Pair-list answers from distribution*

William Johnston
McGill University

Abstract Although questions with plural definites (QPDs) such as *Who do these men like?* have long been observed to elicit pair-list responses, the current consensus is that the form of those responses is not encoded in the semantic content of the question. Instead, it is argued that answers to QPDs must be underlyingly cumulative, and the pair-list form of the response is a pragmatically-motivated elaboration (Dayal 1992, 1996, Krifka 1992). Here, I present new data that calls this treatment into question. I demonstrate that QPDs receive pair-list answers in cases where cumulative answers are either uninformative or incompatible with the context. With this evidence, I argue that observed pair-list answers can be encoded in the question's semantics, and that they arise when a QPD contains a distributive plural definite, giving rise to a semantics parallel to that found in questions with overt universal quantifiers. Further support for such a semantics comes from the emergence in QPDs of subject-object asymmetries, which are characteristic of pair-list answers to other types of questions, and from a correct prediction regarding the interpretation of numeral modifiers in QPDs.

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

Contact: william.johnston4@mcgill.ca
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1 Introduction

It has long been observed that questions with plural definites (QPDs) may receive pair-list responses (Groenendijk & Stokhof 1984, Pritchett 1990). For example, (1a) may elicit (1b).

(1) a. Who do these men like? (Dayal 2016)
b. John likes Sue and Bill likes Jane.

My use of the term "response" here is intentional. It is not clear whether (1b) truly is the *answer* to (1a), in the sense that an answer is generated in the semantics,

* Acknowledgements to be added.

with a direct and predictable correspondence between its content and the semantics of the question that elicits it. A *response*, on the other hand, describes anything that might be said in response to a question, which might incorporate information from the pragmatics, and might not have a direct link to the question's semantics.

The leading account in the literature, proposed independently by Dayal (1992, 1996) and Krifka (1992), promotes what I refer to herein as the "cumulation-only hypothesis". This holds that in the context of QPDs, the semantics is only capable of deriving answers that contain so-called cumulative relations. Such cumulative answers relate two groups, without specifying the relationships between individual members of those groups. Under this analysis, an answer to (1a) must simply provide a relation between the group denoted by *these men* and some group of *liked* individuals, and cannot encode information about specific mappings.[1]

Instead, (1b) is argued to be a pragmatically-motivated over-informative response. As illustrated in (2), the answer derived in the semantics is held to be "These men like Sue and Jane", which simply relates two groups. Given a suitable context, however, answerers may elaborate on this answer, supplying additional information (in this case, specific mappings from individual men to individual women).

(2) Who do these men like? *Question*

↓

These men like Sue and Jane. *Semantic answer*

↓

John likes Sue and Bill likes Jane. *Pragmatic response*

In this paper, I argue that there is a gap in our understanding of the cumulation-only hypothesis. This account claims that in the context of QPDs, *all* answers that do not encode cumulative propositions are unavailable. Yet there exist other cases where pair-list answers are argued to arise in the semantics. Questions with overt quantifiers, like (3a), are such a case. Various analyses have been developed to account for pair-list answers to such questions, including proposals by Engdahl (1980, 1986), Chierchia (1991, 1993) and Krifka (2001). The cumulation-only hypothesis can be read as a claim that such proposals do not also apply to QPDs.

(3) a. Which woman does every man like?
b. John likes Sue, and Bill likes Jane.

Here, I ask: is the cumulation-only hypothesis tenable? One common factor of the analyses of pair-list answers that I mention above is their reliance on a universal

1 As (1a) receives a cumulative interpretation, all possible answers (i.e., all well-formed members of its Hamblin set) must also receive a cumulative interpretation. (1b), along with any other response that encodes mappings between specific atomic individuals, cannot be a well-formed answer.

quantifier. These proposals can be easily adapted to QPDs, if we assume that a covert distributivity operator can effectively allow plural definites to behave as universal quantifiers do. Logical forms derived in this way appear well-formed under their respective analyses. My proposal that distributive QPDs can function like questions with overt quantifiers, which I will lay out in more detail in Section 2.3, is in opposition to the cumulation-only hypothesis. This tension might be resolved in one of two ways. If on the one hand, we wish to preserve the cumulation-only hypothesis, we must come to find some reason why adapting the pair-list derivation found in questions with quantifiers to the QPD context, as I have just suggested, cannot be done. On the other hand, it may be possible to demonstrate that the empirical picture is different than previously supposed, and that true pair-list readings are in fact present for QPDs. In this paper, I take the latter approach.

I argue that these plausible pair-list LFs are not merely plausible, but actually available. In Section 3, I demonstrate that the readings predicted by these LFs can be teased apart from those generated through the cumulation-and-elaboration pathway. With this new evidence, I argue that the cumulation-only hypothesis should be rejected, in favor of a model of QPDs allowing for a structural ambiguity between the cumulation-and-elaboration and pair-list pathways. In Section 4, I discuss two predictions of this analysis. First, the pair-list construal of QPDs is expected not be possible when the *wh*-item is in subject position. Second, the possible interpretations of numeral modifiers in QPDs are expected to fit into two distinct patterns, reflecting the underlying structural ambiguity. Both of these predictions are borne out.

Finally, I discuss the connection identified by Dayal and Krifka between pair-list responses to QPDs and plurality. Specifically, they observe that pair-list responses occur only when both subject and object are plurals, but not when either argument is singular. This behavior is a logical consequence of cumulation, and as such has been key evidence in favor of cumulation-only.

(4) a. Which women do these men like?
    b. John likes Sue and Bill likes Jane.

(5) a. Which woman do these men like?
    b. #John likes Sue and Bill likes Jane.

However, I argue that the number effect is a red herring. This effect is not tied to the cumulation-and-elaboration pathway, and parallel behavior appears in certain declarative sentences and certain instances of bound pronouns. Given its wide-ranging nature, I argue that this effect should not be thought of as evidence for cumulation-only.

2 Why cumulation-only?

I will begin by reviewing the cumulation-only hypothesis of Krifka (1992) and Dayal (1992, 1996). Section 2.1 outlines their proposed derivation for pair-list responses to QPDs, which I refer to as the "cumulation-and-elaboration" pathway. Section 2.2 summarizes their arguments in favor of this being the only available method for deriving pair-list answers to QPDs.

In Section 2.3, I discuss two competing analyses of pair-list answers to questions with overt universal quantifiers. If a plural definite can be interpreted distributively (and thereby convey universal quantification) and can take the appropriate scope, these analyses are predicted to translate to QPDs, generating pair-list answers there as well.

Indirectly, then, the cumulation-only hypothesis seems to necessitate a ban on distributive interpretations of plural definites in QPDs. Aside from the purported absence of canonical pair-list readings, there is little evidence to support such a restriction. This leaves us with a dilemma: we must either come to understand why QPDs are incompatible with the (apparently) well-formed pair-list pathway, or we must find empirical evidence that disconfirms the cumulation-only hypothesis.

2.1 Pair-list responses via cumulation-and-elaboration

As discussed above, Dayal (1992, 1996) and Krifka (1992) argue that pair-list responses to QPDs are derived in the pragmatics, from underlyingly cumulative answers that the semantics supplies. This is what I refer to as the cumulation-and-elaboration pathway. In this reading, a QPD necessarily receives an answer that has a cumulative interpretation of the main predicate. This interpretation is captured by the **-operator of Krifka (1986) and Sternefeld (1998). "$**P(X,Y)$" expresses the weak proposition that a predicate P relates every part of X to some part of Y, and every part of Y to some part of X. That is, each part of both groups must participate in the relation. Crucially, this expresses no information about precisely how the individual parts of X and of Y relate to one another.

To illustrate, consider the question in (6). I assume the context in (7), where *these men* is equivalent to *John and Bill*, and the arrows indicate mappings within the actual *liking* relation.

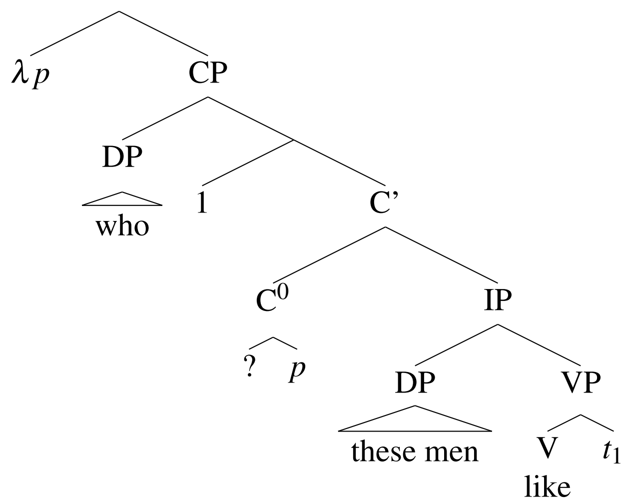
(6) Who do these men like? *Question*

(7) John $\longrightarrow$ Sue *Context*

Bill $\longrightarrow$ Jane

I assume a syntax and semantics in the style of Karttunen (1977) (as updated by Heim (1994) and Fox (2013)). This is shown in (8). *Wh*-movement of *who* results in abstraction over the group of *liked* individuals, and the question receives what is referred to as an "individual answer": that is, an answer that simply supplies the identity of the individual(s) for which the *wh*-phrase stands in.[2]

(8)



This corresponds with the semantics shown below in (11).The *wh*-item, in this case *who*, acts as an existential quantifier, receiving the denotation in (9). The question operator, shown in (10) and represented by ? in the tree above, introduces a free variable into the question's semantics. Ultimately, this free variable is abstracted over, which derives the characteristic function for the question's Hamblin set.

