

- (2) Bill is not aware that June visited Frankfurt or Düsseldorf.
- |    |   |             |
|----|---|-------------|
| a. | $\rightsquigarrow \textit{June didn't visit both Frankfurt and Düsseldorf}$ | EXCLUSIVITY |
|----|---|-------------|

- |  |           |
|--|-----------|
| b. <i>~~ The speaker doesn't know which of the two</i> | IGNORANCE |
|--|-----------|
- (25) Is Bill aware that June visited Frankfurt or Düsseldorf?
- |  |             |
|--|-------------|
| a. <i>~~ June didn't visit both Frankfurt and Düsseldorf</i> | EXCLUSIVITY |
| b. <i>~~ The speaker doesn't know which of the two</i>       | IGNORANCE   |

We take these data point to show that any standard approach to EXCLUSIVITY and IGNORANCE inferences has to be extended in order to account for the derivation of the corresponding inferences at the presupposition level.

## 5.2 The corresponding pragmatic approach

On the pragmatic approach, PRESUPPOSED EXCLUSIVITY and PRESUPPOSED IGNORANCE can be derived on the basis of similar assumptions as their assertion-based counterparts. In particular, it has been suggested in the literature that there is a communicative principle exhorting speakers to presuppose as much as possible by favoring linguistic forms that contribute stronger presuppositions.<sup>7</sup> Crucially, on the basis of this principle, hearers may draw certain inferences about the speaker's intended meaning by comparing what the speaker presupposed to what she could have, but did not presuppose. This approach has recently been extended to account for cases like those in (24)–(25). For ease of exposition, we can formulate this principle as a Maxim of Quantity that would apply at the presupposition level, in parallel to the classical formulation of MQ. Here and in the following, we use the notation ' $\phi_p$ ' to indicate that a sentence  $\phi$  has a presupposition  $p$ .<sup>8</sup>

### (26) Maxim of Presupposed Quantity (MPQ)

If  $\phi_p$  and  $\psi_q$  are both relevant to the conversation,  $q$  is more informative than  $p$ , and  $\psi_q$  is among the alternatives to  $\phi_p$ , then if both  $p$  and  $q$  are satisfied in the context, the speaker should not utter  $\phi_p$ .

Following MPQ, the fact that a speaker uttered a statement  $\phi_p$  with presupposition  $p$  when she could have produced an alternative sentence  $\psi_q$  with a stronger pre-

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<sup>7</sup> The idea goes back to *Maximize Presupposition!*, first proposed in Heim et al. (1991) and developed in much subsequent work; see among others Percus 2006, Sauerland 2008, Singh 2009, Chemla 2008, Magri 2009, Rouillard & Schwarz 2017, Marty 2017, Spector & Sudo 2017, Anvari 2019, Marty & Romoli 2021a,b

<sup>8</sup> While the formulation of MPQ in (26) is very similar to the one of MQ in (5), it slightly departs from it in the last bit, where it says that *the base sentence  $\phi_p$  should not be uttered*, rather than *its alternative  $\psi_q$  should be uttered*. This is because there are other potential reasons why the speaker could decide not to utter  $\psi_q$ , even if its presupposition is stronger than that of  $\phi_p$  and satisfied in the context. In particular, the speaker could decide not to utter  $\psi_q$ , because they do not believe it to be true. The same issue arises for the formulation of MQ and would require the same modifications. We put this issue aside here as it is not important for our purposes.

supposition  $q$  means that  $q$  is not satisfied in the context, i.e., that  $q$  is not already entailed by the common ground,  $\neg\text{CG}(q)$ .<sup>9</sup>

As discussed in the literature, inferences about information not being common ground are very weak (Chemla 2008). It is well-known, however, that speakers may felicitously utter a presuppositional sentence even when its presuppositions are not already common ground at the time this sentence is uttered. For instance, the sentence in (27) can easily be uttered in a context which doesn't entail that the speaker has a sister at the time (27) is uttered. In most cases, the novel information contributed by such presuppositions may be added to the context on the spot (see von Fintel 2008 and references therein), a process often referred to as presupposition accommodation.

- (27) I am sorry I am late, I had to pick my sister at the airport.  
*~~ The speaker has a sister*

With this in mind, the logic of Presupposed Quantity can be refined as follows: the speaker should prefer the presuppositional stronger alternative  $\psi_q$  to  $\phi_p$  if  $q$  is already satisfied in the context or if  $q$  could easily be accommodated. So why didn't the speaker utter  $\psi_q$ ? According to Chemla's (2008) influential proposal, the hearer will reason that this must be either because it is not true that the speaker believes  $q$ , or because she believes  $q$  but she also believes that she does not have the authority about  $q$ , where the notion of authority is defined as follows:

- (28) **Authority:** A speaker  $s$  is an authority about  $q$ , notated  $A_s(q)$ , if she could have convinced the hearer that  $q$  is true simply by presupposing  $q$ .

