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Pair-list answers to questions with plural definites*

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Abstract Questions with plural definites (QPDs) can receive responses that take the form of a pair-list. Following Dayal (in Srivastav 1992, Dayal 1996) and Krifka (1992), these are generally treated not as genuine pair-list answers, but as pragmatically-motivated elaborations on underlyingly cumulative answers. I present new evidence against this view: pair-list answers can be available even in the absence of a corresponding felicitous cumulative answer. I argue that the pair-list form of such answers must be represented in the semantics, and that QPDs must permit both the "cumulation-and-elaboration" strategy and a genuine pair-list parse.

Keywords: pair-list answers, questions, plurals, definites, cumulation

1 Introduction

Questions with plural definites (henceforth QPDs) have long been known to allow for pair-list responses (Groenendijk & Stokhof 1984, Pritchett 1990). For example, (1a) may elicit (1b).

(1) a. Who do the students like?
    b. Ann likes Professor Jones and Ben likes Professor Smith.

My use of the term "response" here is intentional. It has been debated whether (1b) truly is an *answer* to (1a), in the sense that an answer is generated in the semantics, with a direct and predictable correspondence between

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its content and the semantics of the question that elicits it. The term *response*, on the other hand, I use atheoretically to describe anything said in reply to a question, whether or not there is a direct link to the question's content. This distinction in terminology foreshadows the central question of this paper: do pair-list responses to QPDs have the status of *answers*?

The leading account in the literature, proposed independently by Dayal (in Srivastav 1992, Dayal 1996) and Krifka (1992), argues that they do not.[1] Instead, these authors put forward what I refer to herein as the "cumulation-only hypothesis", which holds that QPDs only receive answers that encode cumulative relations. Such relations hold between two (usually plural) individuals, such that every part of the first individual relates to some part of the second, and every part of the second relates to some part of the first. This can be represented by applying the **-operator (see Krifka 1986, Sternefeld 1998, Beck & Sauerland 2000) to the main predicate, resulting in a logical form as in (2).

(2) $$^{**}p(X,Y) = \forall x[x \in X \rightarrow \exists y[y \in Y \wedge p(x,y)]] \wedge \forall y[y \in Y \rightarrow \exists x[x \in X \wedge p(x,y)]]$$

Beyond this, cumulative relations convey no information about how the atomic parts of the two pluralities relate to one another. Responses like (1b), which communicate just such information, must therefore arise in another way. The pair-list form of such responses is treated by Dayal and by Krifka as the result of a pragmatic strategy, by which an answerer may contribute extra information (such as mappings between individuals) that was not expressly asked for. That is, pair-list responses to QPDs are treated as over-informative elaborations on cumulative semantic answers.

(3) Who do the students like? — *Question*
↓
The students like Prof. Jones and Prof. Smith. — *Semantic answer*
↓
Ann likes Prof. Jones and Ben likes Prof. Smith. — *Over-informative elaboration*

In Section 2, I give a more detailed illustration of this "cumulation-and-elaboration" strategy, and I discuss the evidence cited in favor of the cumulation-only hypothesis. Then, in Section 3, I present new data that calls that

1 See Dayal 2016 for a more recent presentation of this view.

hypothesis into question. I show that QPDs can receive pair-list responses even in contexts that do not support the cumulative answers on which they purportedly depend.

On this basis, I reject the cumulation-only hypothesis. The cumulation-and-elaboration pathway is necessary, but it cannot by itself account for the full range of behavior that QPDs show. Rather, I conclude that it must coexist with a genuine pair-list parse. I address the nature of this parse in Section 4, though I will not make detailed claims here about its exact semantic composition.

Section 5 discusses the central prediction of this two-parse view of QPDs, and shows two ways in which it is borne out: the pair-list parse shows subject-object asymmetries in *wh*-extraction (which are absent in the cumulative parse), and the pair-list and cumulative parses differ in what kinds of pluralities numeral modifiers are understood to measure. Section 6 concludes the paper.

2 Why cumulation-only?

I begin by reviewing the cumulation-only hypothesis put forward in Krifka 1992, Srivastav 1992, and Dayal 1996. Section 2.1 outlines the derivational pathway that this account relies on, which I refer to here as the "cumulation-and-elaboration" strategy. As we will see, this strategy is both useful and necessary, and there is no reason to doubt its availability. Section 2.2 discusses the claim that cumulation-and-elaboration is the *only* method by which pair-list responses to QPDs can be derived. It is this claim specifically that I will take issue with in Section 3.

2.1 Pair-list responses via "cumulation-and-elaboration"

As outlined in Section 1, the cumulation-and-elaboration pathway generates pair-list responses to QPDs by first deriving a cumulative answer, then elaborating on that answer for pragmatic purposes. I illustrate this using the question in (4) and the simplified scenario in (5), in which *the students* comprises the individuals Ann and Ben, the arrows indicate the relevant *liking* relationships, and the *liked* individuals consist in this case of Professors Jones and Smith.