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

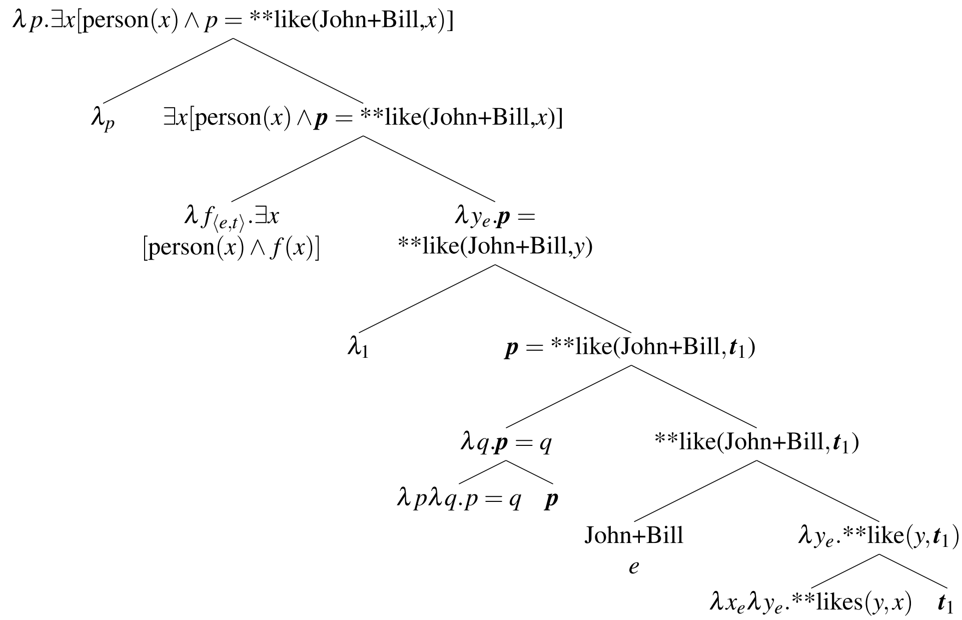
(10) $[\![?]\!] = \lambda p \lambda q.[p = q]$

Putting this all together, the semantics of the question in (6) is as shown in (11).[3] (I assume here that *these men* is simply equivalent to the plural individual John+Bill.)

2 This is also sometimes referred to, in contrast with pair-list answers, as a "single-pair" answer.

3 Throughout this paper, I use boldface to represent the interpretation of a free variable relative to the world of evaluation. E.g., $\boldsymbol{t_1}$ represents $g(t_1)$, the evaluation of the trace relative to world g.

(11)



This derives the characteristic function for the Hamblin set in (12). 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. All possible answers to (6), then, will be propositions that express a cumulative *liking* relation between the group denoted by *these men* and some group of people. The only true answer, in the world described by (7) above, is given in (13). This is expressed using the **-operator as in (13a), which is equivalent to (13b).

(12) $\{$**like(John+Bill, x)$:\ x \in$ *$\{$Sue, Jane, Lisa, Amy, $\dots\}\}$ *Hamblin set*

(13) These men like Sue and Jane. *Answer*

a. **like(John+Bill, Sue+Jane)

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

Ultimately, the semantics derives (13a) as the answer to (6). However, the proposition expressed by (13a) does not provide all the information present in context (7), since it does not specify which particular men are mapped to which particular women. Variation in these mappings does not falsify (13a), so long as the identities of the groups participating in the cumulative relation does not change. For example, all of the hypothetical contexts presented in (14) are also compatible with the truth of (13a). In each case, *these men* cumulatively like the same group of women.

(14) a. $\begin{tikzcd} \text{John} \arrow[dr] & \text{Sue} \\ \text{Bill} \arrow[ur] & \text{Jane} \end{tikzcd}$ b. $\begin{tikzcd} \text{John} \arrow[r] \arrow[dr] & \text{Sue} \\ \text{Bill} \arrow[r] & \text{Jane} \end{tikzcd}$ c. $\begin{tikzcd} \text{John} \arrow[r] \arrow[dr] & \text{Sue} \\ \text{Bill} \arrow[r] \arrow[ur] & \text{Jane} \end{tikzcd}$

It cannot be the case, then, that pair-list answers arise from such a Hamblin set. Instead, the labor is divided between the semantics, which derives the cumulative answer, and the pragmatics, which gives the response its pair-list form.

Given a suitable pragmatic context, an answerer may choose to be over-informative, supplying more information than was explicitly asked for. Apparent pair-list responses (such as (1b) above, reprinted as (15) below) express the semantic answer to the question, plus additional information about the specific mappings between individuals.

(15) John likes Sue and Bill likes Jane. *Pragmatically-motivated elaboration*

Note that the truth of (15) entails the truth of (13): the situation described in (15) is still one in which John and Bill cumulatively like Sue and Jane. No information expressed by the semantic answer is lost. The answerer is simply expressing additional contextually-relevant information about specific men and women.

This appeal to the pragmatics is quite natural; answerers can easily alter the presentation of their answers in ways that take into account their knowledge of the questioner's situation, intent, etc. Likewise, the availability of cumulative answers in general is clear—at least, we have no reason to doubt that QPDs can receive cumulative readings. In short, not only does the cumulation-and-elaboration pathway derive responses of the desired form, but it is essentially self-evident: it is difficult to imagine how, under the correct pragmatic conditions, such a derivation could *not* be available.

By separating discussion of the cumulation-and-elaboration pathway from the arguments for its special status in QPDs, I intend to foreshadow a point I will argue in more detail later: that when it comes to the cumulation-only hypothesis, the "cumulation" aspect is essentially unassailable; it is merely the "only" that should be challenged.

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

After making the case for the existence of the cumulation-and-elaboration pathway, Krifka and Dayal take things one step further. They argue that such a derivation is the only possibility for deriving pair-list responses to QPDs, and that no derivation exists that can derive canonical pair-list answers in the semantics. In effect, they assume that proposed analyses of canonical pair-list answers to other types of questions do not extend to QPDs.

Evidence in favor of the cumulation-only hypothesis comes from an important fact that, while implicit in the term "questions with *plural* definites", I have not so far discussed. This is the observation that the interpretation of questions containing definite DPs is sensitive to number marking on the DPs they contain. In what I refer to as the "number effect", pair-list answers to questions containing definites require plurality of both the *wh*-item and the definite within the question nucleus. For example, (16a), where both *women* and *men* are plural, can readily receive either a pair-list or an individual answer.

(16) a. Which women do these men like?
b. John likes Sue, and Bill likes Jane.
c. They like Sue and Jane.

But when either of the two DPs is singular, as in (17a) and (18a), the pair-list response becomes infelicitous. These questions apparently must receive individual answers.

(17) a. Which woman do these men like?
b. #John likes Sue, and Bill likes Jane.
c. They like Jane.

(18) a. Which women does that man like?
b. #John likes Sue, and Bill likes Jane.
c. He likes Sue and Jane.

The number effect is predicted to occur under the cumulation-and-elaboration pathway; it follows from the definition of cumulation. Relations that are "meaningfully cumulative" (by which, I mean those that are truth-conditionally distinct from distributive relations over the same groups) are only possible when both groups are plural. We can certainly apply the **-operator to a predicate with one singular and one plural argument; however, the mappings underlying these cumulative relations are entirely predictable, since there can be no variation in which part of the singular argument the various parts of the plural argument are related to.

To illustrate: consider the answers that the questions in (16-18) receive when interpreted cumulatively.[4] The answer in (16b) is represented using the **-operator as in (19a), which is truth-conditionally equivalent to (19b). What (19b) conveys is that all individual men in John+Bill like some woman in Sue+Jane and that

4 I assume in the examples that follow that the meaning of *these men* is equivalent in context to the mereological sum John+Bill, and that *this man* is equivalent to the singleton John.

all individual women in Sue+Jane are liked by some man in John+Bill. This is compatible with a range of possible contexts (some of which are illustrated in (14) above) which a pragmatically-motivated elaboration might serve to disambiguate.

