

## A higher-order plurality solution to Xiang’s (2021) puzzle\*

Brian Buccola

**Abstract** Xiang (2021) notes the following puzzle: plural wh-questions involving certain collective predicates are predicted to carry a uniqueness presupposition (Dayal 1996), yet intuitively they don’t (cf. Gentile & Schwarz 2020). She proposes that such questions have ‘higher-order readings’ (Spector 2007, 2008), and crucially that they have answers naming boolean conjunctions. I show that for the data she considers, recourse to higher-order *question* readings is mistaken: Xiang’s puzzle should be solved with higher-order *plurality*, and I provide empirical justification for this approach, mirroring for questions the recent findings for declaratives by Buccola, Kuhn & Nicolas (2021).

**Keywords:** collectivity, conjunction, distributivity, maximal informativity, plurality, presupposition, questions

### 1 Dayal’s (1996) presupposition

Singular wh-questions carry a uniqueness presupposition, while plural ones don’t. For example, (1) presupposes that just one student passed, while (2) carries no such presupposition.

- (1) Which student passed? (#Ali and Beth.)
- (2) Which students passed? (✓Ali and Beth.)

On Dayal’s (1996) influential proposal, questions in general carry a Maximal Informativity Presupposition (MIP): they presuppose that there is a maximally informative true answer (one that entails every other true answer). For (1), the set of Hamblin/Karttunen answers (Hamblin 1973; Karttunen 1977) is in (3). For  $x \neq y$ , the proposition that  $x$  passed is semantically independent from the proposition that  $y$  passed. So, to require that (1) have a maximally informative true answer is to require that it have just one true answer of the form ‘ $x$  passed’, for  $x$  an atomic student. Hence, the MIP yields uniqueness.

---

\* I thank the reviewers and the audience at SALT 32 for helpful comments and questions, especially Yimei Xiang and Aron Hirsch. Thanks also to David Nicolas and Jeremy Kuhn for continued discussion of this work.

- (3)  $\{\lambda w . x \text{ passed}_w \mid x \text{ is an atomic student}\}$

For (2), the set of Hamblin/Karttunen answers is in (4). In this case, the proposition that  $x (\neq y)$  passed *can entail* the proposition that  $y$  passed, namely if  $y$  is a subpart of  $x$ . For example, the proposition that Ali and Beth passed entails the proposition that Ali passed, due to the distributivity of the predicate *pass*. So, the maximally informative true answer is the one that picks out the maximal plurality of passers, which may be either an atom or a proper plurality. Hence, the MIP delivers a mere existence presupposition.

- (4)  $\{\lambda w . x \text{ passed}_w \mid x \text{ is a (possibly atomic) plurality of students}\}$

## 2 Xiang's (2021) puzzle

Xiang (2021) observes that when we switch to a non-distributive predicate, a plural wh-question can have a list of pluralities as an answer. For instance, a possible answer to (5) is *Ali and Beth, and Cara and Dimitri*, indicating two pluralities, each of whom solved the problem together.

- (5) Which students solved the problem together?  
(✓Ali and Beth, and Cara and Dimitri.)

The set of Hamblin/Karttunen answers to (5) is in (6). Unlike for (2), here the proposition that  $x (\neq y)$  solved the problem together is semantically independent from the proposition that  $y$  solved the problem together, even if  $y$  is a subpart of  $x$ , due to the non-distributivity of the predicate *solve the problem together*. So, just like for (1), to require that (5) have a maximally informative true answer is to require that it have just one true answer of the form ‘ $x$  solved the problem together’, for  $x$  a plurality of students. Hence, the MIP incorrectly yields a uniqueness presupposition, that just one plurality of students solved the problem together.

