Pair-List Questions from Dependent Plurals [*]

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Abstract

Questions with plural definites may receive apparent pair-list answers. The dominant analysis in the literature holds that these questions can only receive weak cumulative Hamblin answers, and that these cumulative answers may be elaborated into pair-list responses for pragmatic reasons. Here, I provide evidence that the "cumulation-only" account is insufficient, and that in certain contexts questions containing plural definites receive genuine pair-list Hamblin answers. I argue that these answers arise when the question nucleus contains an anaphoric dependency function between the *wh*-item and a plural definite, parallel to the proposal for declaratives given by Winter (2000). I conclude that two distinct parses must be available for questions with plural definites: a cumulation-and-elaboration strategy, and a dependency strategy.

1 Introduction

It has been observed that questions with plural definites (QPDs) may receive pair-list responses.[1] For example, (1a) may elicit (1b).

1. (a) Who do these men like? (Dayal, 2016)

   (b) John likes Sue and Bill likes Jane.

While this response is felicitous in many contexts, is (1b) truly the semantic answer to (1a)? That is, is (1b) the strongest true member of (1a)'s Hamblin set?[2] Dayal (1992, 1996) and Krifka (1992) hold that Hamblin answers to QPDs can only take the form of weak cumulative propositions, and thus there is no member of (1a)'s Hamblin set that takes the form of (1b). Instead, (1b) is held to be a pragmatically-motivated elaboration on the strongest true (cumulative) Hamblin answer. In Section 2, I review the Dayal-Krifka account (which I will refer to as the "cumulation-only" account), drawing attention to two key pieces of supporting evidence.

In Section 3, I present new data that shows that the cumulation-only account is insufficient, and that pair-list answers to QPDs must be derivable as Hamblin answers in the semantics. In Sections 4 and 5 I argue that plural *wh*-phrases in QPDs can have a semantics parallel to Winter's proposal for so-called dependent definites, and I explore some predictions that this structure makes. I conclude with a brief discussion of an unresolved question raised by this approach.

[1]See e.g. Groenendijk and Stokhof (1984) and Pritchett (1990).

[2]I.e., the set of all possible answers to (1a). (Hamblin, 1973)

2   Pair-list answers via cumulation

2.1   The cumulation-only account.

Under the cumulation-only account, the Hamblin answers to a QPD must receive a so-called cumulative interpretation of the main predicate. This is described by the **-operator of Krifka (1986) and Sternefeld (1998). "$**P(X, Y)$" expresses the weak proposition that for each x in X, there is some y in Y such that $P(x, y)$ holds, and for each y in Y, there is some x in X such that $P(x, y)$ holds. That is, each part of the first group must be related to some part of the second, and vice-versa.

In the case of (1), the cumulation-only account holds that the strongest true Hamblin answer to (1a) is equivalent to the proposition that "these men (between them) like Sue and Jane". This can be expressed using the **-operator as in (2a), which is equivalent to the first-order logical expression in (2b).

2. (a) **like(these men, Sue+Jane)

    (b) $\forall x[\text{man}(x) \rightarrow \exists y[y \in \{\text{Sue, Jane}\} \wedge \text{like}(x, y)]] \wedge$
         $\forall y[y \in \{\text{Sue, Jane}\} \rightarrow \exists x[\text{man}(x) \wedge \text{like}(x, y)]]$

This answer is the strongest true member of the Hamblin set shown in (3), which contains all possible cumulative *liking* relations from the relevant men to women.

3. Hamblin set: $\{**\text{like}(\text{these men}, x) : x \in *\{\text{Sue, Jane, Lisa, Amy}, \ldots\}\}$

Note that this Hamblin set does not contain propositions that encode mappings from particular men to particular women. Thus, the pair-list response (1b) cannot, under this account, be derived in the semantics.