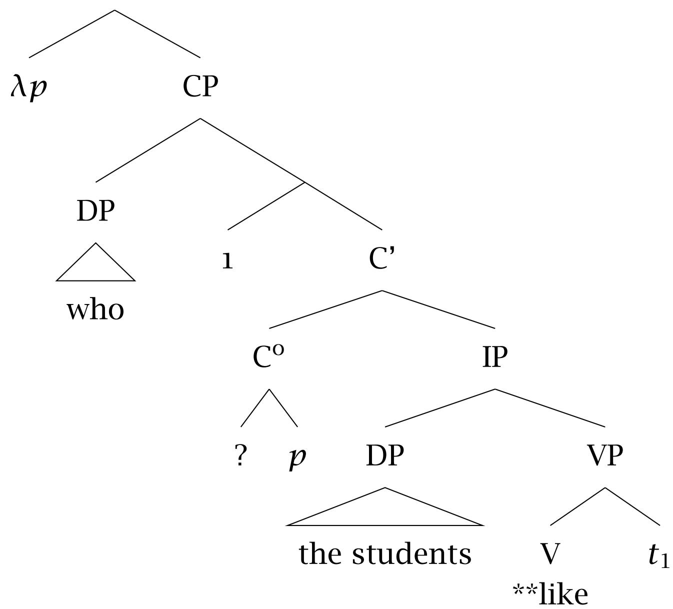
(4) Who do the students like? *Question*

(5) Ann ⟶ Jones *Scenario*

Ben ⟶ Smith

For concreteness, I assume a syntax and semantics in the style of Karttunen (1977), as updated by Heim (1994) and Fox (2012). This is shown in (6). *Wh*-movement of *who* results in abstraction over the group of *liked* individuals, and the question receives what can be called an "individual answer"[2]: that is, an answer that supplies the identity of the (atomic or plural) individual for which the *wh*-phrase stands in.

(6)



(7) $[\![\text{who}]\!] = \lambda f_{\langle e,t \rangle}.\exists x[\text{human}(x) \wedge f(x)]$

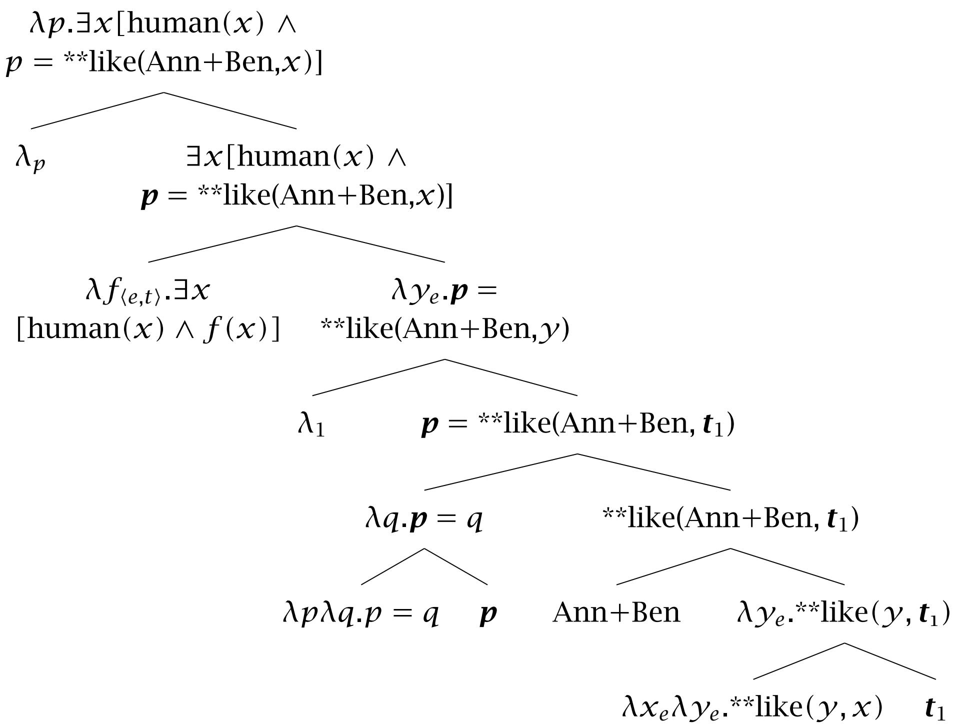
(8) $[\![?]\!] = \lambda p \lambda q.[p = q]$

The *wh*-item, in this case *who*, acts as an existential quantifier, receiving the denotation in (7). The question operator, represented here by ?, introduces a free variable into the question's semantics. Ultimately, this variable is abstracted over, to derive the characteristic function for the question's Hamblin set. The semantic composition is given in (9).[3]

2 The term "single-pair answer" is also sometimes used, to contrast with the notion of a pair-list answer.

3 I use boldface here to represent the interpretation of a free variable relative to a variable assignment. For example, $\boldsymbol{t}_1$ represents $g(t_1)$, the evaluation of the trace relative to variable assignment g.