- (6)  $\{\lambda w . x \text{ solved}_w \text{ the problem together} \mid x \text{ is a plurality of students}\}$

Xiang proposes that (5) has a *higher-order* reading, ranging not over pluralities of students, but over *generalized quantifiers* (GQs) over students (Spector 2007, 2008). Roughly: ‘Which GQ  $G$  over students is such that  $G$  solved the problem together?’ A possible  $G$  is  $(\text{Ali} + \text{Beth})^\uparrow \cap (\text{Cara} + \text{Dimitri})^\uparrow$ , where ‘+’ denotes plurality formation, and ‘ $\uparrow$ ’ denotes Montagovian lift. An answer like *Ali and Beth, and Cara and Dimitri* can name this  $G$ , on standard assumptions about plurality formation, lifting, and boolean conjunction as set intersection. Applying this  $G$  to the predicate then yields the attested reading that Ali and Beth solved the problem together, and so did Cara and Dimitri.

### 3 A higher-order plurality solution

Fox (2020) proposes that (6) is the right question denotation, and that  $x$  may be a *higher-order plurality* (HOP). While Fox provides some tentative independent support for HOP, he does not give concrete arguments *against* Xiang’s (2021) proposal, but merely describes the situation as a ‘dilemma’: his general theory of questions and Xiang’s use of boolean conjunctions are incompatible. The main contribution of this paper is to provide new support *for* a HOP solution and *against* a higher-order question reading solution.<sup>1</sup>

#### 3.1 First new argument for a HOP solution

Consider (7). In this context, question (5), repeated in (8), may be answered by the conjunctive DP in (9a). On Xiang’s (2021) account, this conjunction straightforwardly names the GQ ( $\llbracket$ the French students $\rrbracket$ )<sup>↑</sup>  $\cap$  ( $\llbracket$ the Italian students $\rrbracket$ )<sup>↑</sup>, yielding the right reading. Crucially, however, question (5) may also be answered in context (7) by the DP in (9b), which does not so straightforwardly pick out that same GQ, given the lack of conjunction (*and*).

- (7) *Context: This class consists of students from France, Italy, Russia, and China. The French students solved the problem together, and so did the Italian students.*
- (8) Which students solved the problem together?
- (9) a. The French students and the Italian students.  
b. The students from the two Mediterranean countries.

DPs like (9b), and the readings they give rise to, were recently discussed by Buccola et al. (2021), who provide an analysis in terms of Landman’s (1989) *groups*, extended with a mechanism of scope-taking.<sup>2</sup> Roughly, (9b) has the logical form in (10b), where ‘ $\uparrow$ ’ is Landman’s group-forming operator. By scoping *the two countries* out of its group-denoting DP (reminiscent of inverse-linking constructions), two groups are created, indexed by country: the structure in (10b) ends up equivalent to the one in (10a), where *and* denotes ‘+’. Both structures denote a plurality of two groups, each of whom solved the problem together. This HOP thus plays the same role as any ordinary plurality (of ordinary individuals) in plural wh-questions

<sup>1</sup> The implementation of HOP advocated here follows the group-based account in Buccola et al. 2021, rather than the one in Fox 2020. I leave a comparison of the two for future work.

<sup>2</sup> They also propose an alternative analysis that involves dynamically accessible covers (Schwarzschild 1996). For simplicity and concreteness, I present only the group-based analysis here. I leave open the question of whether the cover-based analysis can be applied to the question-answer dialogs explored here.

with distributive predicates, like (2). Thus, the MIP correctly yields a mere existence presupposition, rather than a uniqueness presupposition, for the same logical reason as for (2).

- (10) a.  $\uparrow$ [the students from France] and  $\uparrow$ [the students from Italy]  
 b. [the two Mediterranean countries]  $\lambda x \uparrow$ [the students from  $x$ ]

### 3.2 Second new argument for a HOP solution

The predicates Xiang discusses are what Grimau (2020) calls ‘plurality-distributive’: they distribute down to subpluralities, hence the important role of conjunction ( $\cap$ ) in the requisite GQ answer. However, the exact same higher-order reading arises even for ‘plurality-collective’ predicates (*hit each other, meet in adjacent rooms*), which have readings that do *not* distribute. Such readings are analyzed by Buccola et al. (2021), under the label ‘symmetric readings’. Thus, for example, (11) sets up a symmetric context in which one group hit another group, and vice versa (but there was no hitting within groups). Crucially, the question in (12) may then be answered by either of the two DPs in (9a) or (9b) above, repeated in (13a) and (13b). The GQ answer ( $\llbracket$ the French students $\rrbracket$ ) $^\uparrow \cap$  ( $\llbracket$ the Italian students $\rrbracket$ ) $^\uparrow$  yields the wrong (distributive) reading (the French students hit each other, and so did the Italian students). But the HOP answer yields the right reading: applied to *hit each other*, the pluralities in (13a) and (13b) yield that the French group hit the Italian group, and vice versa, just like applying *Itchy and Scratchy* yields that Itchy hit Scratchy, and vice versa.