(19) a. **like(John+Bill, Sue+Jane)
b. $\forall x[x \in \text{John+Bill} \rightarrow \exists y[y \in \text{Sue+Jane} \wedge \text{likes}(x,y)]] \wedge$
$\forall y[y \in \text{Sue+Jane} \rightarrow \exists x[x \in \text{John+Bill}] \wedge \text{likes}(x,y)]]$

The answer in (17c) is illustrated in (20) below. The singular marking of *woman* ensures that this property holds of atomic individuals. Like before, this cumulative relation means that every member of the group of men must like some member of the group of women, but in this case both men must be related to the same sole member. Of course, the lone member of the group of women must be liked by at least one man, although if the first condition holds, she is in fact liked by every member of the group of men. So in effect, this mapping is equivalent to a distributive relation over the same individuals![5] Crucially, this is the only mapping compatible with a cumulative relation over these individuals, and this mapping is already entailed by (17c). There are no other possible mappings for a pragmatic elaboration to discriminate between.

(20) a. **like(John+Bill, Sue)
b. $\forall x[x \in \text{John+Bill} \rightarrow \exists y[y \in \text{Sue} \wedge \text{likes}(x,y)]] \wedge$
$\forall y[y \in \text{Sue} \rightarrow \exists x[x \in \text{John+Bill} \wedge \text{likes}(x,y)]]$

The same holds true if the subject is the singleton and the object is the plural, as in the case of (18a). Just as before, there cannot be multiple mappings for a pragmatic elaboration to discriminate between.

In short, if pair-list responses to QPDs are derived via cumulation-and-elaboration, the absence of a pair-list response with singular arguments is entirely expected. Pair-list responses only emerge when the cumulative relation holds between two plural individuals, because only then is there additional information about mappings not contained in the answer itself.

This behavior of QPDs distinguishes them from, for example, questions with quantifiers. For the latter, as shown in (21), the number effect is absent. Pair-list readings are readily derived with singular DPs. Dayal and Krifka take examples such as (21) to indicate that the canonical pair-list derivation available to questions with quantifiers does not display the number effect.

(21) a. Which woman does every man like?
b. John likes Sue, and Bill likes Jane.

5 I.e., that all members of the group of men like all members of the group of women.

Furthermore, they assume that were a canonical pair-list derivation available to QPDs, it would display similar behavior to (21), readily generating pair-list answers to questions containing singular definites. Under this assumption, the missing pair-list responses in (19b) and (20b) could simply be provided by the same number-insensitive derivation present in (21), and the number effect would not be observed. In short, the number effect is taken to be incompatible with the presence of canonical pair-list answers.

In summary, the cumulation-only hypothesis neatly predicts the number effect observed in QPDs. The cumulation-and-elaboration pathway is expected to be available on its own merit, and the number effect (that is, the unavailability of pair-list responses in precisely the cases where cumulation entails a specific mapping) is taken as evidence that no canonical pair-list derivation is available. The pair-list pathway available in questions with quantifiers, as in (21), is excluded from the QPD context.

2.3 Canonical pair-list answers to QPDs

The arguments of Dayal (1992, 1996) and Krifka (1992), as discussed in the previous section, appear to account for the data without appealing to any derivational mechanisms other than the cumulation-and-elaboration pathway. Their hypothesis neatly predicts the number effect in QPDs, but the question remains as to why the cumulation-only hypothesis might hold.

In this section, I will illustrate the plausibility of a true pair-list reading for QPDs, by appealing to another common property of plural definites: their ability to participate in distributive readings (with universal quantificational force). QPDs, then, are expected to take logical forms parallel to those found in questions with overt universal quantifiers. With this high degree of similarity, analyses originally proposed for pair-list answers to questions with quantifiers can be extended to QPDs as well. To illustrate, I review two analyses of pair-list answers to questions with quantifiers (the functional analysis of Engdahl (1980, 1986) and Chierchia (1991, 1993), and the speech-act quantification analysis of Krifka (2001)) and briefly sketch out how these can be implemented in (distributive) QPDs.

The apparent compatibility of QPDs with these analyses lets us reframe the question of how to motivate the cumulation-only hypothesis. Now, a defense of cumulation-only must proceed by establishing some incompatibility between QPDs and distribution, or perhaps by arguing that questions with distributive plural definites and questions with overt universal quantifiers are not, for some reason, semantically parallel.

However, there remains an alternative. Empirical evidence for the existence of canonical pair-list readings to QPDs would allow us to reject the cumulation-only hypothesis outright, confirming that a true pair-list parse is available.

2.3.1 Definites as universals

The arguments of Dayal and Krifka hinge on one behavior displayed by plural definites: that they participate in cumulative relations. However, in certain situations, plural definites exhibit a distinctly different pattern of behavior, participating in distributive relations. These distributive meanings are captured by a covert distributivity operator *D*. Here I assume, following Heim et al. (1991), that *D* merges within the DP, which gives the DP a semantics equivalent to a universal quantifier.[6]

This essentially equates one possible reading of QPDs to questions with universal quantifiers, which as seen in the preceding section are a canonical example of a pair-list question. So, what is to stop us from taking an example like (21) above, replacing *every man* with the logically equivalent distributive interpretation of *these men*, and applying our pair-list derivation of choice to the resulting QPD?

First, we should consider what concrete proposals exist in the literature that derive pair-list answers for questions with quantifiers. The two candidates I review here are the functional analysis of Engdahl (1980, 1986) and Chierchia (1991, 1993), and the speech-act quantification analysis of Krifka (2001) Both rely on a universal quantifier from within the question nucleus taking a particular scope. For Chierchia and Engdahl, this means taking scope over the trace of the *wh*-item and binding into it. For Krifka, this means taking scope over an illocutionary operator QUEST. Both types of analysis derive true pair-list answers in the semantics.[7] Because of these key similarities, the two analyses are, for the purposes of the present discussion, essentially interchangeable. I will make no argument as to which is the better account of pair-list answers generally. I review both analyses simply to demonstrate that the problems facing the cumulation-only hypothesis do not depend on a particular theory of pair-list answers.

Can these derivations be implemented in the QPD context? With the aid of a distributivity operator, that answer appears to be yes.

6 I make this assumption primarily for expository purposes, as it makes clear the link between the scope of the DP and the scope of universal quantification. If instead we treat *D* as originating within VP (which seems to be the prevalent view in the literature; see Champollion (2015) for discussion), the same effect can be achieved by assuming that universal quantification comes from the predicate that the definite DP composes with.

7 That is, their answers either express Hamblin answers (in the Engdahl-Chierchia version), or they express a meaning that is computed predictably in the semantics from (a set of) Hamblin answers (in Krifka's version).

2.3.2 The functional analysis of pair-list answers (Engdahl 1980, 1986, Chierchia 1991, 1993)

The crux of the Engdahl-Chierchia analysis of pair-list answers is the observation that pair-list answers are closely related to so-called functional answers. While both provide a relation between two groups, pair-list answers do so by listing specific mappings between individuals, and functional answers do so by describing the relation itself. (22b), for example, indicates that the advisor-advisee relation maps each student to the professor that they like.

(22) Which professor does every student like?

a. Ann likes Professor Jones, and Ben likes Professor Smith. *Pair-list answer*

b. Every student likes their advisor. *Functional answer*

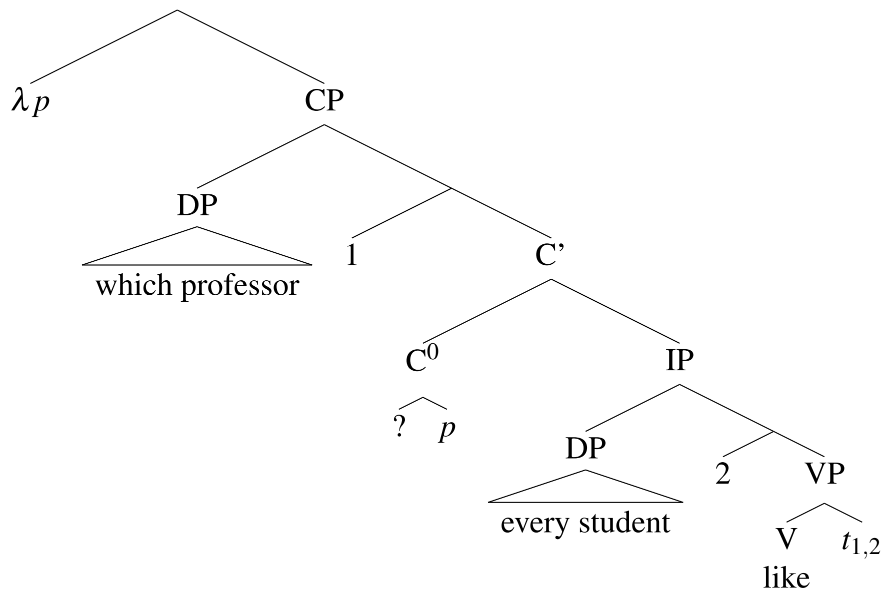
Engdahl (1980, 1986) argues that pair-list answers are a subset of functional answers; a pair-list is simply an explicit spelling out of the graph of some function.[8] This means that pair-list answers can be given to many questions that underlyingly ask the answerer to provide a function.[9]

The functional meanings that this analysis relies on are generated by binding. The quantifier in the question nucleus binds the trace of the *wh*-item. The syntax of this structure is illustrated in example (23). This is similar to the structure of an individual question, such as (8) in Section 2.1, modulo the added binding relationship between *every student* and the *wh*-trace.