In other words, in contrast to regular assertion-based implicatures, presupposition-based implicatures require an extra assumption about accommodation. For what is most relevant for us, if the speaker is assumed to have authority about the presupposition  $q$  of the alternative  $\psi_q$ , then the output of MPQ, namely  $\neg B_s(q) \vee \neg A_s(q)$ , can be strengthened to  $\neg B_s(q)$ , that is, to a primary presupposed implicature. From that point, this result can be further strengthened to a secondary implicature,  $B_s(\neg q)$ , if opinionatedness is assumed, exactly as with regular implicatures.

With these ingredients in place, we can go back to the sentence in (2), the alternatives of which are shown in (29).

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<sup>9</sup> We assume here a standard Stalnakerian framework where presuppositional sentences can be uttered only if their presuppositions are satisfied in the context, i.e., if their presuppositions are part of the common ground and thus entailed by the context set. We are also making the simplifying assumption that the common ground represents common beliefs, putting complications aside (see Stalnaker 1974, 2002 for discussion).

$$(29) \quad \left\{ \begin{array}{lll} \text{Bill is not aware that June visited Frankfurt} & \phi_p \\ \text{Bill is not aware that June visited Düsseldorf} & \psi_q \\ \text{Bill is not aware that June visited Frankfurt and Düsseldorf} & \chi_{p \wedge q} \end{array} \right\}$$

As it is easy to verify, all three alternatives above have stronger presuppositions than (2), which merely presupposes  $p \vee q$ . As a result, upon hearing (2), the hearer will reason on the basis of MPQ that none of these stronger presuppositions are commonly believed, that is,  $\neg CG(p)$ ,  $\neg CG(q)$ , and  $\neg CG(p \wedge q)$ . Next, the hearer will go on to ask why the speaker did not utter any of these alternatives and let their presuppositions be accommodated. As we explained, the hearer will conclude that it must be either because it's not the case that the speaker believes them to be true or because she doesn't have the authority about them. If the hearer believes that the speaker would have had the authority over  $p$ ,  $q$  and  $p \wedge q$ , they will then derive the following three primary implicatures:  $\neg B_s(p)$ ,  $\neg B_s(q)$ , and  $\neg B_s(p \wedge q)$ . Among those, only  $\neg B_s(p \wedge q)$  can be further strengthened to a secondary implicature through opinionatedness.<sup>10</sup> The result,  $B_s(\neg(p \wedge q))$ , gives us the PRESUPPOSED EXCLUSIVITY inference that we were interested in.

It is worth emphasizing that, on this approach, if PRESUPPOSED EXCLUSIVITY is derived, then so is PRESUPPOSED IGNORANCE, because the different steps deriving the former also derive the latter in the process. Indeed, one of the key assumptions that hearers have to make in order to derive PRESUPPOSED EXCLUSIVITY is that the speaker has authority about the conjunctive presupposition  $p \wedge q$ . Crucially, this assumption also leads to PRESUPPOSED IGNORANCE inferences: if the speaker has authority about  $p \wedge q$ , then she has authority about  $p$  and she has authority about  $q$  and, consequently, the primary implicatures  $\neg B_s(p)$  and  $\neg B_s(q)$  follow.

In sum, in ordinary contexts, disjunctive presuppositions give rise to IGNORANCE and EXCLUSIVITY inferences similar to those arising from disjunctive assertions. These presupposition-based implicatures can be given a similar pragmatic account as regular implicatures by assuming a version of MQ applying at the presupposition level, together with additional, auxiliary assumptions like authority and opinionatedness. As we explained, however, the successive epistemic steps required to derive PRESUPPOSED EXCLUSIVITY also derive PRESUPPOSED IGNORANCE in the process. As a result, we end up with the prediction in (30), which links EXCLUSIVITY and IGNORANCE in a way similar as before.

- (30) **Prediction:** Presupposed ignorance and presupposed exclusivity inferences should be suspended altogether if MPQ is not active in the context.

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<sup>10</sup> The reason is that, if the primary implicature about the independent disjuncts were strengthened (i.e.,  $B_s(\neg(p))$  and  $B_s(\neg(q))$ ), then their presuppositions (i.e.,  $\neg p$  and  $\neg q$ ) would contradict the basic presupposition of (2) (i.e.,  $p \vee q$ ).

### 5.3 A similar challenge?

Does the challenge raised by semi-cooperative contexts extend to the pragmatic approach to presupposition-based implicatures? Building on the argumentation in Fox (2014), Marty (2018) proposes to test the prediction in (30) by investigating the interpretation of disjunctive presuppositions in game contexts like (31).