- (11) *Context: This class consists of students from France, Italy, Russia, and China. A fight broke out, and the French students hit the Italian students, and vice versa.*
- (12) Which students hit each other?
- (13) a. The French students and the Italian students.  
 b. The students from the two Mediterranean countries.

## 4 Conclusion

I’ve provided new arguments that Xiang’s puzzle not only *can*, but *must* be solved with HOP, extending recent findings from the declarative to the interrogative domain, and adding to the growing evidence that natural language makes use of HOP, even in the absence of conjunction. I conclude with some brief remarks on embedded questions and on the status of higher-order conjunctions/question readings more broadly.

#### 4.1 Embedded questions and homogeneity

Sentences with embedded questions exhibit a homogeneity effect that is analagous to what definite plurals exhibit (Gajewski 2005; George 2011; Križ 2015; Cremers 2018).

- (14) a. The students passed.  $\rightsquigarrow$  **Each** student passed.  
b. The students didn't pass.  $\rightsquigarrow$  **No** student passed.
- (15) a. Sam knows which students passed.  
 $\rightsquigarrow$  For **each** student  $x$  who passed, Sam knows  $x$  passed.  
b. Sam doesn't know which students passed.  
 $\rightsquigarrow$  For **no** student  $x$  who passed does Sam know  $x$  passed.

Križ (2015) argues that this parallelism can be explained if we assume that the answers to the question *which students passed* (propositions of the form ' $x$  passed', for  $x$  a student) are trivalent propositions when  $x$  is a plurality. (See Križ's paper for details.)

The same homogeneity effect obtains for embedded questions with a non-distributive predicate.

- (16) Sam knows which students solved the problem together.  
 $\rightsquigarrow$  For **each** plurality  $x$  of students who solved the problem together, Sam knows  $x$  solved the problem together.
- (17) Sam doesn't know which students solved the problem together.  
 $\rightsquigarrow$  For **no** plurality  $x$  of students who solved the problem together does Sam know  $x$  solved the problem together.

If the answers to *which students solved the problem together* are propositions of the form ' $x$  solved the problem together', with  $x$  a HOP of students, then we correctly expect these HOP propositions to trigger homogeneity effects.<sup>3</sup> If, however, the answers are higher-order conjunctions instead of pluralities, then it's less clear how or why homogeneity effects would arise.

#### 4.2 Do we still need higher-order conjunction/question readings?

I've argued that the puzzling data observed by Xiang (2021) can and should be accounted for with HOP, not higher-order question readings that involve boolean conjunction/intersection. Should we conclude, then, that there is *only* HOP? Based just on the data explored here, there is no theoretical reason to rule out the possibility

<sup>3</sup> I thank Yimei Xiang for raising and discussing this point with me.

that both HOP and higher-order conjunction/question readings might co-exist. I won't settle the matter here, but let me end by mentioning the kind of (very difficult) data that could bear on the issue.

My second argument for HOP involved moving from plurality-distributive to plurality-collective predicates, and showing that a DP answer naming a HOP is possible. If higher-order conjunction is *also* possible, then we may expect that questions with plurality-collective predicates can *also* have a conjunction of HOP-denoting DPs as an answer. An attempt at this possibility is the context in (18), the question in (19), and the answer in (20).

- (18) *Context: This class consists of students from France, Italy, Denmark, Norway, Russia, and China. A fight broke out, and the French students hit the Italian students, and vice versa, and the Danish students hit the Norwegian students, and vice versa.*
- (19) Which students hit each other?
- (20) The students from the two Mediterranean countries and the students from the two Scandinavian countries.