8 Chierchia takes a different approach, attributing the distinction between pair-list and functional answers to the optional occurrence of *absorption* at the left edge of the clause.

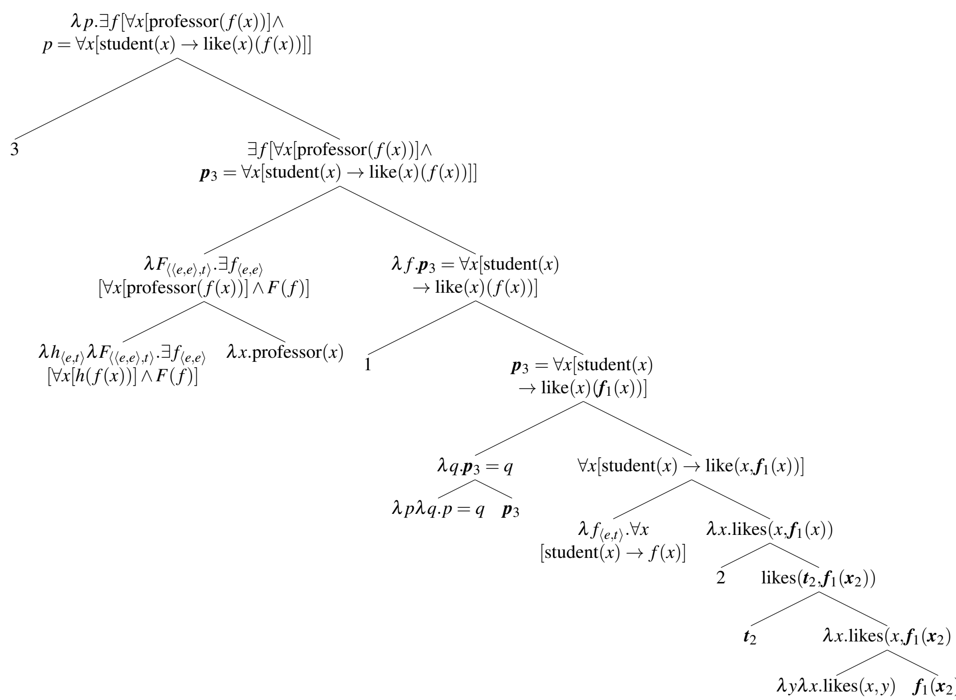
9 Although pair-list answers cannot be given in all cases where functional answers are available. In particular, pair-list answers are unavailable under negative quantification, while other functional answers remain acceptable. Pair-list answers, then, form a proper subset of functional answers.

(23)



In the semantics, shown in (24), there are two key differences between an individual construal of the question, and the functional/pair-list construal illustrated here. The first is that the *wh*-trace in the question nucleus is not a variable over individuals. Instead it is interpreted as a variable over Skolem functions, functions from individuals to individuals whose arguments can be bound into. It does not have the semantic type of e, instead it is of type $\langle e, e\rangle$. The argument of this functional trace is supplied by binding; *every student* binds into the trace, restricting the possible values of the trace to functions whose domain is the relevant set of students.

(24)



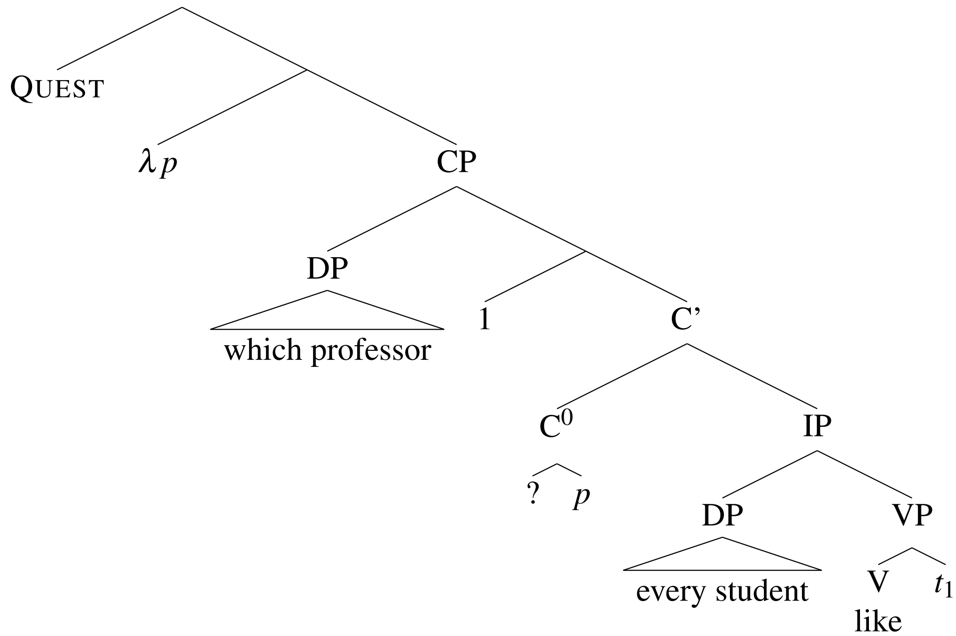
The second key point is that *which* also receives a slightly different interpretation. It still operates in typical Karttunen style as an existential quantifier, however it quantifies over Skolem functions instead of over individuals. Its argument, *professor*, describes the range of the function. So, *which professor* presupposes the existence of some function f into professors.

The binding occurs during the composition of the question nucleus, which consists of a *liking* relation whose domain is equal to the relevant set of students. This composes with the question operator in C^0, and the function f_1 is abstracted over, resulting in a node of type $\langle\langle e,e\rangle,t\rangle$ for *which professor* to apply to. In essence, this question presupposes the existence of some function that maps each student to the professor that student likes, and asks the answerer to provide it. While this function could potentially be provided with a canonical relationship term (e.g., *every student likes their advisor*), it can also be spelled out pointwise, resulting in a pair-list answer.

2.3.3 The speech-act quantification analysis of pair-list answers (Krifka 2001)

Krifka (2001) proposes an account of pair-list answers that formalizes a natural intuition: that pair-list answers might simply be groups of single-pair answers. The basic syntax of the question, as shown in (25), is again similar to (8). This proposal does not rely on binding, the trace is a variable over individuals, and *which* is once again an existential quantifier over individuals. This gives rise to a question that, as expected, asks for an individual, single-pair Hamblin answer.

(25)



To derive a pair-list from such single-pair answers, Krifka proposes that *every* takes exceptionally high scope, raising above the speech-act operator QUEST. This requires a new denotation for *every*, incorporating a generalized conjunction operator over speech acts, represented by **&**. The conjunction of speech acts is treated as equivalent to the consecutive performance of those acts. A conjunction of question acts, then, is equivalent to asking a series of questions one after the other. A conjunction of answers is given by listing a series of individual answers: in effect, a pair-list.

The meaning derived in this way is more or less as expected.[10] Instead of a single, individual question, what is in fact asked is the generalized conjunction of all possible question acts of the specified form. This meaning can be paraphrased as "For every student x, I ask you: which professor does x like?"

10 Krifka assigns to speech acts the semantic type a. The operator QUEST is of type $\langle\langle st,t\rangle,a\rangle$, taking the question's "sentence radical" (in this case a set of propositions, i.e. type $\langle st,t\rangle$) and deriving a question act of type a. Abstraction over the free variable within this speech act yields an expression of type $\langle e,a\rangle$. This means that in order to take scope as shown in (26), *every student* must also be of a higher type: $\langle\langle e,a\rangle,a\rangle$.

(26) $\boldsymbol{\&}\{\text{QUEST}(\lambda p \exists x[\text{professor}(x) \wedge p = \text{likes}(y,x))|\ \text{student}(y)\}$

- every student $\lambda P.[\boldsymbol{\&}(P(y)|\text{student}(y))]$
- $\lambda y.[\text{QUEST}(\lambda p.\exists x[\text{professor}(x) \wedge p = \text{likes}(y,x))]$
  - λ_1
  - $\text{QUEST}(\lambda p.\exists x[\text{professor}(x) \wedge p = \text{likes}(\boldsymbol{t}_1, x)]$
    - QUEST
    - $\lambda p.\exists x[\text{professor}(x) \wedge p = \text{likes}(\boldsymbol{t}_1, x)]$

In this analysis, a pair-list answer is likewise a conjunction. Each conjoined question receives an answer from its Hamblin set, and the pair-list is simply the successive enumeration of those answers. While this pair-list is not equivalent to any single Hamblin answer, it is composed in the semantics via speech-act conjunction. This results in a pair-list whose content is predictable based on the semantics of the question.