Instead, (1b) is analyzed as a pragmatically-motivated elaborative response—one that expresses the strongest true Hamblin set member (2a), plus some amount of additional information. The truth of (1b) entails the truth of the Hamblin answer (2a), so no information expressed by that Hamblin answer is lost. (However, (2a) is equally compatible with a situation in which John likes Jane and Bill likes Sue, or in which John likes Sue and Bill likes both Jane and Sue, etc.)

2.2   Review: Evidence for cumulation-only

Cumulation is a possible source for pair-list responses.   QPDs have been shown to lack the subject-object asymmetries that are characteristic of canonical pair-list questions. Compare the questions with quantifiers in (4-5) with the QPDs in (6-7). The pair-list answer is felicitous in (4), when *wh*-moving the object, but infelicitous when *wh*-moving the subject in (5).

4. (a) Which professor does every student like?   (Dayal, 2016)

    (b) Bill likes Professor Carl and Alice likes Professor Dan.

5. (a) Which student likes every professor?   (Dayal, 2016)

    (b) #Bill likes Professor Smith and Alice likes Professor Jones.

The contrast between (4) and (5) is discussed by Chierchia (1993), who holds it to be a matter of quantifier scope. In (4), the universal quantifier attached to the subject takes wide scope relative to the base position of the *wh*-item, enabling the pair-list reading. In (5), the

quantifier attaches to the object, which remains below the base position of the *wh*-item. This means there is no way to derive the necessary scope ordering for a pair-list reading without incurring a weak crossover violation. The pair-list reading is therefore unavailable in (5).

Compare questions with quantifiers to QPDs, where a pair-list response is felicitous regardless of which argument is *wh*-moved.

6. (a) Who do these men like?   (Dayal, 2016),

    (b) John likes Sue, and Bill likes Jane.   repeated from (1a)

7. (a) Who likes these men?   (Dayal, 2016)

    (b) Sue likes John, and Jane likes Bill.

This lack of asymmetry has been has been taken as evidence that QPDs do not receive their pair-list responses from the same source as questions with quantifiers. Instead, these pair-list responses must derive from a source that is available in both (6) and (7), and that is not sensitive to the relative scope of the two arguments. This source is argued to be cumulation. (Dayal, 1992; Krifka, 1992)

However, while this is persuasive evidence that a cumulation-and-elaboration strategy must be available for (6-7), this does not preclude the availability of other strategies.

Pair-list responses *only* derive from cumulation.   It has also been shown that pair-list responses to QPDs appear to depend on the plurality of both arguments. For example, when the *wh*-item is singular, the pair-list response becomes infelicitous.

8. (a) Which women do these men like?

    (b) John likes Sue, and Bill likes Jane.

9. (a) Which woman do these men like?

    (b) #John likes Sue, and Bill likes Jane.

As Dayal and Krifka point out, we would not expect a quantifier scope-based account of the pair-list reading to require plurality of the *wh*-item, since questions that uncontroversially receive their pair-list readings in this way do not abide by such a requirement.[3]

On the other hand, the contrast between (8) and (9) is quite natural under the cumulation-only account, since the only cumulative relations possible with a singular argument are trivial. We can certainly apply the **-operator to a predicate with one singular and one plural argument; however, there can be no variation in which part of the singular argument the various parts of the plural argument are related to.[4] In the question context, this effectively gives us an individual answer.

In summary, the lack of subject-object asymmetries in QPDs provides evidence that pair-list responses can be generated by a cumulation-and-elaboration strategy, and the unavailability of pair-list responses in precisely the cases where cumulation is trivial provides evidence that no other strategy is available.

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[3]E.g., example (6) in the preceding section.