(9)



This derives the characteristic function for the Hamblin set in (10). This Hamblin set is composed of propositions of the form determined by the question nucleus, varying over the value assigned to the trace of the *wh*-phrase.

(10) $\{{**}\text{like}(\text{Ann+Ben}, x) : x \in {*}\{\text{Jones, Smith, Brown, } \ldots\}\}$ *Hamblin set*

All possible answers to (4), then, will be propositions that express a cumulative *liking* relation between the group denoted by *the students* and some group of people. The only true answer, in the world described by (5) above, is given in (11). This is expressed using the **-operator as in (11a), which is equivalent to (11b).

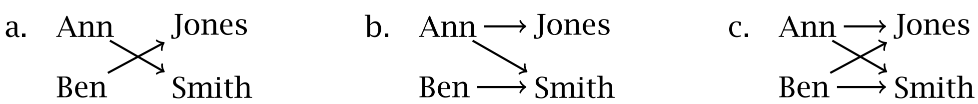
(11) The students like Prof. Jones and Prof. Smith. *Unique true answer*

a. **like(Ann+Ben, Jones+Smith)

b. $\forall x[x \in \{\text{Ann, Ben}\} \rightarrow \exists y[y \in \{\text{Jones, Smith}\} \wedge \text{like}(x, y)]] \wedge$
$\forall y[y \in \{\text{Jones, Smith}\} \rightarrow \exists x[x \in \{\text{Ann, Ben}\} \wedge \text{like}(x, y)]]$

However, (11) does not distinguish between (5) and various other possible worlds in which Ann and Ben like Jones and Smith, since it does not specify which particular students are mapped to which particular professors. For example, (11) is also true in all of the hypothetical scenarios schematized in (12).

(12)



Since the Hamblin set in (10) does not encode particular mappings, it cannot be the case that pair-list answers arise directly from such a Hamblin set. Instead, Dayal and Krifka divide the labor between the semantics and the pragmatics. An answerer may (in a suitable pragmatic context) choose to be over-informative, resulting in a pair-list response like (13).

(13) Ann likes Prof. Jones and Ben likes Prof. Smith. *Over-informative elaboration*

Note that no information expressed by the semantic answer is lost. The truth of (13) entails the truth of (11): the scenario described in (13) is still one in which Ann and Ben cumulatively like Professors Jones and Smith. The answerer is simply expressing additional information about specific individuals (which is presumably relevant in context).

There is empirical support for this approach in the distribution of the pair-list responses themselves. As noted by Chierchia (1991, 1993), pair-list readings of questions with overt quantifiers (like *every student* in the examples that follow) show a characteristic subject-object asymmetry.[4] When the *wh*-phrase is the object, as in (14), the question supports either an individual answer or a pair-list answer. When the *wh*-phrase is the subject, as in (15), only an individual answer can be given; a pair-list answer is not supported.[5]

4 The true empirical picture is more nuanced than this presentation suggests; Achimova, Déprez & Musolino (2014) provide experimental evidence that, although robust, the subject-object asymmetry is subject to variation, with some participants seeming to lack it entirely.

5 For Chierchia, the significance of this asymmetry is in the correlation it establishes between pair-list answers and functional answers. For example, the functional answer (i), which maps students to professors by the “advisee-of” function, is also infelicitous in response to (15a). For the present discussion, this is not strictly relevant; what’s important is the distinct behavior of canonical pair-list answers and over-informative elaborations.

i. #Their advisee likes every professor.

(14) a. Who does every student like?
b. Every student likes Professor Jones.
c. Ann likes Professor Jones, and Ben likes Professor Smith.

(15) a. Who likes every professor?
b. Ann likes every professor.
c. #Ann likes Professor Jones, and Ben likes Professor Smith.

QPDs, on the other hand, do not obviously show this asymmetry. As shown in (16–17), it does not seem to matter whether the *wh*-phrase is the subject or the object. A pair-list answer is possible in either case.

(16) a. Who do those students like?
b. They like Professor Jones and Professor Smith.
c. Ann likes Professor Jones, and Ben likes Professor Smith.

(17) a. Who likes those professors?
b. Ann and Ben like them.
c. Ann likes Professor Jones, and Ben likes Professor Smith.

If one assumes the pair-list answers in (16c) and (17c) to be derived via the same mechanism as those in (14c) and (15c), this behavior is surprising. The cumulation-and-elaboration pathway, however, predicts this behavior: neither the cumulative answer (that is the source of elaboration) nor the pragmatic factors that bring about the elaboration should be sensitive to the relative structural position of the *wh*-marked and non-*wh*-marked arguments.