(31) **Marty's (2018) Easter Egg Contest**

Every year, John hides chocolate Easter eggs around the house for his two sons to go egg-hunting. The children earn every egg they find and, in addition, there is a special prize for the best hunter: the one who finds more eggs wins a big chocolate bunny. The father knows the location of every group of eggs but he cannot fully disclose this information (not without ruining the contest). Yet he can disclose partial information to his children to keep them motivated during the hunt.

Marty observes that, in this context, the sentence in bold in (32) can be felicitously uttered by the father, even though it is common ground that it is him who hid the eggs and therefore he knows their exact locations. Not only is that sentence felicitous, but it gives in fact a promising lead to its recipient: it has an informative presupposition which discloses the possible location of some of the eggs while asserting that this information is not known to the other contestant. Crucially, the felicity of this utterance indicates that, just like regular IGNORANCE inferences, PRESUPPOSED IGNORANCE inferences are readily suspended in semi-cooperative contexts.<sup>11</sup>

- (32) [Context: after 15 minutes of egg-hunting, one of the brothers has only found a few eggs and now looks quite discouraged]  
FATHER: The contest isn't over, you still have a chance. **Your brother is unaware that there are eggs behind the house or behind the barn.**  
a. ↗ The father is ignorant as to whether there are eggs behind the house and as to whether there are eggs behind the barn  
b. ~~ There aren't eggs both behind the house and behind the barn

<sup>11</sup> Note that, if the relevant sentence in (32) were associated with PRESUPPOSED IGNORANCE inferences, it would then be infelicitous, as these inferences contradict the assumption that the father knows where the eggs are hidden. This point is demonstrated by the infelicity of sentences like (i), which was constructed by embedding the sentence in (13) under the negative factive predicate *unaware* and which is odd for the very same reasons that (13) is odd (see Marty & Romoli 2021a).

(i) #John is unaware that I was born in Bergen or in Oslo.

This observation teaches us in turn that either MPQ is not active in such contexts or the weak inferences following from MPQ are not strengthened any further to primary implicatures.<sup>12</sup> Whichever is the case, Marty argues that, in contrast to PRESUPPOSED IGNORANCE, PRESUPPOSED EXCLUSIVITY still arises in such contexts: intuitively, the father's hint strongly suggests that there aren't eggs in both locations. This intuition can be sharpened by considering the variant of this sentence in (33), where PRESUPPOSED EXCLUSIVITY is again blocked by the addition of *or both*.

- (33) FATHER: The contest isn't over, you still have a chance. **Your brother is unaware that there are eggs behind the house or behind the barn, or both.**
- a. ↗ *The father is ignorant as to whether there are eggs behind the house and as to whether there are eggs behind the barn*
  - b. ↗ *There aren't eggs both behind the house and behind the barn*

Thus, Marty's egg hunt scenarios can be taken to offer preliminary evidence that the prediction in (30) is disconfirmed. Nonetheless, the introspective judgements reported above remain subtle and their interpretation subject to caution. First of all, while PRESUPPOSED EXCLUSIVITY has received attention in the recent theoretical literature, this inference type has never been experimentally investigated and its existence has not been formally established yet. Second, Marty's scenarios leave open the possibility that, once again, exclusive interpretations arise as a result of implicit, contextual assumptions, rather than scalar reasoning *per se*. In particular, PRESUPPOSED EXCLUSIVITY could arise in these cases as a result of the hearer reasoning that, if they were eggs in both locations, the speaker's hint would not just help its recipient, it would also make the contest unfair. In sum, while the observations above may be empirically correct, they remain to be established on firmer grounds.

## 6 Experiment 2: Extending the challenge

As we just saw, the interpretation of disjunctive presuppositions in semi-cooperative contexts could also turn out to be a challenge for pragmatic accounts of presuppositional implicatures. Experiment 2 aimed at establishing people's intuitions about these cases by quantitative means and, ultimately, at determining whether or not the challenge is real. For these purposes, the experiment was designed as a

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<sup>12</sup> While both these options are theoretically possible, we notice that, in the present case, the second option is likely ruled out by the context as it can reasonably be assumed that the speaker could have convinced the hearer that there are eggs at any given location simply by presupposing this information. As a result, if MPQ were active in this context, primary implicatures would immediately obtain and, thus, PRESUPPOSED IGNORANCE would ensue, contrary to the facts.

follow-up to Exp.1. The materials and method were the same as in Exp.1 in all but one aspect: the formulation of the hints provided by the host was modified so as to investigate the novel presuppositional environments of interest. A schematic description of the experimental conditions is provided in Table 3. We hypothesised that, if PRESUPPOSED EXCLUSIVITY is available in semi-cooperative contexts, then the contrasts between OR and OR-BOTH hints that we found in Exp.1 should reproduce in full with the presuppositional cases. If this is correct, then the response patterns in the MONEY and SLIME conditions should be entirely parallel to those from Exp.1.