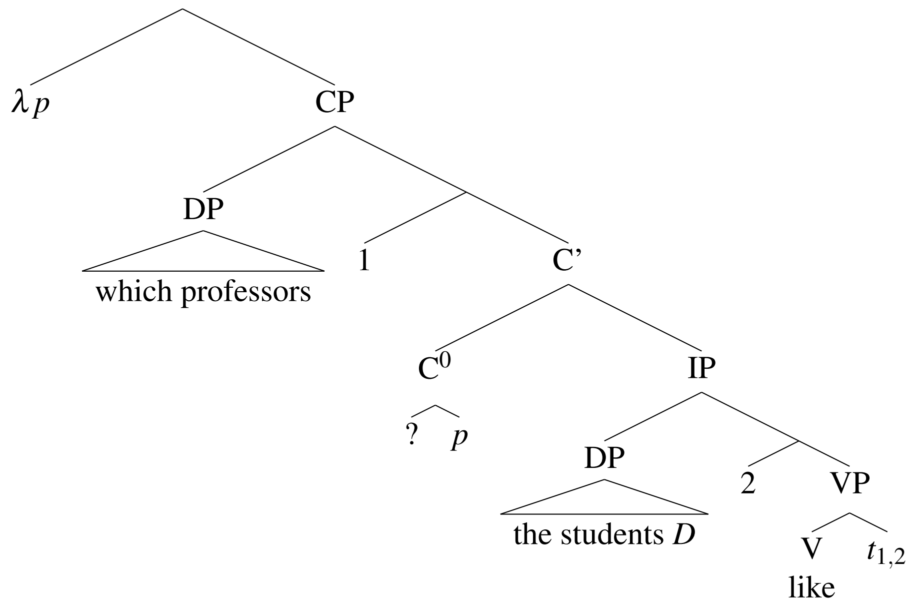
2.3.4 Translating quantificational analyses into the QPD context

In the preceding sections, I've outlined two possible derivations capable of generating pair-list answers in the semantics. The basic syntax of these analyses is quite similar. In both cases, we have the structure expected of an individual reading of the question, with slight modifications. In the Engdahl-Chierchia family of analyses, a binding relationship leads to a functional reading of the question, to which a pair-list answer can be given. In Krifka's proposal, the universal quantifies over the question act, letting us conjoin multiple individual questions, to which a conjoined answer (i.e. a pair-list) can be given. I make no claim here as to which of these is the better representation of pair-list answers generally. I merely observe that both of these analyses are plausible means of generating pair-list answers to questions with quantifiers.

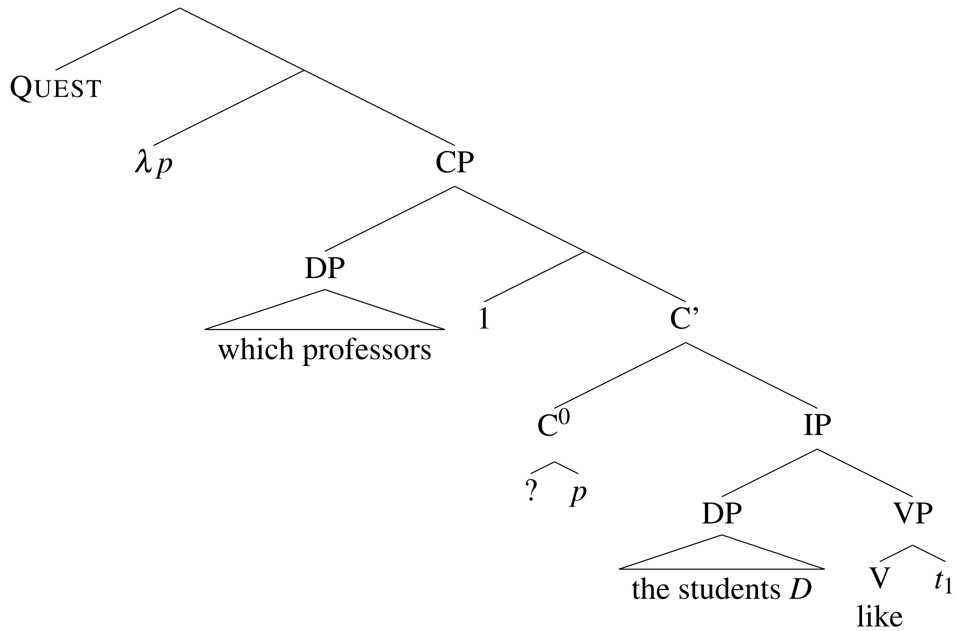
Although QPDs by definition lack overt universal quantifiers, they are still quite capable of hosting derived universal quantifiers. And since the analyses discussed above do not make reference to the internal structure of the quantifier, we should be able to apply them regardless of whether the quantificational force arises from *every* or from the distributivity operator *D*. In essence, questions containing distributive plural definites and questions with overt quantifiers can receive a unified analysis.

In effect, we can make a simple substitution of *the students D* in place of *every student*, resulting in the structures shown below in (27) and (28). These are parallel to the structures seen above in (23) and (25), respectively. Whichever analysis of pair-list answers we happen to prefer, we can simply substitute the DP containing the operator *D* in place of that containing *every*. This allows in Engdahl's and Chierchia's version for binding of the trace by *D*, and in Krifka's version for raising of *the students* above the speech-act operator QUEST.

(27)



(28)



I suggest that it is this sort of unified analysis of pair-list answers that the cumulation-only hypothesis should be understood as excluding. So, if we wish to explain where the "only" in cumulation-only arises, we now have a more tangible problem to confront: we must demonstrate that the apparently well-formed structures in (27) and (28) do not, in fact, derive pair-list answers to QPDs.

There are multiple possibilities, although none that are immediately promising. Perhaps QPDs are generally incompatible with distributive readings? Such a restriction would be surprising; analogous structures with covert distributivity operators are found widely, including in declaratives[11]. Perhaps instead, these proposed pair-list derivations are for some reason sensitive to the internal structure of the universal quantifier, although it is difficult to see why that might be the case.

I will set aside the question of whether such attempts to exclude structures like (27) and (28) from the QPD context are tenable. Instead, I present another option. We might also show that the empirical picture surrounding QPDs is different than previously thought, and that they can in fact receive true pair-list readings. This would allow us to reject the cumulation-only hypothesis, and these newly-observed pair-list readings could be derived just as suggested in the structures in (27–28), by grouping distributive readings of QPDs and questions with overt quantifiers under a single, unified analysis (whichever that might be).

11 See, for example, Winter (2000) on so-called "co-distributive" readings.

That is the approach that I will take. In the following section, I provide new evidence that QPDs can receive pair-list answers, and I will argue that such readings arise from the same pair-list pathway found in questions with overt quantifiers.

3 Cumulative answers are not strong enough

While the arguments reviewed in the preceding section are persuasive, insofar as they establish that a cumulation-and-elaboration strategy is necessary, new evidence shows that cumulation cannot be the only source of pair-list responses to QPDs. In this section I present two main observations. First, pair-list answers to QPDs may be given in contexts that preclude cumulative answers, showing that cumulation plays no part in their derivation. Second, pair-list readings appear under question-embedding, which shows that these readings arise as answers in the semantics, rather than as elaborations in the pragmatics. This evidence supports a view of QPDs wherein pair-list answers and cumulative answers represent distinct derivational pathways.

3.1 Cumulation-only undergenerates pair-list responses

To illustrate, I will consider the example in (29).

(29) a. Which numbers did the players pick?
     b. Ann picked 1, Ben picked 2, Chris picked 3, Dan picked 4, Emma picked 5.

In a context like (30), this is a felicitous question-answer exchange. The assistant coach in this scenario could quite naturally ask (29a), eliciting a response of (29b) from the head coach. (Let's assume that (29b) is the correct answer in context, i.e., that the player's actual choices are as represented in (31) below).

(30) 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 players chose exactly one jerseys. However, the assistant coach was not present for the choosing, and so doesn't yet know which player selected which jersey.

(31) Ann $\longrightarrow$ 1 Chris $\longrightarrow$ 3 Emma $\longrightarrow$ 5
     Ben $\longrightarrow$ 2 Dan $\longrightarrow$ 4

Under the cumulation-only account, (29a) is assumed to have a Hamblin set of the form shown in (32), containing all cumulative *picking* relations from players to numbers, of which (33) is the only true member.

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

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

Any proposition in the Hamblin set (32) 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, for example 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.

This poses a problem for cumulation-only. (30) clearly establishes that the questioner already believes the only true cumulative answer to be the case (i.e., the assistant coach believes that the numbers 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 felicitously ask (34), since the players' identities are already common knowledge. In short, the cumulation-only hypothesis predicts the asking of (29a) to be as infelicitous as the asking of (34).

(34) #Who are the players?