Before moving on, I would like to note that, in addition to the empirical arguments, the cumulation-and-elaboration pathway is essentially self-evident. QPDs clearly permit cumulative readings. Likewise, the appeal to the pragmatics is quite natural; answerers can easily alter the presentation of their responses for a variety of reasons, including awareness of the questioner's intent or background knowledge. It is difficult to imagine how, under the correct pragmatic conditions, such a strategy could fail to be available.

2.2 Cumulation is the *only* source for pair-list responses

In addition to proposing the cumulation-and-elaboration strategy, both Krifka and Dayal take things one step further. They argue that this is the *only* way in which QPDs can receive pair-list responses, and that no derivation exists that can derive genuine pair-list answers to QPDs.

Key evidence for this view comes from what I refer to as the "number effect" observed in questions containing definite DPs. Such questions only receive pair-list answers when both the *wh*-item and the definite within the question nucleus are plural. (18a), where both *professors* and *students* are plural, can readily receive either the individual answer (18b) or the pair-list reponse (18c).

(18) a. Which professors do the students like?
b. They like Professor Jones and Professor Smith.
c. Ann likes Professor Jones, and Ben likes Professor Smith.

However, when either of the two DPs is singular, the pair-list response becomes infelicitous. Questions like those in (19) and (20) must receive individual answers.

(19) a. Which professor do the students like?
b. They like Professor Jones.
c. #Ann likes Professor Jones, and Ben likes Professor Smith.

(20) a. Which professors does the student like?
b. She likes Professor Jones and Professor Smith.
c. #Ann likes Professor Jones, and Ben likes Professor Smith.

The cumulation-and-elaboration pathway is predicted to show this number effect, as it follows from the nature of cumulation. (19b) can be represented using the **-operator as in (21a), but the resulting logical form is a universal statement: both Ann and Ben must like the same (unique) atomic individual.

(21) a. **like(Ann+Ben, Jones)
b. $\forall x[x \in \text{Ann+Ben} \rightarrow \exists y[y \in \text{Jones} \wedge \text{likes}(x, y)]] \wedge$
$\forall y[y \in \text{Jones} \rightarrow \exists x[x \in \text{Ann+Ben} \wedge \text{likes}(x, y)]]$

The usual uncertainty about specific mappings, as found with cumulative relations between two pluralities, is eliminated. And with it, we also eliminate the motivation for giving an elaborative pair-list response rather than a (semantic) answer.

In short, pair-list responses to QPDs appear to coincide precisely with those cumulative relations that allow for some uncertainty in their underlying mappings. This is further evidence in favor of the cumulation-and-elaboration strategy, but more importantly, it suggests that no alternative strategy exists. The chief candidate for such an alternative is a canonical pair-list parse, as observed in multiple-*wh* questions or questions with overt quantifiers. Yet these pair-list questions do not appear sensitive to number-marking in the same way. For example, (22a) is not limited to the individual answer in (22b); it can easily receive the pair-list answer (22c), despite the singular marking on both subject and object.

(22) a. Which professor does every student like?
b. Every student likes Professor Jones.
c. Ann likes Professor Jones, and Ben likes Professor Smith.

Were such a parse available in either (19) or (20), it would presumably supply the “missing” pair-list answers in (19c) and (20c). The number effect would still hold of the cumulation-and-elaboration pathway, but it would be masked by the number-insensitive pair-list parse. The fact that the number effect *is* observed, then, is taken as evidence that QPDs do not allow a pair-list parse at all.

3 Cumulative answers are not strong enough

While Dayal (Srivastav 1992, Dayal 1996) and Krifka (1992) establish that a cumulation-and-elaboration strategy is both possible and desirable in certain cases, I will present new empirical evidence that this cannot be the only source of pair-list responses to QPDs. The primary observation that I will make in this section is that pair-list answers to QPDs do not always depend on cumulative answers. That is, QPDs can be felicitous and receive pair-list responses even in contexts where the question meaning that arises from a parse with cumulative predication is infelicitous. This behavior is observed both in matrix questions and with embedded QPDs, which shows that the pair-list interpretation must be encoded in the semantics, and not merely arise from some pragmatic strategy.

This evidence points to the availability of a genuine pair-list parse for QPDs. But importantly, the availability of such a parse does not rule out the cumulation-and-elaboration pathway described in Section 2.1. Rather, I argue that the two strategies must coexist.

I begin by considering a context in which a QPD might receive a pair-list response. In (23), the members of a basketball team have each chosen a differently-numbered jersey.

(23) Context: A basketball team's head coach had five jerseys made, numbered 1-5. From these, each of the team's five players chose exactly one jersey. The assistant coach (the questioner) knows all five players, knows the numbers that were available, and believes that each player chose exactly one jersey.

In this context, the assistant coach might naturally ask (24), and this might elicit from the head coach a response like (25), which takes the form of a pair-list. (Assume that (25) is an accurate representation of the players' choices in context.)

(24) Which numbers did the players pick?