[4]To spell this out more clearly: the answer to (9a) will be of the form shown below. This spells out the proposition that every atomic part of *the men* likes some atomic part of *the woman*, and since there is only one atomic woman in this scenario, every man must like that one woman.

i. $\forall x[\text{man}(x) \rightarrow \exists y[\text{woman}(y) \wedge \text{likes}(x,y)]] \wedge \forall y[\text{woman}(y) \rightarrow \exists x[\text{man}(x) \wedge \text{likes}(x,y)]]$

3   Cumulative answers are not strong enough

Cumulation-only undergenerates pair-list responses.   While the arguments reviewed in the preceding section are persuasive, insofar as they establish that a cumulation-and-elaboration strategy is necessary, several new observations show that cumulation cannot be the only source of pair-list responses to QPDs. To demonstrate, I will consider the example in (10).

10. (a) Which numbers did the players pick?

    (b) Ann picked 1, Ben picked 2, Chris picked 3, Dan picked 4, Emma picked 5.

This is a felicitous question-answer exchange in context (11). The assistant coach in this example could quite natrually ask (10a), eliciting a response of (10b) from the head coach.

11. The head coach of a basketball team had five jerseys made, numbered 1-5, for the five players on the team. Each player chose a jersey. The assistant coach knows all five players on the team, knows the numbers that were available, and believes that each of those player chose exactly one of those jerseys. However, the assistant coach was not present for the choosing, and so doesn't yet know which player selected which jersey.

Under the cumulation-only account, (10a) is assumed to have a Hamblin set of the form shown in (12a), of which (12b) is the strongest true member. In fact, if *picked* is interpreted cumulatively, (12b) is the *unique* true Hamblin answer in this context.

12. (a) Hamblin set: $\{^{**}\text{picked}(\text{the players}, x) : x \in {}^{*}\{1, 2, 3, 4, 5\ldots\}\}$

    (b) Strongest true answer: $^{**}\text{picked}(\text{the players}, 1+2+3+4+5)$

Any proposition in the Hamblin set (12a) that contains more than five numbers will be false, since only five numbers are available. Any proposition that contains fewer than five numbers will also be false, since in this context, all players must have picked a jersey and two players cannot choose the same jersey. And any proposition that contains a number not available to be picked, e.g. 6, will also be false. All true answers must relate the players to exactly the five numbers available in context, and since *picked* is interpreted cumulatively, there is exactly one proposition in the Hamblin set that does so.

That (10a) is a felicitous question in this context poses a problem under the cumulation-only analysis. (11) clearly establishes that the assistant coach already believes the unique true cumulative answer (12b) to be the case (i.e., the assistant coach believes the numbers that the players chose were 1–5). But information-seeking questions are generally infelicitous when the strongest true answer is known to the questioner (and when the answerer knows that the questioner knows). For example, the assistant coach in this context could not ask (13), since the players' identities are already common knowledge.

13. #Who are the players?

In short, if the cumulation-only analysis is correct, we expect the asking of (10a) to be as infelicitous as the asking of (13). Yet it is perfectly natural for the assistant coach to ask (10a), eliciting (10b). This suggests that (10a) can have a true Hamblin answer that is stronger than the weak cumulative proposition in (12b).

I hypothesize that this stronger answer is a true pair-list answer, encoding the mappings stated in (10b). To test this, we can modify (10a) by adding the adverbial expression *between them*, which will disambiguate the question towards a cumulative reading. Under the

cumulation-only account, this should produce no change in interpretation, since (10a) is necessarily already cumulative. If my hypothesis is correct, and (10a) must receive a pair-list answer in order to be a felicitous information-seeking question in this context, then forcing a cumulative reading should result in infelicity. This prediction is borne out.

14. #Which numbers did the players pick between them?

As (14) shows, forcing cumulation causes the question to become infelicitous in context (11). (14) can only be understood as a question about the identity of the numbers chosen, which is already known to the assistant coach.

These observations suggest that a QPD can receive a true pair-list answer in the semantics. However, one might argue that these facts can be explained away in the pragmatics. Perhaps questioners have learned to exploit the tendency of answerers to give elaborative responses, and this has become conventionalized to such a degree that prior knowledge of the strongest true answer is immaterial. And perhaps the addition of *between them* somehow precludes this conventionalized usage. As we will see in the next section, however, data from question-embedding poses a significant challenge to proposals of this type.