Since the assistant coach is able to ask the question, this suggests that he must be asking for some information that he does not currently know. In this context, that must be a stronger proposition than the weak cumulative (33). By hypothesis, this question is seeking a true pair-list answer, encoding the mappings stated in (29b). (In the Engdahl-Chierchia formulation, the information that the assistant coach does not know is the function that maps players to their chosen numbers. In Krifka's formulation, the assistant coach does not know the answers to all, or in fact any, of the conjoined questions.)

To test this, we can modify (29a) by adding the adverbial expression *between them*, which will disambiguate the question towards a cumulative reading. Under the cumulation-only account, this is expected to produce no change in interpretation, since (29a) is necessarily already cumulative, and *between them* should not rule out a cooperative elaboration. If my hypothesis is correct, and (29a) 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. The latter prediction is borne out.

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

As (35) shows, forcing cumulation causes the question to become infelicitous in context. This new question can only be understood as a question about the identity of the numbers chosen, which is already known to the assistant coach. These observations show that QPDs can receive true pair-list answers in the semantics.

Despite this evidence, there remains the possibility, though remote, that the facts discussed above 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, while the addition of *between them* somehow precludes this conventionalized usage. Alternately, perhaps when questioners ask questions whose answers they are known to know, they indicate that they are seeking something other than the semantic answer. These types of pragmatic fixes to the cumulation-only analysis can be ruled out, however, after considering data from question-embedding.

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 & Uegaki 2016, Spector & Egré 2015). When that answer is known, infelicity or falsity results. For example, neither proposition in (36) is true and felicitous in context (30), since the assistant coach already has complete knowledge of the players' identities.

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

The examples in (37), then, convey the assistant coach's ignorance of the strongest true answer to (29a). If the cumulation-only account holds, the assistant is not in fact ignorant of this answer, which should result in the falsity or infelicity of both examples below. Clearly, though, both of these are true and felicitous in context!

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

Crucially, the truth and felicity of (37a) and (37b) does not depend on the available pragmatic strategies; they are determined by the semantics of the embedded question. In essence, this embedding data poses the same problem for the cumulation-only account as discussed in the preceding subsection; however, in this case we definitively rule out the possibility of a pragmatic fix for cumulation-only. This confirms that the semantic answer to (29a) in context (30) must be stronger than a weak cumulative proposition; the obvious candidate for this answer is the pair-list answer (29b).

3.2 Two derivational pathways for QPDs

The evidence presented in the preceding section demonstrates that pair-list responses to QPDs can in fact have the status of answers. With this, we can decisively set aside the cumulation-only hypothesis.

A natural way to account for such pair-list readings, given the double-duty of plural definites between distributive and cumulative readings, is to group the (universally-quantified) distributive QPDs together with questions with overt universal quantifiers. Any analysis of pair-list answers that depends on quantifier scope is likely to treat distributive QPDs and questions with universal quantifiers equivalently.

None of the evidence presented here does away with the cumulation-and-elaboration pathway outlined by Dayal and Krifka. Cumulative answers are still possible and necessary, and answerers may certainly give elaborative responses based on the pragmatic context.[12]

The reason why this structural ambiguity has so far avoided detection is, I believe, because both derivational pathways can yield responses with the superficial form of a pair-list. They can be separated, however, by constructing a context that, like (30) above, precludes one possible interpretation.

Having argued for the existence of two distinct derivational pathways for QPDs, I will next discuss two predictions this proposal makes, both of which are borne out.

4 Predictions

In this section, I discuss two predictions of the current proposal. They show additional syntactic and semantic differences between the two derivations, with the cumulation-and-elaboration pathway patterning as expected of a derivation involving a cumulative relation, and with the pair-list pathway patterning as expected under both analyses of pair-list answers discussed in this paper.

The first prediction relates to the observation that canonical pair-list answers have characteristic subject-object asymmetries. As predicted, these asymmetries emerge in QPDs, although they are only readily apparent in cases where the cumulation-and-elaboration pathway is unavailable. The second prediction relates to the interpretation

12 A concrete example of the utility of the cumulation-and-elaboration approach will be seen in examples (40–41) in the following section.

of numeral modifiers, which are expected to make distinct contributions to the semantics of the two derivational pathways. This prediction is confirmed as well; numeral modifiers in QPDs display an ambiguity between the two predicted interpretations, and contexts that rule out one of the two derivations also remove the corresponding interpretation of the numeral modifier.

4.1 Emergence of subject-object asymmetries

As outlined in the preceding section, I argue that QPDs receive their pair-list answers through a derivation parallel to that found in questions with overt quantifiers. This makes an important prediction about exactly which QPDs can derive pair-list readings.

As noted in previous literature, questions with overt quantifiers exhibit distinctive subject-object asymmetries. They may only receive a pair-list reading when the *wh*-phrase is the object, as in (38). When the *wh*-phrase is the subject, as in (39), a pair-list reading is infelicitous.

(38) a. Who does every man like?
b. John likes Sue, and Bill likes Jane.

(39) a. Who likes every man?
b. #Sue likes John, and Jane likes Bill.

For QPDs, on the other hand, it does not appear to matter whether the *wh*-phrase is the subject or the object. As shown in (40–41), a pair-list answer is possible in either case. Under the cumulation-only hypothesis, this is another signature of the cumulation-and-elaboration pathway, since neither the cumulative relation nor the pragmatics should be sensitive to the relative structural position of the *wh*-marked and non-*wh*-marked arguments. I agree that examples (40–41) are evidence for the presence of the cumulation-and-elaboration pathway.

(40) a. Who do these men like?
b. John likes Sue, and Bill likes Jane.

(41) a. Who likes these men?
b. Sue likes John, and Jane likes Bill.

In my proposal, however, there is a second derivation for QPDs, the same as employed in (38–39). This generates true pair-list answers, which we expect should also display the same characteristic subject-object asymmetries. In (40–41), which are given without context, either reading is possible, and so the more permissive cumulation-and-elaboration pathway obscures the asymmetries predicted by the more restrictive pair-list pathway.

However, we can remove the cumulation-and-elaboration pathway from consideration just as in the preceding section, by adopting a context that precludes the cumulative construal of the question. For simplicity, let's return to the "basketball team" context from (30) above. Example (29a), reprinted below, involves *wh*-movement of the object and forms a felicitous pair-list question in context. But (42) below, where instead the subject is *wh*-moved, is infelicitous in context. This is because in (42), just as in (39) above, subject *wh*-movement is not compatible with a pair-list reading. The only possible interpretation for (42) is a cumulative individual reading of the question, whose answer is simply the identities of the group of players, which are already known to the questioner.

(29a) Which numbers did the players pick?

(42) #Which players picked the numbers?

This asymmetry can only be detected in a context that, like the one considered here, precludes cumulative answers. This, I believe, is why subject-object asymmetries in QPDs have so far gone unnoticed. In a neutral context, the cumulation-and-elaboration strategy will also be available, and may easily supply a pragmatic elaboration with the same form as the "missing" true pair-list answer.

4.2 Numeral modifiers differentiate the two derivations

Another prediction that the two-derivation model makes relates to the interpretation of numeral modifiers. Numeral modifiers are felicitous in demonstrably different circumstances under the pair-list and cumulation-and-elaboration pathways. It will be useful here to clearly outline the semantic contributions numeral modifiers make in each case.

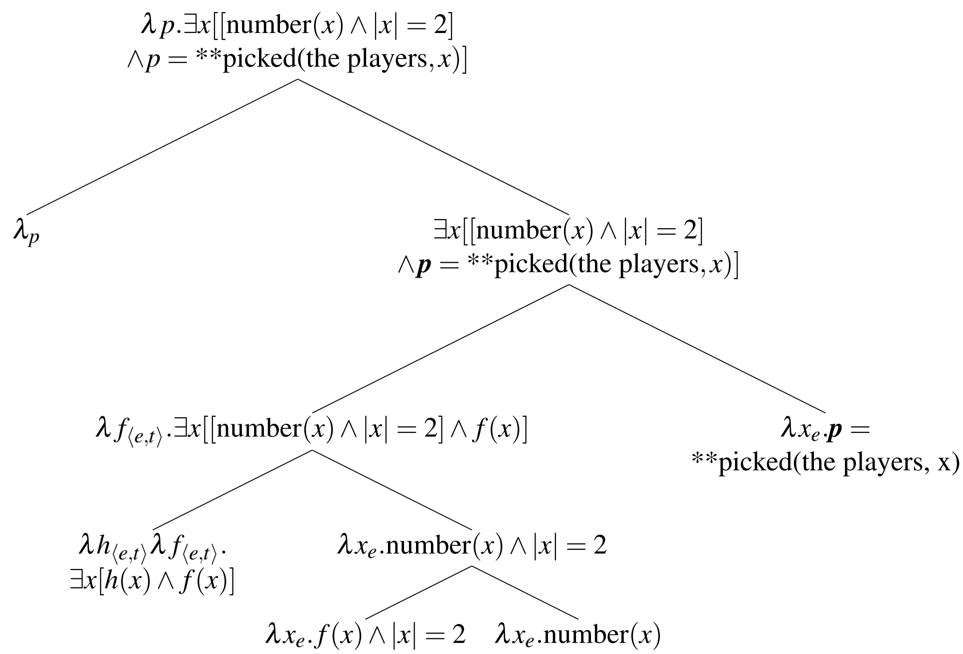
First, in the cumulation-and-elaboration pathway, I show that numerals within the *wh*-phrase constrain the size of the plural individual that participates in the cumulative relation. Second, I show that both proposed pair-list derivations discussed in Section 2.3 (the functional analysis of Chierchia and the speech-act quantification analysis of Krifka) make the same prediction: that numeral modifiers constrain the size of the second member of each pair.