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

The felicity of this exchange is problematic for the cumulation-only account. Recall that under that account, (24) must be interpreted cumulatively and receive a Hamblin set of the form shown in (26). The propositions in this set vary only in the identity of the group of numbers. Of these, (27) is the only true member in context; it relates the players to exactly the five numbers that were chosen.

(26) $\{{**}\text{picked}(\text{the players}, x) : x \in {*}\{1, 2, 3, 4, 5 \dots\}\}$

(27) **picked(the players, 1+2+3+4+5)

However, the context in (23) establishes that the questioner (the assistant coach) already believes (27) to be true (i.e., they believe that the numbers the players chose were 1–5). Information-seeking questions are generally infelicitous when the complete true answer is known to the questioner (including when the proposition expressed by that answer is already in the common ground). For example, the assistant coach could not felicitously ask either of the questions in (28), since the identities of the players and numbers are already common knowledge.

(28) a. #Who are the players?
b. #What numbers were picked?

In short, the cumulation-only hypothesis wrongly predicts the asking of (24) to be as infelicitous as the asking of (28a-b) in context.

The predicted behavior can be brought out under particular circumstances; for example, an adverbial expression like *between them* can disambiguate toward a cumulative reading of the question. This leads to the expected infelicity, as the modified question in (29) can only be construed as asking for the identity of the numbers chosen.

(29) #Which numbers did the players pick between them?

But in the general case, this prediction is incorrect. The felicity of (24) in context suggests that its strongest true answer (i) is not known to the questioner, and (ii) must in this case be a logically stronger proposition than the weak cumulative (27), which the questioner does know. The obvious candidate for such an answer is one that encodes the pair-list form of the response directly in the semantics.

Given what we have seen thus far, there may yet be some hope of preserving the cumulation-only analysis by offering a stronger claim about the role of the pragmatics. For example, one might perhaps claim that the cumulation-and-elaboration strategy has become conventionalized to such a degree that speakers use QPDs with the express goal of eliciting an elaboration, and the conventional content of the question is no longer strictly relevant. However, this sort of hypothetical modification cannot account for the parallel behavior of embedded QPDs.

Certain question-embedding verbs, such as *wonder* or *discover*, only produce a true and felicitous proposition if their subject lacks (or previously lacked) complete knowledge of the embedded question's strongest true answer (e.g., Spector & Egré 2015, Roelofsen & Uegaki 2016). When that answer is (or already was) known, falsity or infelicity results. For example, neither proposition in (30) is true and felicitous in context (23), since the assistant coach already has complete knowledge of the players' identities.

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

In contrast, both examples in (31) are true and felicitous in context. These convey the subject's ignorance of the strongest true answer to the embedded question (which, in this case, is the same question found in example (24) above). Crucially, *wonder* and *discover* should not be sensitive to pragmatic strategies that might surround the embedded question in some hypothetical non-embedded usage. Rather, the acceptability of these examples must be attributed to the embedded question's conventional semantic content. Just as before, the answer to (24) must be stronger than the weak cumulative proposition already known to the question-asker.

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

Note also that (31a–b) are subject to the same cumulative/pair-list ambiguity seen for non-embedded QPDs. A cumulative construal of the embedded question is in principle available for both (31a-b), though this gives rise to a sentence that is false or infelicitous in context, as the assistant coach is not ignorant of the identity of the numbers. Just as before, *between them* can be used to disambiguate to this reading, with (32) showing the expected falsity or infelicity.

(32) #The assistant coach wonders/will discover which numbers the players picked between them.

As the data in this section shows, QPDs can receive genuine pair-list answers, whether they serve as matrix or embedded questions. These examples cannot be explained by the cumulation-and-elaboration pathway, and show the need for a genuine pair-list parse. To account for this pattern, I claim here that QPDs have two possible parses. One results in the cumulative examples (29) and (32) that are infelicitous/false in the current context; the other results in the well-formed pair-list examples (25) and (31).

The rest of the paper explores the consequences of this two-parse model. The cumulation-and-elaboration strategy requires no explanation beyond that given in Section 2.1, but in Section 4 I will address the semantics of the pair-list parse. Section 5 then discusses two predicted differences between the cumulative and pair-list parses.

4 Pair-list answers in the semantics

The overall lesson from Section 3 is that, in additional to cumulative individual answers, QPDs must be able to receive true pair-list answers. I take these to result from two distinct parses: a cumulative parse subject to possible elaboration, just as argued for by Dayal (in Srivastav 1992, Dayal 1996) and Krifka (1992), and a genuine pair-list parse. But what does this pair-list parse look like?