If (20) is a felicitous true answer to (19) in context (18), then this would support the existence of a higher-order conjunction of two HOPs, each of which is a HOP of two groups. Unfortunately, judgments in such cases are far from clear. One problem is that the 'higher up' an answer goes, the more ambiguous it gets (and the more it relies on context). In an even more extreme case, one could imagine judging the felicity of answering question (19) in context (18) with the DP in (21), where the relevant regions of Western Europe are the Mediterranean and Scandinavia. Theoretically, this DP could denote a HOP consisting of two HOPs: the HOP composed of the French group and the Italian group, and the HOP composed of the Danish group and the Norwegian group.

- (21) The students from the two regions of Western Europe.

More controlled testing is necessary, perhaps following or adapting the methodology described in Buccola et al. 2021.

## References

- Buccola, Brian, Jeremy Kuhn & David Nicolas. 2021. Groups vs. covers revisited: Structured pluralities and symmetric readings. *Natural Language Semantics* 29. 509–525. doi:10.1007/s11050-021-09179-x.
- Cremers, Alexandre. 2018. Plurality effects in an exhaustification-based theory of embedded questions. *Natural Language Semantics* 26. 193–251. doi:10.1007/s11050-018-9145-3.

- Dayal, Vaneeta. 1996. *Locality in WH Quantification: Questions and Relative Clauses in Hindi* Studies in Linguistics and Philosophy. Dordrecht, Holland: Kluwer Academic Publishers.
- Fox, Danny. 2020. Partition by exhaustification: Towards a solution to Gentile and Schwarz's puzzle. Manuscript. <https://semanticsarchive.net/Archive/TljZGNjZ>.
- Gajewski, Jon. 2005. *Neg-Raising: Polarity and Presupposition*. Cambridge, MA: PhD dissertation. <http://hdl.handle.net/1721.1/33696>.
- Gentile, Francesco & Bernhard Schwarz. 2020. Higher-order quantification and free choice in *how many*-questions. In *Sinn und Bedeutung*, vol. 24, 205–222. Osnabrück, Germany. <https://semanticsarchive.net/Archive/mZhNDA4Y>.
- George, B. R. 2011. *Question Embedding and the Semantics of Answers*. Los Angeles, CA: University of California, Los Angeles PhD dissertation.
- Grimau, Berta. 2020. Structured plurality reconsidered. *Journal of Semantics* 38(1). 145–193. doi:10.1093/jos/ffaa012.
- Hamblin, C. L. 1973. Questions in Montague English. *Foundations of Language* 10(1). 41–53. <http://www.jstor.org/stable/25000703>.
- Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics and Philosophy* 1(1). 3–44. doi:10.1007/BF00351935.
- Križ, Manuel. 2015. Homogeneity, trivalence, and embedded questions. In *Amsterdam Colloquium*, vol. 20, 207–216. <http://semanticsarchive.net/Archive/mVkJOTk2N/>.
- Landman, Fred. 1989. Groups, I. *Linguistics and Philosophy* 12(5). 559–605. doi:10.1007/BF00627774.
- Schwarzschild, Roger. 1996. *Pluralities*. Dordrecht, Holland: Kluwer.
- Spector, Benjamin. 2007. Modalized questions and exhaustivity. In *Semantics and Linguistic Theory (SALT)*, vol. 17, 282–299. doi:10.3765/salt.v17i0.2962.
- Spector, Benjamin. 2008. An unnoticed reading for *wh*-questions: Elided answers and weak islands. *Linguistic Inquiry* 39(4). 677–686. doi:10.1162/ling.2008.39.4.677. <https://www.jstor.org/stable/40071459>.
- Xiang, Yimei. 2021. Higher-order readings of *wh*-questions. *Natural Language Semantics* 29. 1–45. doi:10.1007/s11050-020-09166-8.

Brian Buccola  
Department of Linguistics, Languages, and Cultures  
Michigan State University  
East Lansing, MI 48824  
[buccola@msu.edu](mailto:buccola@msu.edu)