Throughout this section, I will use (43) as an example of a QPD containing a numeral modifier.

(43) Which two numbers did the players pick?

I begin with the cumulation-and-elaboration pathway. I assume here that *numbers* is simply a property of individuals, to which *two* applies, adding the restriction that the individual denoted must have exactly two atomic parts. *Which* is treated, in typical Karttunen fashion, as an existential quantifier; it applies to *two numbers*, presupposing the existence of a plural individual in the extension of *numbers* with cardinality of two.[13]

(44) Which two numbers did the players pick? *Cumulation-and-elaboration*



This *wh*-phrase combines with a question nucleus consisting of a cumulative *picking* relation between players and the bound variable t_1. This variable is identified with the plural individual whose existence is presupposed by *which two numbers*. So in short, this question presupposes that there exists some group of two numbers which was cumulatively picked by *the players*.

This reading of the question derives a Hamblin set of the form in (45), wherein every possible answer relates *the players* to a group of exactly two numbers. Assuming the uniqueness presupposition of Dayal (1996), there must be exactly one member of this Hamblin set which is the strongest true member.

(45) $\{{**}\text{picked}(\text{the players}, x) \colon x \in {*}\{1, 2, 3\ldots\} \wedge |x| = 2\}$

Note, however, that these propositions are logically independent. No proposition from this Hamblin set entails any other Hamblin set member. For an answer to be strongest true member of such a Hamblin set, it must in fact be the unique true member.[14] Effectively, (45) presupposes that exactly two numbers were picked.

13 In the examples that follow, I use "$|x| = 2$" to express "x has two atomic parts".

14 If more than one member of this Hamblin set were true, it would be impossible to determine the strongest true answer, and the use of the question would be infelicitous in that particular context.

Let's assume the unique true member of (45) is (46). This information, could be presented in one of two ways: either as a cumulative answer, as in (46a), or as a pragmatic elaboration on that answer, one possible version of which is shown in (46b). But regardless of which way this information is presented, the *liking* relation described must include exactly two numbers in total.[15]

(46) **picked(the players, 1+2)

a. The players picked 1 and 2.

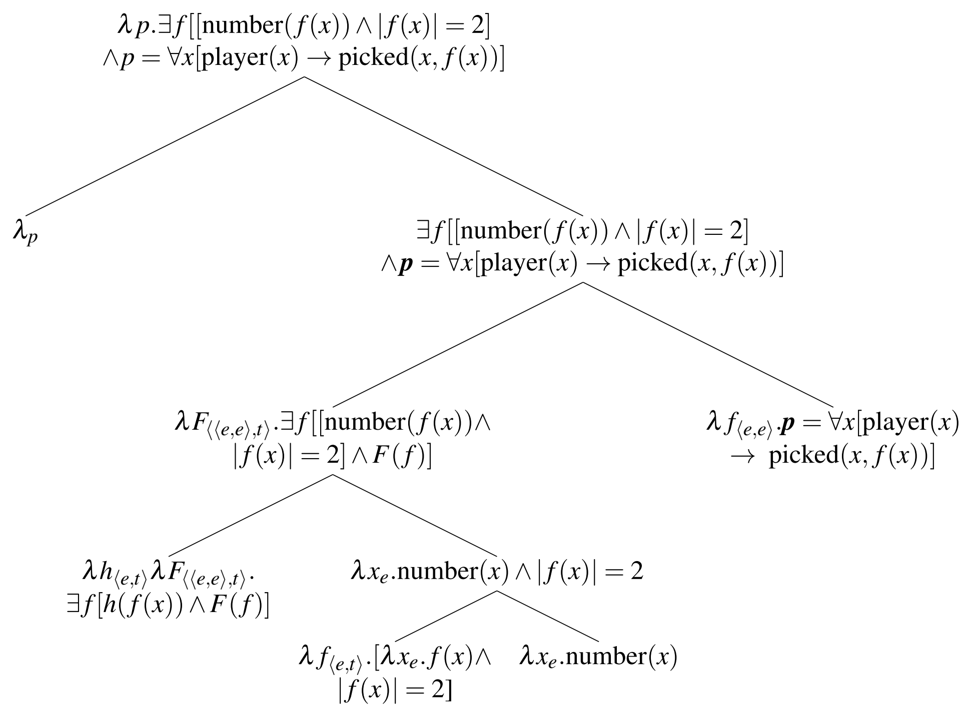
b. Ann and Ben picked 1, and Chris, Dan, and Emma picked 2.

In the true pair-list derivation, the quantity of numbers picked in the scenario can in fact be much higher. It is important to note that both analyses of pair-list answers I consider here predict the same semantic contribution from numeral modifiers. In this respect, the two accounts are essentially interchangeable. However, because the derivations are quite different, I will illustrate this separately under the functional and speech-act quantification analyses.

To begin, I examine the functional analysis of Engdahl and Chierchia. Just as in the cumulative case, *two* combines with *numbers*, yielding a property that denotes groups of two numbers. However, when *two numbers* combines with the higher-order version of *which*, it yields a presupposition that there exists a function from individuals to individuals such that every individual in the range is a group of two numbers.

15 In this context, this forces a many-to-one mapping. Since each of the five players must relate to one of the two numbers, there will necessarily be multiple players related to each number.

(47) Which two numbers did [the players D] pick? *Pair-list (functional analysis)*



Ultimately, this question asks for the identity of the presupposed function, which both maps every individual in the domain to a group of exactly two numbers, and also correctly maps every player to the (plural) individual of numbers picked by that player. This gives rise to the Hamblin set in (48) below. The members of this set are all of the same form, each asserting that every player picked the individual he is mapped to by some function into doubleton individuals of numbers, varying only by the identity of the particular function involved.

(48) $\{\forall x[\text{player}(x) \rightarrow \text{picked}(x, F(x))] \mid F:\ D \rightarrow \{x:\ \text{number}(x) \wedge |x| = 2\}\}$

Again, the Hamblin set members are logically independent, so there must be a unique true individual in order for the question to be felicitous. Let's assume the context is such that (49a) is the unique true answer. This answer asserts that every part of *these men* likes the (plural) individual they are mapped to by some function F', where F' is simply the function that correctly maps players to numbers in context.

(49) a. $\forall x[\text{player}(x) \rightarrow \text{picked}(x, F'(x))]$

b. $F' = \{\langle \text{Ann, 1+2}\rangle, \langle \text{Ben, 3+4}\rangle, \langle \text{Chris, 5+6}\rangle, \langle \text{Dan, 7+8}\rangle, \langle \text{Emma, 9+10}\rangle\}$

(50) Ann picked 1 and 2, Ben picked 3 and 4, Chris picked 5 and 6...

I assume this context is such that there is no overlap in choices, that is, that no atomic number was chosen by more than one individual player. Other contexts might be more conducive to some overlap in mappings. However, it's quite clear in (49–50) that the number of atomic numbers chosen can be much higher than in the pair-list reading than in the cumulative reading. While in cumulative answers like (46), the total number of atomic individuals that were picked must be equal to the numeral modifier, in the pair-list answer (49), the number of atomic individuals picked can be as high as the value of the numeral modifier multiplied by the number of pairs within the pair-list.

This same behavior is also predicted by the speech-act quantification analysis of Krifka. The structure of the question nucleus here is similar to the cumulative case. *Which* presupposes the existence of a group of two numbers, and the question asks for the identity of that group. The difference is that *the players* takes exceptionally high scope, deriving the generalized conjunction of a set of questions, each of which has its own existence presupposition, its own Hamblin set, and its own answer. The meaning this derives can be generally paraphrased as "For each player x in the domain, which group of two numbers did x pick?"