Pair-list answers to other question types (i.e., questions with overt quantifiers and multiple-*wh* questions) have received a variety of analyses in the literature. These can generally be divided into two main lines of thinking.[6] The first of these, the "family of questions" approach, involves quantification over a set of single-pair questions, from whose individual answers the pair-list answer is composed (Hagstrom 1998, Krifka 2001, Willis 2008, Fox 2012, Nicolae 2013, Kotek 2014). In these analyses, the semantics first creates an individual question, then asks that question of every individual in the relevant domain. In contrast, the "function-based" approach involves a functional dependency between two sets of individuals, which can be spelled out pointwise in the form of a pair-list (Engdahl 1980, 1986, Chierchia 1991, 1993, Dayal 1996, 2016, Xiang 2016, Abels & Dayal 2021). This relies on the semantics providing or establishing such a dependency, and offers a natural link between the properties of pair-list and functional answers.[7]

I hypothesize that under either type of theory, the plural definite can be made to participate in logical forms isomorphic to those found in canonical pair-list questions (modulo the internal structure of the DP). In a conservative extension of the family-of-questions approach, the plural definite must take wide scope relative to the *wh*-item, as do overt quantifiers in pair-list questions with quantifiers (or the second *wh*-item in multiple-*wh* questions). In a similar extension of the function-based approach, the plural definite must be able to participate in the functional dependency, which again relies on the it taking wide scope relative to the question nucleus, as quantifiers or *wh*-items do in other types of pair-list question. Of course, the present discussion abstracts away from the specific details of these various theories — I leave it for others to determine, on a theory-by-theory basis, whether more preferable alternative hypotheses might exist.[8]

6 Other recent proposals include works from the inquisitive semantics framework, which derive pair-list answers from straightforward quantifier raising (Qing & Roelofsen 2022) or the application of dynamic logics (Dotlačil & Roelofsen 2020, Li 2021), as well as other works making use of dynamic logics (e.g. Bumford 2015).

7 See footnote 5 above.

8 One possible alternative comes from Xiang (2023). In response to Johnston (2019), Xiang suggests that although pair-list answers to QPDs do encode a functional dependency, it is of a different sort than that found in pair-list questions with overt quantifiers, arising instead from *respective* distributivity (see Gawron & Kehler 2004, Chaves 2012, Law 2019). Xiang's approach remains compatible with the central claim of this paper: that QPDs receive their pair-list interpretations in the semantics.

5 Predictions

Under the two-parse model argued for in Section 3, a QPD can receive either a pair-list parse (which shares a uniform logical form with canonical pair-list questions) or a cumulative parse (which can then be elaborated on). This predicts certain differences between the output of the two parses: namely, the first is expected to consistently show the effects of distributive quantification, while the second is expected to show semantic signatures of cumulation (despite its pair-list surface form).

In this section, I show two ways in which this prediction is borne out. First, the pair-list parse is expected to show the same subject-object asymmetries as found in other types of pair-list questions, which are notably absent in the cumulative parse. Second, numeral modifiers in QPDs are expected to apply to different pluralities in the underlyingly distributive and underlyingly cumulative cases.

5.1 Subject-object asymmetries in QPDs

Recall from Section 2.1 that canonical pair-list answers are associated with distinctive subject-object asymmetries: when the *wh*-item is the object, as in (33), a pair-list answer is possible, but when it serves as the subject, as in (34), pair-list answers are unavailable.

(33) a. Who does every student like?
b. Ann likes Professor Jones, and Ben likes Professor Smith.

(34) a. Who likes every professor?
b. #Ann likes Professor Jones, and Ben likes Professor Smith.

If QPDs can receive a genuine pair-list parse, as I have claimed, then we might expect to find similar asymmetries in QPDs. However, Dayal (in Srivastav 1992, Dayal 1996) and Krifka (1992) have claimed that QPDs lack such structural sensitivity, as demontrated by examples like (35–36).

(35) a. Who do those students like?
b. Ann likes Professor Jones, and Ben likes Professor Smith.

(36) a. Who likes the professors?
b. Ann likes Professor Jones, and Ben likes Professor Smith.

This behavior is consistent with the availability of the cumulation-and-elaboration strategy, but it does not necessarily rule out the existence of alternative strategies. Of the two strategies that I argue for here, cumulation-and-elaboration is the more liberal: it readily derives a response of the observed pair-list surface form regardless of which argument is *wh*-marked. This masks the infelicity that the pair-list reading of (36) is expected to show.

This confound can be removed, however, by once again excluding the cumulative reading. For this, I adopt the same context (23) from Section 3. In this context, with only the pair-list parse available, the predicted asymmetry emerges. Example (37), with its *wh*-marked object, forms a felicitous pair-list question. In the same context, (38), with its *wh*-marked subject, is infelicitous.

(37) Which numbers did the players pick?

(38) #Which players picked the numbers?

(38) can only be understood as a question about the identity of the group of players. This is already known to the questioner, which results in infelicity. And this is precisely as expected if the pair-list parse is subject to the same asymmetry found with pair-list questions with overt quantifiers. This can only be observed, however, when the more flexible cumulation-and-elaboration pathway is not available. That is, the infelicity of (38) arises only when neither of the two parses can generate a felicitous pair-list response.