Question-embedding removes pragmatic strategies. We can isolate these problems from pragmatic effects by considering cases where the question is embedded. Certain question-embedding verbs, such as *wonder* or *discover*, only produce a true and felicitous proposition if their subject lacks complete knowledge of the embedded question's strongest true answer. (Roelofsen and Uegaki, 2016; Spector and Egré, 2015) When that answer is known, infelicity or falsity results. For example, neither proposition in (15) is true and felicitous in (11), since the assistant coach already has complete knowledge of the players' identities.

15. (a) #The assistant coach wonders who the players are.
    (b) #The assistant coach will discover who the players are.

Both examples in (16), then, imply ignorance of the strongest true answer to (10a). If the cumulation-only account holds, this answer is already known to the assistant, which should result in the falsity or infelicity of the examples in (16). Yet both of these can be true and felicitous in context!

16. (a) The assistant coach wonders which numbers the players picked.
    (b) The assistant coach will discover which numbers the players picked.

Crucially, the truth or falsity of (16a) and (16b) does not depend on the available pragmatic strategies; it is determined by the semantics of the embedded question. In essence, this embedding data presents the same prior knowledge problem discussed in the preceding section; however, in this case a pragmatic rescue is not possible.

This shows that the semantic answer to (10a) in context (11) must be stronger than the cumulative proposition expressed in (12b). I take this to confirm the hypothesis that the strongest true answer to (10a) is, in fact, the pair-list answer (10b).

4   Pair-list answers via dependent plurals.

Functional dependencies between plurals. How, then, is the pair-list reading derived? It is established that questions can receive functional answers, and pair-list answers have been

argued to form a subset of these. (Engdahl, 1980, 1986; Chierchia, 1993) This functional reading arises, in cases like (4) from Section 2.2, from a quantifier taking wide scope over the *wh*-item. This makes examples like (10a) seem slightly puzzling. After all, there is no overt quantifier in this case. But as I will argue, the interaction of the two plurals gives us the quantification we need.

I propose that pair-list readings of QPDs arise from an anaphoric dependency between the plural definite in the question nucleus and the plural *wh*-item, analogous to the model of dependent definites developed by Winter (2000). In Winter's account, a structurally lower definite contains a covert syntactic variable bound by a distributive operator that accompanies a higher definite. This dependency is represented in (17) by T, "a contextually salient function from individuals to individuals mapping each soldier to a target". (Winter, 2000)

17. (a) The soldiers hit the targets.   (Winter, 2000)

    (b) $\forall x[\text{soldier}(x) \rightarrow \text{hit}(x, T(x))]$

Note that this representation does contain a universal quantifier, which originates from a distributivity operator D attached to the subject. This operator binds the lower definite, as illustrated in (18).

18. [[the soldiers] D_1] [hit [the targets(x_1)]]   (Winter, 2000)

Winter deals with declaratives, but there is no reason *prima facie* this structure cannot occur in questions as well. In QPDs, then, the *wh*-marked object behaves as Winter's dependent definites do, and is bound by the distributivity operator attached to the plural definite subject. *Wh*-movement then yields abstraction over the dependency function, resulting in a Hamblin set like (19a) that varies over functions from individuals to individuals. Pair-list answers are thereby derived in the semantics. In context (11), this Hamblin set contains exactly one true proposition, (19b), which is based on the dependency function in (19c). This unique true member is equivalent to the pair-list answer (10b).