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#### **MONEY conditions**

There are 100 numbered boxes in total, and 5 of them contain a million dollar prize. The host tells the remaining players that previous contestants were unaware that there is money in {**box 20 or 25 (OR)** / **box 20 or 25, or both (OR-BOTH)**}. The contestant picks box 20 and {**finds a million dollars (WON)** / **does not win any money (LOST)**}.

Imagine you are the next contestant in this game. The host does not give you any more information. Which action are you most likely to take?

Choose box 25

Choose any other box

---

#### **SLIME conditions**

There are 100 numbered boxes in total, and 5 of them are associated with slime. The host warns the remaining celebrities that previous contestants were unaware that slime is associated with {**box 20 or 25 (OR)** / **box 20 or 25, or both (OR-BOTH)**}. The celebrity picks box 20 and {**nothing happens (WON)** / **is slimed (LOST)**}.

Imagine you are the next contestant in this game. The host does not give you any more information. Which action are you most likely to take?

Choose box 25

Choose any other box

---

**Table 3** Example items illustrating the MONEY and SLIME conditions in Experiment 2. The task and instructions were the same as in Experiment 1.

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## 6.1 Participants

203 new participants (average age 35 yrs; 103 female) were recruited online through Prolific using the same pre-screening criteria as in Exp.1. Participants were paid £0.7 for their participation and average completion time was about 4-5 minutes (£10/hr). The consent and data collection procedures were the same as in Exp.1.

## 6.2 Materials and method

The materials used in this experiment differed from the materials used in Exp.1 along one unique dimension: all the scenarios involved novel hints obtained by modifying the hints used in the scenarios of Exp.1. Specifically, the novel hints were constructed by embedding the previous hints under the negative factive predicate *unaware*, as exemplified in (34) and (35) for the MONEY conditions.

- (34) HOST: Previous contestants were unaware that there is money in box 20 or box 25.
- ↗ The host doesn't know in which box there is money*
  - ↖ There isn't money in both of the boxes* ?
- (35) HOST: Previous contestants were unaware that there is money in box 20 or box 25 or both
- ↗ The host doesn't know in which box there is money*
  - ↗ There isn't money in both of the boxes*

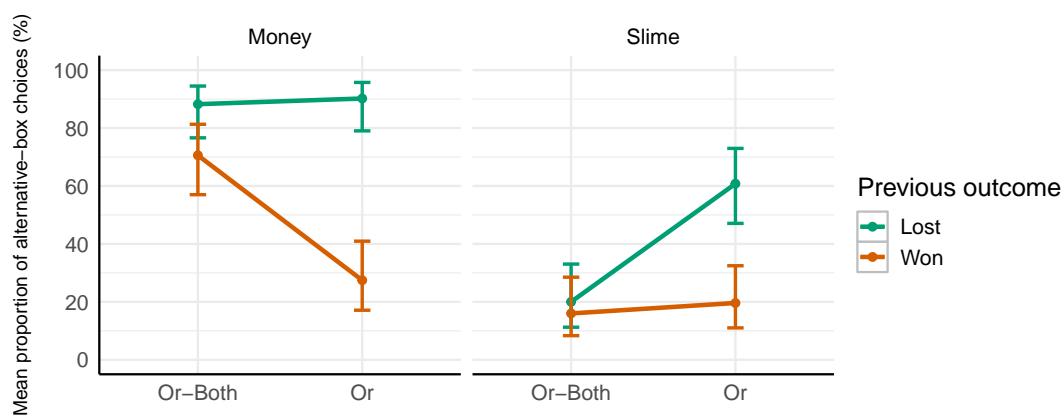
For consistency, the formulation of the hints used in the filler items were adjusted so as to involve the same type of constructions (e.g., *Previous contestants were unaware that there is {money/slime} associated with at least one door with a number less than 3*). The rest of the design was identical to that of Exp.1 in all respects.

## 6.3 Procedure

The procedure was identical to the one used in Exp.1 (see Section 4.3 for details and see Appendix A for the instructions). The distribution of the participants was even across the four sets of experimental conditions (MONEY-OR: 51, MONEY-OR-BOTH: 51, SLIME-OR: 51, SLIME-OR-BOTH: 50).

## 6.4 Data processing and analyses

The data were processed and analysed using the data analysis pipelines from Exp.1 (see Section 4.4-4.5 for details). Just like in Exp.1, due to a clerical error in the preparation of the materials, some participants in the SLIME game only saw instances of the control cases for one of the two game setups, namely the 6-sided die setup. In order to preserve a balanced design for hypothesis tests, all responses associated with this game setup were excluded from analyses, exactly as in Exp.1.