5.2 Numeral modifiers in QPDs

The two parses are also predicted not to interact differently with certain modifiers. In particular, numeral modifiers within the plural definite DP should be interpreted as measuring different pluralities in the two cases: in the pair-list parse, the numeral constrains the number of individuals within each separate mapping, while in the cumulative parse, the numeral constrains the total number of participants. This prediction is borne out, as we will see from the examples below.

First, consider the modified context in (39), where each player is now assumed to have chosen exactly two numbers. Here, a questioner might ask (40), eliciting an answer like (41).

(39) Context: A basketball team's head coach had ten jerseys made, numbered 1–10. From these, each of the team's five players chose exactly two jerseys, an even-numbered jersey for home games and an odd-numbered jersey for away games. The assistant coach (the questioner) knows all five players, knows the numbers that were available, and believes that each player chose exactly two jerseys.

(40) Which two numbers did the players pick?

(41) Ann picked 1 and 10, Ben picked 2 and 3, Chris picked 4 and 7, Dan picked 5 and 6, Emma picked 8 and 9.

The semantic contribution of the numeral modifier *two* is consistent with a pair-list reading of (40): here, *two* constrains the cardinality of the second element in each pair. That is, the pair-list answer in (41) maps each player to a group of two numbers.[9]

The answer in (41) cannot be derived from (40) via the cumulation-and-elaboration pathway. After all, if we were to treat (41) as an over-informative elaboration, what sort of cumulative proposition must it arise from? In this case, one that describes a cumulative relation between the group of players Ann, Ben, Chris, Dan, and Emma and the group of numbers 1–10. But a cumulative interpretation of (40) would not give rise to such an answer; its Hamblin set (given in (42)) consists only of propositions that involve groups of exactly two numbers. That is, there is no possible source for the putative elaboration in (41).

(42) $\{{**}\text{picked}(\text{the players}, x): x \in {*}\{1, 2, 3, 4, 5 \ldots\} \wedge |x| = 2\}$

Correspondingly, the same *between them* test as in Section 3 results in the expected infelicity of the now-cumulative example (43).

(43) #Which two numbers did the players pick between them?

For these reasons, it is clear that the behavior of the numeral modifier *two* in (40) is consistent with the pair-list parse and not with the cumulative parse.

9 This is exactly the same interpretation as we observe for numeral modifiers in pair-list questions with overt quantifiers, for example (i).

i. a. Which two numbers did each/every player pick?

b. Ann picked 1 and 10, Ben picked 2 and 3 …

Conversely, there are examples in which the interpretation of the numeral is consistent only with the behavior of the cumulative parse. For example, the further-modified context in (44) describes a scenario in which ten jerseys were chosen, but the questioner does not have prior knowledge of their identities. Here, the questioner might felicitously ask (45), eliciting either of the responses in (46).

(44) Context: A basketball team's head coach got out a large crate of jerseys with various numbers. From these, each of the team's five players chose exactly two jerseys, an even-numbered jersey for home games and an odd-numbered jersey for away games. The assistant coach (the questioner) knows all five players and believes that each player chose exactly two jerseys, but has no information about what jersey numbers were available.

(45) Which ten numbers did the players pick?

(46) a. They picked numbers 1–10.
b. Ann picked 1 and 10, Ben picked 2 and 3, Chris picked 4 and 7, Dan picked 5 and 6, Emma picked 8 and 9.

The semantic contribution of the numeral modifier *ten* in (45) is consistent with the cumulative parse; it constrains the total size of the group of jerseys. The unique true answer to (45) is given by (46a), which simply expresses the identity of the jerseys that were chosen. Assuming the answerer judges it useful to do so, this answer can be elaborated into the pair-list response in (46b). There is no direct relationship between the numeral modifier *ten* and the cardinality of numbers in each pair, as would be expected of the pair-list parse.

The two-parse model neatly predicts the ambiguity that examples (40) and (45) highlight. In the cumulation-and-elaboration strategy, the numeral modifier constrains the underlying cumulative relation, and thus the total number of individuals that can be involved across the entire pair-list. In the pair-list parse, the numeral modifier constrains the number of individuals in each pair, but makes no comment on the total number across the entire pair-list answer.[10]

10 In function-based approaches, the pair-list parse can be understood as describing a function into groups of cardinality *n*. In family-of-questions approaches, the pair-list parse could be understood to involve a witness set (see e.g., Nicolae 2013) that contains groups of cardinality *n*.

6 Conclusion and Discussion

In this paper, I presented new evidence against the cumulation-only analysis of questions with plural definites (Srivastav 1992, Dayal 1996, Krifka 1992). Instead, I argued that pair-list responses to QPDs are ambiguous between two possible derivations: one following the cumulation-and-elaboration pathway described by Dayal and Krifka, the other deriving true pair-list answers in the semantics. The current proposal accounts for the key observation that pair-list answers to QPDs are possible even when cumulative answers are unavailable. It also makes two correct predictions: first, that subject-object asymmetries found in canonical pair-list questions should also be found in (the pair-list parse of) QPDs, and second, that certain numeral modifiers within QPDs are ambiguous in their interpretation.