19. (a) Hamblin set: $\{\forall x[\text{player}(x) \rightarrow \text{picked}(x, F(x))] \mid F : D \rightarrow \{1, 2, 3, 4, 5 \ldots\}\}$

    (b) Strongest true answer: $\forall x[\text{player}(x) \rightarrow \text{picked}(x, F'(x))]$

    (c) $F' = \{\langle \text{Ann}, 1 \rangle, \langle \text{Ben}, 2 \rangle, \langle \text{Chris}, 3 \rangle, \langle \text{Dan}, 4 \rangle, \langle \text{Emma}, 5 \rangle\}$

This produces a structure that is, in fact, quite similar to questions with overt quantifiers. Ultimately, pair-list answers in both cases are derived by placing the universal quantifier and the *wh*-item in the same relative scope.[5]

Two strategies are needed for QPDs. Note that the evidence presented here does not do away with the cumulation-and-elaboration strategy! Cumulative answers are obviously still possible, and answerers may certainly give elaborative responses that communicate additional information not encoded in the strongest true Hamblin answer. Examples (6-7) in Section

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[5]As this system ultimately depends on the relative scope of, and a binding relationship between, a quantifier and a structurally low DP, it inherits some issues found in other scope/binding analyses of similar phenomena. One of these, as a reviewer has brought to my attention, is the lack of pair-list readings under negative quantification. For example, the following question cannot mean "give me a list containing each student and the corresponding exam which that student cannot fail":

  i. Which exam(s) must no student(s) fail?

2, which cannot be produced by a dependency parse, clearly demonstrate the need for the cumulation-and-elaboration strategy.

However, this strategy must coexist with another, one that is capable of deriving pair-list Hamblin answers. This is the role of the dependency strategy.[6] Absent context, any arbitrary QPD will have two parses, one deriving a pair-list answer, and the other deriving a cumulative answer (which can then be elaborated upon).

5   Confirmed predictions

Emergence of subject-object asymmetries.   Subject-object asymmetries are, as noted in Section 2, a hallmark of canonical pair-list questions. To reiterate: pair-list questions require the universal quantifier to c-command the base position of the *wh*-item. When this is not possible (i.e., when the *wh*-item is the subject and the universal quantifier is contained within the object) pair-list readings become unavailable due to weak crossover effects.

The dependency model, like any other scope/binding analysis, should be display these asymmetries. This prediction is borne out—compare (20a), which in context (11) lacks a pair-list reading, with example (10a) from Section (3).

20. (a) Which players picked the numbers?

    (b) #Ann picked 1, Ben picked 2, Chris picked 3, Dan picked 4, Emma picked 5.

The *wh*-marked object in (10a) may be bound at its base position by the distributive operator accompanying the subject, but no such binding relationship is possible when, as in (20a), the distributive operator does not take scope above the *wh*-item.

The reason that these subject object asymmetries in QPDs have so far gone unnoticed, I ascribe to the many contexts in which a QPD could conceivably support either the cumulation-and-elaboration parse or the dependency parse. The asymmetries that arise from the dependency strategy can often be masked by the more permissive cumulation-and-elaboration strategy.

Restricted interpretation of numerals.   The cumulation-and-elaboration strategy and the dependency strategy diverge in the possible interpretations they allow for numeral modifiers. In contexts such as (11) where the cumulation-and-elaboration strategy is unavailable, numerals are interpreted as expected under the dependency strategy.

In the cumulation-and-elaboration strategy, numeral modifiers constrain the cardinality of the range of the entire cumulative relation. However, they do not directly constrain the possible elaborative responses that can be generated in the pragmatics. For example, (21a) has a Hamblin set of the form in (21b), where x must be a plural individual of women with exactly two atomic parts. Thus, the strongest true answer must map the two men to a group of two women. The answerer is then free to elaborate this cumulative answer into a pair-list response such as (21d), which maintains a range of cardinality two.[7]

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[6]See Beck and Sauerland (2000) for arguments that cumulation and dependency strategies coexist in declaratives as well.

[7]In many contexts, questions like (21a) may be ambiguous as to which parse is intended. For example, (21a) could also receive a scope/binding parse, in which case the answer is a pair-list mapping each man to two women:

 i. John likes Sue and Jane, and Bill likes Lisa and Amy.