**Figure 2** Mean proportion of ‘alternative-box’ choices in the MONEY and SLIME conditions of Experiment 2 as a function of the type of Hint (OR-BOTH vs. OR) and the Outcome of the previous contestant’s pick (LOST vs. WON). Error bars represent 95% binomial confidence intervals. The response patterns were entirely parallel to those found in Exp.1.

## 6.5 Results

Figure 2 gives the mean proportion of ‘alternative’ box choices as a function of the experimental condition.

### 6.5.1 Control cases

Responses in the control cases were as expected: in the WON situations of the MONEY game, participants uniformly chose the alternative box ( $M_s \geq 88\%$ ). Alternatively, in the corresponding LOST situations of the SLIME game, they largely disregarded the alternative box ( $M_s \leq 20\%$ ) and preferred the ‘any other box’ option. These results show that participants correctly understood the instructions associated with each game show. They also suggest that participants had no particular issue accommodating the informative presuppositions contributed by the hints and using this information to identify the most favorable course of action in these situations.

### 6.5.2 Target cases

As in Exp.1, we fitted participants’ responses to the target cases into a binomial linear model predicting response type likelihood from the type of Game (MONEY vs. SLIME; dummy-coded), the type of Hint (OR vs. OR-BOTH; dummy-coded) and

the interaction between the two. The coefficients of the model are given in Table 4.

Coefficient	Estimate	Standard error	95% CI
Intercept	1.34	0.24	[0.89, 1.85]
Hint	-0.99	0.31	[-1.62, -0.38]
Game	0.16	0.35	[-0.53, 0.87]
Hint:Game	-0.12	0.45	[-1.02, 0.76]

**Table 4** Coefficients of the full model with the 95% CIs for the (beta) estimates.

The comparison between the full model and its nested variant missing the main-effect term for Hint was significant ( $\chi^2(1) = 10.27$ , adjusted  $p < 0.01$ ), indicating that participant selected more often the response type associated with EXCLUSIVITY after getting OR than OR-BOTH hints. No other model comparisons were significant (all  $\chi^2$ s  $< .72$ , all adjusted  $p$ s = 1). As in Exp.1, post-hoc analyses showed that the estimated mean for OR was significantly different from the estimated mean for OR-BOTH in both the MONEY conditions ( $\beta = 0.99$ , SE = 0.31, adjusted  $p < .01$ ,  $d = 0.91$ ) and the SLIME conditions ( $\beta = 1.19$ , SE = 0.32, adjusted  $p < .01$ ,  $d = 1.03$ ). Compared to the OR-BOTH conditions, participants selected the response type associated with EXCLUSIVITY at least twice more often in the OR conditions, whether they took part in the MONEY game (73% vs. 30%) or the SLIME game (61% vs. 20%).

## 6.6 Discussion

We designed this experiment as a variant of Exp.1 with the aim of investigating how people interpret disjunctive presuppositions in gaming contexts. We were interested in knowing whether, as claimed in [Marty \(2018\)](#), PRESUPPOSED EXCLUSIVITY is generally available in this kind of semi-cooperative contexts where IGNORANCE is found to be suspended. Our experimental results provide evidence in favor of this claim and, as a result, for the more basic claim that PRESUPPOSED EXCLUSIVITY exists as an inference type, as recently proposed in the theoretical literature.

Overall, the response patterns for disjunctive presuppositions were entirely parallel to those observed for disjunctive assertions: in parallel to what we found in Exp.1, we found that participants in both the MONEY and the SLIME game opted at least twice more often for the response option associated with exclusive interpretations after getting OR hints than their OR-BOTH variants. The size of the Hint effects was large and similar to that of the Hint effects observed in Exp.1. We take these results to show that PRESUPPOSED EXCLUSIVITY exists as an inference type and that it can be derived independently from PRESUPPOSED IGNORANCE, contra the prediction

in (30). On this basis, we conclude that the challenge raised by semi-cooperative contexts extends to the pragmatic approach to presupposition-based implicature.

## 7 Summary

Our studies make two contributions. First, our results replicate Agyemang's experimental findings, hence confirming Fox's original judgments, and they rule out an independent account explaining EXCLUSIVITY in terms of game-related assumptions. Second, our results show that these findings extend to presuppositional cases where similar inference types have been identified, raising a similar challenge for recent proposals extending the pragmatic approach from the assertion to the presupposition level.

As we explained, the standard pragmatic account predicts that ignorance and exclusivity inferences should go together. We confirmed and refined the challenge from semi-cooperative contexts, where it appears that the latter can be present without the former, against the aforementioned prediction. We also showed that the challenge extends from the assertive to the presuppositional domains, where it arises to the same extent.