(51) Which two numbers did [the players D] pick? *Pair-list (speech-act quantification analysis)*

$$\boldsymbol{\&}\{\textsc{quest}(\lambda p.\exists x[[\text{number}(x) \wedge |x| = 2] \wedge p = \text{picked}(y,x))|\text{player}(y)\}$$

$$\lambda P.[\boldsymbol{\&}(P(y)|\text{player}(y))] \qquad \lambda y.[\textsc{quest}(\lambda p.\exists x[[\text{number}(x) \wedge |x| = 2 \wedge p = \text{picked}(y,x))]$$

$$\lambda_1 \qquad \textsc{quest}(\lambda p.\exists x[[\text{number}(x) \wedge |x| = 2] \wedge p = \text{picked}(\boldsymbol{t}_1,x)]$$

$$\textsc{quest} \qquad \lambda p.\exists x[[\text{number}(x) \wedge |x| = 2] \wedge p = \text{picked}(\boldsymbol{t}_1,x)]$$

A more literal paraphrase for this specific case might be "Which two numbers did Ann pick, which two numbers did Ben pick... and which two numbers did Emma pick?" This more clearly conveys that the component questions are, in fact, full questions in their own right. The first conjunct receives the Hamblin set in (52), from which an answer like (53) is selected.

(52) $\{\text{picked}(\text{Ann}, x):\ x \in {}^*\{1,2,3\ldots\} \wedge |x| = 2\}$

(53) picked(Ann, 1+2)

This same process is carried out for every question that participates in the conjunction. Each receives a parallel Hamblin set to (52), and each receives an answer of the same form as (53). These individual Hamblin answers are then conjoined, yielding a pair-list like (54).

(54) Ann picked 1 and 2, Ben picked 3 and 4, ... and Emma picked 9 and 10.

In short, for each individual question, the speech-act quantification analysis behaves similarly to the typical cumulative reading in (44) above. In both cases, the numeral modifier is effectively a constraint on the size of the plural individual picked out by the answer. However, since the pair-list in (54) is a conjunction of answers, Krifka's model predicts the same behavior that Chierchia's does: namely, that the number of atomic individuals in the range of the entire pair-list can be much greater than the numeral modifier, up to the amount of the numeral modifier multiplied by the number of pairs in the pair-list.

Since this behavior falls out from both analyses discussed here, I will treat it as a general prediction of quantifier scope-based analyses of pair-list answers. Furthermore, since this contrasts with the interpretation of cumulative answers, we have a clearly testable prediction. If a QPD containing a numeral modifier receives a pair-list response, we can examine the form of the response to determine whether it is a true answer derived via the pair-list pathway, or a cooperative elaboration derived via the cumulation-and-elaboration pathway. If it arises from the pair-list pathway, then the numeral modifier constrains the size of the plural individual each pair maps to. If it arises from the cumulation-and-elaboration pathway, the numeral modifier constrains the total number of atomic individuals across the entire (underlyingly cumulative) relation.

To show this in more concrete terms, I will assume a slightly modified version of the context discussed in Section 3, so that each player now selects two jerseys. And I assume that the true mappings from players to numbers are as depicted in (56).

(55) The head coach of a basketball team had ten jerseys made, numbered 1-10, for the five players on the team. Each player chose two jerseys, one in "home" colors and one in "away" colors. The assistant coach knows all five players on the team, knows the numbers that were available, and believes that each of those players chose exactly two jerseys. However, the assistant coach was not present for the choosing, and so doesn't yet know which players selected which jerseys.

(56)
$$\begin{tikzcd}[row sep=small, column sep=small]
\text{Ann} \arrow[r] \arrow[dr] & 1 & \text{Chris} \arrow[r] \arrow[dr] & 5 & \text{Emma} \arrow[r] \arrow[dr] & 9 \\
& 2 & & 6 & & 10 \\
\text{Ben} \arrow[r] \arrow[dr] & 3 & \text{Dan} \arrow[r] \arrow[dr] & 7 & & \\
& 4 & & 8 & &
\end{tikzcd}$$

In this new context, the assistant coach might felicitously ask (43), which I reprint here, in order to elicit an answer containing the mappings from players to numbers. The head coach might felicitously respond with (57).

(43) Which two numbers did the players pick?

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

Given the arguments of the preceding section, we have reason to believe that (57) is not derived via cumulation-and-elaboration. Under said derivation, the numeral modifier *two* ensures that the cumulative answer must contain exactly two atomic numbers. In this context, however, all groups of numbers that relate cumulatively to the group of players contain at least five numbers. There is no true answer that cumulatively relates the players to two numbers. Following the existence presupposition of Dayal (1996), we expect that without a true answer, the cumulative reading of the question should be infelicitous.

On the other hand, the pair-list derivation (regardless of which specific analysis one subscribes to) correctly predicts not only the acceptability of the question-answer pair, but also the form of the pair-list answer (57). The numeral modifier dictates the number of atomic individuals within the range of each pair. This correctly predicts that each pair will relate every player to a group of two numbers, for a total of ten jerseys chosen.[16]

In summary, the two-pathway model of QPDs predicts that differences in interpretation should arise, depending on whether the pair-list pathway or cumulation-and-elaboration pathway is employed. These differences can be made more salient by the presence of numeral modifiers, which display distinct patterns of behavior in

16 In this case, context precludes any overlap in the numbers chosen, but nothing about the pair-list derivation itself leads to such a restriction. For example, in a context where students choose their reading material from a provided list of articles, it may be natural to assume some overlap. A question like “Which three articles did the students read for their term papers?” could easily be conducive to an answer like “Ann read articles A, B, and C; Ben read articles C, D, and E; Chris read articles B, D, and F. . . ” In this case, it’s clear that the numeral’s contribution to the pair-list answer essentially imposes an upper bound on the total number of articles (equal in this case to three articles times the number of students).

the two derivations. In some cases, a particular pathway may not even give rise to a true answer.

5 Conclusion

In this paper, I present evidence against the cumulation-only hypothesis of Dayal (1992, 1996) and Krifka (1992) for questions with plural definites. Instead, I argue that pair-list responses to QPDs are ambiguous between two possible derivations: one follows the cumulation-and-elaboration pathway described by Dayal and Krifka, the other derives true pair-list answers from the same mechanism open to questions with overt quantifiers. I illustrate this second derivation within the functional analysis of Engdahl (1980, 1986) and Chierchia (1991, 1993), as well as the speech-act quantification analysis of Krifka (2001). Regardless of which analysis of pair-list answers one endorses, we expect that it should extend to QPDs as well.

The current proposal makes two correct predictions. First, subject-object asymmetries found in questions with overt quantifiers should also be found in QPDs, given the correct context. And second, numeral modifiers make different contributions to the semantics of the two derivations, leading to a clear divergence in the truth conditions of the pair-list and cumulative readings.

I return now to the "number effect" discussed in Section 2.2 as evidence for the cumulation-only hypothesis. Given the new data I introduce in Section 3, however, the empirical picture is more complex. 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? In this case, the number effect cannot simply be reduced to a logical fact about the interpretation of the type of relation in question.

Although I cannot offer a complete answer here, I will make two observations about this fact. First, this phenomenon is not limited to the domain of questions. Parallel behavior appears with demonstratives and with plural marking on bound pronouns. In a suitable context, (58a) can be read as expressing a proposition equivalent to the pair-list answer (29b)[17], while in (58b), the singular demonstrative can only be understood as referring to an atomic number.

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

17 (58a) could even serve as an answer to the assistant coach's question in context (30); for example, if the head coach uttered (58a) as she was in the process of handing the assistant coach a written list of the player-number pairs.

This is roughly parallel to the behavior of bound pronouns. (59a), which contains a bound plural pronoun, has a reading where each boy thinks he himself is brilliant, while the bound singular pronoun in (59b) must refer to one atomic boy.

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

The second observation I offer is that there appears to be some variation, both inter-speaker and contextual, with respect to the judgments expressed by speakers for examples like those in (60). Most speakers appear to agree with the reports most prevalent in the literature: that (60a) can easily elicit a pair-list answer, while (60b) generally cannot. However, a handful of speakers with whom I've discussed these examples find that both (60a) and (60b) can receive a pair-list interpretation.

(60) a. Which numbers did the players pick?
b. #Which number did the players pick?

This anecdote fits with experimental observations that, for sentences compatible with either covertly distributive or nondistributive interpretations, the covertly distributive interpretations appear to be generally dispreferred. Champollion (2015) discusses a number of studies which lend support to the idea that, even for languages like English, which widely allow covert distribution, nondistributive readings nonetheless remain more easily accessible. Perhaps covertly distributive readings are facilitated by plural marking, and that overt singular marking simply allows the preference for nondistributive readings to assert itself.

In short, the examples with demonstratives and bound pronouns support the argument that the number effect in QPDs is simply one aspect of a broader phenomenon, one that is neither confined to questions nor to cumulative readings. Furthermore, the general preference for nondistributive readings over covertly distributive readings hints at a possible origin for this phenomenon. So while the issue of the number effect in QPDs is not yet explained, it is clear that this behavior is not specific to QPDs alone, and it should not be interpreted as evidence that QPDs necessarily receive cumulative answers.

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William Johnston
1085 ave Dr-Penfield, Room 204
Montreal, QC H3A 1A7
Canada
william.johnston4@mcgill.ca

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