However, it is not possible to give a cumulative answer, within which each man likes two women, for a total of

21. (a) Which two women do these men like?

    (b) Hamblin set: {**like(these men, x) : $x \in$ *{Sue, Jane, Lisa, Amy, ...} $\wedge$ x has two atomic parts}

    (c) Strongest true answer: **like(these men, Sue+Jane)

    (d) Elaborative response: John likes Sue and Bill likes Jane.

However, the dependency strategy differs in the interpretation it allows. In this case, the numeral constrains the cardinality of *each individual* in the range. Returning to the basketball team example, replacing "which numbers" in (10a) with "which five numbers" only permits the pair-list answer to map each player to a group of five numbers. If evaluated within context (11), (22) is in fact infelicitous, since it contradicts the presupposition that the players chose one number each.

22. *In context (11):*
    #Which five numbers did the players pick?

Evaluated in a neutral context, we see that this same question can only receive a response like (23b), that maps each player to a group of five numbers.

23. *In a neutral context:*

    (a) Which five numbers did the players pick?

    (b) Ann picked 1-5, Ben picked 6-10...

    (c) #Ann picked 1, Ben picked 2, Chris picked 3, Dan picked 4, Emma picked 5.

6 An unresolved puzzle

Modifying (10a) by making *numbers* singular instead of plural, as shown in (24), causes the pair-list answer to disappear. Setting aside any context, (24) can only be felicitously answered by a proposition that maps the group of players to a single number. As discussed in Section 2.2, this has been interpreted as a signature of cumulation.

24. (a) Which number did the players pick?

    (b) #Ann picked 1, Ben picked 2, Chris picked 3, Dan picked 4, Emma picked 5.

    (c) The players picked 1.

Although I cannot yet offer a complete answer, I will make two observations about this fact. First, this phenomenon is not limited to the domain of questions. A parallel constraint appears with demonstratives. In a suitable context, (25a) can be read as expressing a proposition equivalent to the pair-list answer (10b)[8], while (25b) cannot.

25. (a) The players picked these/those numbers.

_____

four women between them:

ii. #These men like Sue, Jane, Lisa, and Amy.

[8](25a) could even serve as an answer to the assistant coach's question in context (11); for example, if the head coach uttered (25a) as she was in the process of handing the assistant coach a written list of the player-number pairs.

(b) #The players picked this/that number.

The second observation I offer is that there appears to be some inter-speaker variation with respect to the judgments expressed in (24). The prevailing view agrees with the the literature: that (24c) is a felicitous answer to (24a), while (24b) is not. However, two of the approximately ten native speakers of North American English with whom I have discussed this data find both answers in (24) to be felicitous. That is, for a (presumed) minority of speakers, pair-list answers to (24a) are readily available.

How do we make sense of this data? It's possible that some kind of dynamic plural logic might resolve this puzzle.[9] For example, the inter-speaker contrast with respect to (24b) might be described in the PCDRT system of Brasoveanu (2008) as a contrast in whether the singular morphology is interpreted as discourse-level or domain-level atomicity. In the former case, there must exist only one atomic number in the total *picking* relation, giving rise to the infelicity of (24b). In the latter case, there must exist only one atomic number in each mapping within the *picking* relation, in which case (24b) is a felicitous response. At present, however, I cannot offer a full account of these facts.

7   Conclusion

Pair-list answers to QPDs may be available even when cumulative answers are contextually precluded. This contradicts the cumulation-only analysis, lending support instead to a model of QPDs wherein two distinct pathways for deriving pair-list responses are available. One is the cumulation-and-elaboration approach of Dayal (1992, 1996) and Krifka (1992). The other, I argue, arises from an anaphoric dependency, akin to the system described by Winter (2000). Both cumulation and dependency strategies are necessary to reach a complete description of questions with plural definites.

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[9]Thank you to my reviewers for suggesting this approach.

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