The challenge to the standard pragmatic approach to implicatures can be taken, and has been taken, to support the grammatical approach, both at the assertion and at the presupposition level (Fox 2007, 2012, Marty 2017, Marty & Romoli 2021b, a.o.). On this approach, exclusivity is derived as an entailment of a possible LF of the sentence involving a silent exhaustivity operator. Ignorance inferences, on the other hand, arise pragmatically on the basis of a version of the Maxim of Quantity, or as the result of another LF. Either way, on this approach, exclusivity can arise independently from ignorance inferences, which is compatible with our results.

Alternatively, one can take our results as indicating that the pragmatic approach needs to be modified and refined to respond to the challenge. Here we take this second direction, and we propose a generalisation of the Maxim of Quantity and the Opinionatedness assumption, which allows us to account for why exclusivity can arise even in the absence of ignorance.

## 8 A possible Gricean response

The challenges that we have identified are based on the assumption that MQ is de-activated in semi-cooperative contexts. We would like to suggest, however, that there is a way to formulate MQ so that it remains active in these contexts and leads to exclusivity, but not to ignorance. The reformulation that we propose is in (36). Specifically, we propose to extend the reasoning from the speaker's epistemic state to a more general attitude which we call 'being in a position to communicate', as

defined in (37), where  $W_s(\psi)$  means that the speaker is willing to add  $\psi$  to the common ground (if she believes it).

(36) **Generalised Maxim of Quantity (GMQ):**

If  $\phi$  and  $\psi$  are both relevant to the conversation,  $\psi$  is more informative than  $\phi$ , and  $\psi$  is among the alternatives to  $\phi$ , then if a speaker is in a position to communicate both, the speaker should utter  $\psi$  rather than  $\phi$ .

(37) **Being in a position to communicate**

$$PtC_s(\psi) = B_s(\psi) \wedge W_s(\psi)$$

Together with this reformulation, we propose to make the opinionatedness assumption more general and turn it into what we will call ‘having an informative attitude’, defined as in (38).

(38) **Having an informative attitude**

$$PtC_s(\psi) \vee PtC_s(\neg\psi) = [B_s(\psi) \wedge W_s(\psi)] \vee [B_s(\neg\psi) \wedge W_s(\neg\psi)]$$

With these two novel ingredients in place, consider now how implicatures can be derived in this framework. First, on the basis of GMQ, the fact that the speaker uttered a weaker statement  $\phi$  when she could have produced a stronger alternative  $\psi$  leads the hearer to derive the weaker primary implicature that it’s not the case that the speaker is in a position to communicate the stronger statement  $\psi$ . This inference is compatible with the speaker not having the belief that  $\psi$  is true or with her not being willing to communicate  $\psi$ , as shown below:

$$(39) \quad \neg PtC_s(\psi) = \neg[B_s(\psi) \wedge W_s(\psi)] = \neg B_s(\psi) \vee \neg W_s(\psi)$$

Arguably, in ordinary conversations, it is generally assumed that the speaker is willing to share all the relevant information that she has. Therefore, the hearer will assume in such contexts that the speaker is willing to communicate  $\psi$ , if she believes it. On the basis of this assumption and the previous result in (39), we derive the usual primary implicature  $\neg B_s(\psi)$ . Next, if we make the informative attitude assumption in (38), we can derive the secondary implicature in (40), that is, the speaker believes  $\neg\psi$  and is willing to communicate  $\neg\psi$ . The second conjunct is not surprising at all in ordinary conversations: as mentioned, it is already assumed that the speaker will share all the relevant information she has, therefore if she believes  $\neg\psi$ , she will share it, i.e.,  $W_s(\neg\psi)$ . The first conjunct is more interesting as it corresponds to the usual secondary implicature.

$$(40) \quad PtC_s(\neg\psi) = B_s(\neg\psi) \wedge W_s(\neg\psi)$$

Consider now how this applies more specifically to the exclusivity and ignorance

inferences of disjunction, going back to (1) and its more informative alternatives:

$$(1) \quad \text{June visited Frankfurt or Düsseldorf} \quad (p \vee q)$$

$$(41) \quad \left\{ \begin{array}{l} \text{June visited Frankfurt} \\ \text{June visited Düsseldorf} \\ \text{June visited Frankfurt and Düsseldorf} \end{array} \right. \quad \left. \begin{array}{c} p \\ q \\ (p \wedge q) \end{array} \right\}$$

From GMQ and the assumption that the speaker would be willing to communicate any of the relevant alternatives if she believed them to be true, we obtain the same primary implicatures as before: it's not true that the speaker believes that June visited Frankfurt, it's not true that she believes that June visited Düsseldorf, and it's not true that she believes that June visited both cities.

$$(42) \quad \neg B_s(p), \neg B_s(q), \neg B_s(p \wedge q)$$

From the primary implicatures in (42), and the assumption that the speaker believes what she said, IGNORANCE also follows as before: the speaker doesn't know whether June visited Frankfurt and doesn't know whether she visited Düsseldorf.