While this view is consistent with the data presented in Section 3, it raises a thorny question that I must now address. Recall the "number effect" discussed in Section 2.2, under which pair-list answers to QPDs appear to rely on the plurality of both arguments. Examples like (19), repeated here, were cited as key evidence for the cumulation-only hypothesis, as the unavailability of pair-list responses like (19c) is predicted by the nature of cumulation.[11]

(19) a. Which professor do the students like?
b. They like Professor Jones.
c. #Ann likes Professor Jones, and Ben likes Professor Smith.

Under the two-parse model, however, the empirical picture is more complex: this number effect must be taken to follow from *both* available parses. It's clear that the cumulation-and-elaboration pathway is still compatible with the observed number effect; nothing has changed there. But what of the pair-list derivation?

No pair-list response is possible in (19), so the pair-list parse must also be unavailable for some reason. But it's unclear why the pair-list parse is unavailable, given that canonical pair-list questions, as in (47), are perfectly compatible with singular-marked arguments.

(47) a. Who does every student like?/Which professor does which student like?
b. Ann likes Professor Jones, and Ben likes Professor Smith.

11 Although generally accepted in the literature, the judgment in (19c) may not actually hold for all English speakers. See discussion of examples (50–51) below.

Although I cannot offer a complete explanation here, I will make two observations about this fact. First, this phenomenon is not limited to the domain of questions. Parallel behavior appears in declaratives, with plural marking on demonstratives and on bound pronouns. In a suitable context, (48a) can be read as expressing a proposition equivalent to the pair-list answer (25)[12], while in (48b), the singular demonstrative can only be understood as referring to an atomic number.

(48) a. The players picked these/those numbers.
b. #The players picked this/that number.

Likewise, (49a), which contains a bound, plural-marked pronoun, has a reading where each boy thinks he himself is brilliant. In contrast, the singular-marked pronoun in (49b) must refer to an atomic boy.

(49) a. The boys think they are brilliant.
b. #The boys think he is brilliant.

It may be the case that plural marking is merely a signature of the binding relationship in these examples, and this line of thinking might extend to QPDs under the "function-based" family of analyses outlined in Section 4.[13] Under the "family of questions" analyses, however, an alternative explanation must be sought.

The second observation I offer is that there may be some variation with respect to the judgments surrounding the number effect in QPDs. Most speakers judgments agree with those presented in previous literature, even when controlling for the presence of two possible parses. Assuming once again the context in (23), (50) is judged to be compatible with a pair-list interpretation, while (51) is generally not. However, a handful of speakers with whom I've discussed these examples find that both (50) and (51) can receive a pair-list interpretation.[14]

12 (48a) could even serve as an answer to the assistant coach's question in context (23); for example, if the head coach uttered (48a) while handing the assistant coach a written list of player-number pairs.

13 Winter (2000), who discusses binding in so-called "co-distributive" (i.e., functional) readings of declaratives, observes a similar pattern. Such functional readings are available either with plural definites, or with the combination of a singular definite and overt quantifier, but they are not attested when a singular definite lacks an overt quantifier.

14 Although I mark (51a–b) with %, this may only represent a small minority of English speakers. Three of the approximately twelve speakers with whom I've discussed this data have judged

(50) a. Which numbers did the players pick?
b. Ann picked 1, Ben picked 2 …

(51) a. %Which number did the players pick?
b. %Ann picked 1, Ben picked 2 …

For such speakers, (51b) represents a genuine pair-list parse, not only due to contextual factors but also because, as illustrated in Section 2.2, the cumulation-and-elaboration pathway cannot derive a pair-list response in this case.

Under a family of questions analysis of QPDs, which as I suggest in Section 4 may rely on covert distribution, the variability in judgments in (51) may reflect variable ease of access to covert distributive interpretations. Experimental evidence (see Champollion 2020) indicates that even when available, covert distributive interpretations are generally dispreferred, and that nondistributive interpretations remain more easily accessible. Perhaps covertly distributive readings are accessible in both (50–51), but are in some way facilitated by the plural marking of (50) and/or hindered by the singular marking in (51).[15]

Taken together, the parallels to demonstratives and bound pronouns and the variable judgments in (51) suggest that the number effect in QPDs is perhaps only one aspect of a broader phenomenon, one that is not confined to pair-list readings of QPDs. While not yet fully explained, the number effect should not be interpreted as evidence that QPDs necessarily receive cumulative answers.

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(51) to be a felicitous exchange. Experimental investigation of these judgments would be helpful, but is sadly beyond the scope of the present investigation. Until then, the judgments indicated in (51) should not be taken as definitive.

15 Depending on whether a particular function based approach requires covert universal quantification, we may expect the same trend in that family of analyses as well.

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