$$(43) \quad \neg B_s(p) \wedge \neg B_s(q) \wedge \neg B_s(\neg p) \wedge \neg B_s(\neg q)$$

Finally, the primary implicature about exclusivity in (42) can be strengthened by making the informative attitude assumption, resulting in the inference in (44): the speaker believes that June didn't visit both Frankfurt and Düsseldorf and is willing to communicate that.

$$(44) \quad B_s(\neg(p \wedge q)) \wedge W_s(\neg(p \wedge q))$$

In sum, nothing changes in ordinary contexts: we derive primary and secondary implicatures in the usual way, given the assumption that, in these contexts, speakers are not withholding relevant information they have, i.e., they are willing to share what they believe is true and relevant for the purpose of the conversation.

With this in mind, we can go back to semi-cooperative contexts and explain how the ingredients above can derive exclusivity without deriving ignorance for sentences like (45).

$$(45) \quad \text{There is money/slime in box 20 or 25.}$$

Let us start by reviewing the contextual assumptions: (i) the host is assumed to know exactly where the money/slime is, and (ii) the host can give hints but cannot give away the exact location. As a result, in such contexts, we cannot safely assume that the speaker is willing to communicate any of the more informative alternatives to (45). This, in turn, means that, from the weaker primary implicatures about the

disjuncts in (46a) and (46b), we cannot conclude that it's not true that the speaker believes that there is money in box 20 and that it's not true that she believes that there is money in box 25, as we did before, because it could be that she believes either of those, but is not willing to communicate them (e.g., to comply with the rules of the game). Thus, these primary implicatures remain as they are; in fact, these implicatures are already entailed by the context: given the rules of the game,  $\neg W_s(p)$  and  $\neg W_s(q)$  are already commonly believed. As a result, we do not derive ignorance, in accordance with intuitions.

- (46)    a.  $\neg PtC_s(p) = \neg[B_s(p) \wedge W_s(p)]$  from GMQ  
          b.  $\neg PtC_s(q) = \neg[B_s(q) \wedge W_s(q)]$  from GMQ

As for exclusivity, we cannot assume  $W_s(p \wedge q)$  either and therefore, from the primary implicature in (47), we cannot directly conclude that it's not true that the speaker believes  $p \wedge q$ .

- $$(47) \quad \neg PtC_s(p \wedge q) = \neg [B_s(p \wedge q) \wedge W_s(p \wedge q)] \quad \text{from GMQ}$$

Unlike in the case of the single disjuncts, however, there is a way for the hearer to strengthen the weaker primary implicature by making the informative attitude assumption in (48). From (48), and the contextual assumption that it's not true that the speaker is willing to communicate  $(p \wedge q)$ , i.e.,  $\neg W_s(p \wedge q)$ , we derive the secondary exclusivity implicature in (49) as before: the speaker doesn't believe that there is money in both boxes and she is willing to communicate that. Crucially here,  $W_s(\neg(p \wedge q))$  is compatible with the rules of the game for the speaker is not revealing the exact location of the money/slime by disclosing this information.

- (48)  $[B_s(p \wedge q) \wedge W_s(p \wedge q)] \vee [B_s(\neg(p \wedge q)) \wedge W_s(\neg(p \wedge q))]$   
 (49)  $[B_s(\neg(p \wedge q)) \wedge W_s(\neg(p \wedge q))]$

In sum, we argue that MQ, once generalised, can be assumed to be active in semi-cooperative contexts as well. We believe that this move is also conceptually appealing given that, in these contexts, the speaker is in fact as cooperative as possible given the constraints imposed by the context. The more general formulation of MQ and the informative attitude assumption do not derive ignorance in these contexts, but, crucially, they derive exclusivity. The same explanation applies to the presuppositional cases. Once the authority assumption is made, everything else follows in a similar way.<sup>13</sup> In particular, we assume the following

13 We also notice that the same derivation applies to cases involving more than two disjuncts such as *There is money in box 20, box 25, or box 30*. Specifically, the same reasoning can be applied in these cases to each of the intermediate alternatives which are needed for the derivation of exclusivity

generalised version of MPQ where, in addition to satisfaction and authority, we consider once again the willingness of the speaker (in the sense defined above) towards the presupposition of the alternative.

(50) **Generalised Maxim of Presupposed Quantity (MPQ)**

If  $\phi_p$  and  $\psi_q$  are both relevant to the conversation,  $q$  is more informative than  $p$ , and  $\psi_q$  is among the alternatives to  $\phi_p$ , then if both  $p$  and  $q$  are satisfied in the context or if the speaker has authority about  $p$  and  $q$  and is willing to communicate  $p$  and  $q$ , the speaker should not utter  $\phi_q$ .

This reformulation weakens the primary presupposed implicatures in the same way as in the asserted cases. This weakening will have no effect in ordinary contexts for the same reason as before, as there is generally no reason to assume that the speaker is not willing to communicate the presupposition of the relevant alternatives. However, it will block presupposed ignorance in semi-cooperative contexts. Presupposed exclusivity can instead follow in the same way as before, once we make the informative attitude assumption about the presuppositions.

Before closing, let us clarify one implicit assumption in our derivations that deserves some more attention. Indeed, in (48), we assumed that the hearer can make informative attitude assumptions in order to strengthen the primary implicature about exclusivity in (51), hence deriving the result in (49).

$$(51) \quad \neg[B_s(p \wedge q) \wedge W_s(p \wedge q)]$$

However, given the rules of the context, (51) is also compatible with the speaker believing  $p \wedge q$  and not being willing to communicate it. So why would the hearer make the informative attitude assumption nonetheless? We argue that, in situations of uncertainty, the hearer will tend to assume as much as possible in order to strengthen the interpretation of the speaker's utterance, as long as the result aligns with relevance considerations and remains consistent with other constraints in the context (e.g., the rules of the games). As we explained, the primary implicature in (51) is very weak, but making the informative attitude assumption allows to strengthening it to a secondary exclusivity implicature. Given that this strengthening is possible, the hearer will tend to do it.<sup>14</sup>

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here (e.g., *There is money in box 20 and 25*, *There is money in box 25 and 30*, etc.). See Sauerland 2017 for discussion. Thanks to Uli Sauerland for discussion on this point.

<sup>14</sup> This line of explanation is also needed to address a related issue arising from a different version of the game show contexts, discussed by Fox (2012: Section 4), where the host is not assumed to have complete knowledge about the location of the money or slime. This is because, in these contexts, the relevant willingness assumptions do not hold and the informative attitude assumption can be made in a situation of uncertainty, given the strengthening preference suggested above. We also note that a similar assumption about maximizing strength is arguably needed in the alternative grammatical

## 9 Conclusion

Disjunctive sentences give rise to exclusivity and ignorance inferences, both at the assertion and at the presupposition level. On the standard pragmatic approach, these inferences are derived on the basis of the same ingredients. The interpretation of disjunctive sentences in semi-cooperative contexts challenge this approach. In this paper, we confirmed and refined the challenge for assertion-based implicatures and extended it to presupposition-based implicatures. We provided a response to this challenge from the pragmatic approach based on a generalisation of the classical assumptions underlying the derivation of exclusivity and ignorance inferences. We showed that, in semi-cooperative contexts, this novel approach does not give rise to ignorance inferences while it can still generate exclusivity. We then sketched how this approach extends to the presuppositional case. On this refinement, the hearer is assumed to reason not only over what the speaker actually said and could have said instead, but also over what the speaker *would have been willing to say*.

Finally, we think that the notion of willingness to share a proposition might be helpful in understanding a variety of other discourse contexts where it is assumed that the speaker has reasons not to share all the information they have, e.g. when an underinformative utterance is used for reasons of tact, or where an evasive answer is given in political interviews. We leave this extension to future research.

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approach to implicatures, in order to account for why, in a situation of uncertainty, a listener would decide a parse of the sentence which results in a stronger meaning. Indeed, such a principle has been discussed across different approaches to implicatures in the literature; see Chierchia et al. 2012 among others for discussion. See also Dieuleveut et al. 2019 for a related case in which secondary scalar implicatures appear to be derived even in a situation of uncertainty about the competence of the speaker, and for discussion of a different pragmatic account, involving higher order reasoning.

## A Instructions in Experiment 1 and 2

### Money game show (**MONEY** conditions)

Suppose you are on a game show where you have to choose an item from a set of options. Some of the items are associated with **a million dollars** – the contestant will win a million dollars if they are picked. The other items are not associated with any money. You do not know which items are associated with money, and which are not. The game show host does know, but they cannot explicitly tell you this information. However, at various points in the game, the host can give you hints.

- If you choose an item that has money associated with it, you will leave the game with a million dollars.
- If you choose an item that does not have money associated with it, you will leave the game with nothing.

The game continues with a new contestant until all of the items in the set that are associated with money are chosen.

### Slime game show (**SLIME** conditions)

Suppose you are a celebrity on a game show where you have to choose an item from a set of options. Some of the items are associated with **slime** – the celebrity will have a tank of slime poured on them if they are picked. The other items are safe and do not cause anything to happen. You do not know which items are associated with slime, and which are not. The game show host does know, but they cannot explicitly tell you this information. However, at various points in the game, the host can give you hints.

- If you choose an item associated with slime, you will be slimed and leave the game.
- If you choose an item that does not have slime associated with it, you will leave the game without being slimed.

The game continues with a new celebrity until all the items in the set associated with slime are chosen.

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