Disjoining questions

Aron Hirsch
Massachusetts Institute of Technology

Abstract

The consensus in the majority of the literature is that questions cannot be disjoined. Ciardelli et al. (2015), however, recently observed that there *are* felicitous cases of question disjunction. Building on their insights, this paper, first, maps out the different ways that disjoined questions can be interpreted. This results in identification of two classes of disjoined questions with different descriptive profiles. I develop an analysis of the two classes, and relate the differences between them to independently attested variability in the way simple questions are interpreted. Specifically, one class of disjoined questions has properties in common with simple *mention-all* questions, while the other is interpreted just like simple *mention-some* questions. A main contribution, then, is to connect disjoined questions with the broader interrogative typology.

Acknowledgments: I am indebted to Kai von Fintel, Danny Fox, Martin Hackl, Irene Heim, David Pesetsky, and Roger Schwarzschild for their invaluable feedback. I have presented this work in talks at MIT and Sinn und Bedeutung 21 (Edinburgh), and I also thank the audiences at those venues. All errors are, of course, my own. I receive partial financial support from a SSHRC doctoral fellowship.

1 Introduction

While declarative clauses are productively co-ordinated, it remains controversial to what extent co-ordination is available with other types of clauses. The focus in this paper is on disjunction of questions.

Groenendijk & Stokhof (1989) suggested that questions can be disjoined, and that a disjunction Q_1 *or* Q_2 offers the responder a choice between answering Q_1 and Q_2. They considered data along the lines of:

(1) What did Mary read? Or, what did Judy read?

The status of disjoined questions, however, has been murky territory. Theoretically, certain approaches to interrogative semantics are incompatible with question disjunction — and this accords with an empirical claim in Szabolcsi (1997) that genuine question disjunction is never attested. Motivated in part by cross-linguistic data, Szabolcsi suggested that *or* in (1) is not true disjunction, but a separate idiomatic device akin to *or rather* or *instead*. The idea that disjoined questions are impossible remained largely uncontested until recently, when it was falsified by Ciardelli et al. (2015), who introduced a first data point showing that questions *can* be disjoined in certain cases.

This paper picks up on these insights, and makes two main contributions. First, I discuss new data which map out the different ways that disjoined questions can be interpreted. The results show that question disjunction is really quite productive when the right sorts of examples are considered, and identify two classes of disjoined questions which differ in their descriptive profile.

Second, I provide a comprehensive analysis of disjoined questions which accounts for the full set of empirical results. Discussion centers on (i) and (ii), which have consequences for how questions are interpreted (for (i)), and what the space of possible variability in question interpretations is (for (ii)).

(i) Given that certain theories of questions disallow disjunction, how does *or* operate on questions to yield a well-formed output?

(ii) How do the different classes of disjoined questions differ from one another? Do the two classes relate to independently attested variability in the interpretation of simple questions?

For (i), I show that question disjunction "follows for free" if questions denote the sets of their possible answers, as in Hamblin (1973). The upshot is that Q_1 *or* Q_2 does not really offer the responder a choice between questions — but rather is interpreted as a single question, which can be answered in different ways.

With Q_1 *or* Q_2 interpreted as a single question, I propose that the differences between the two classes of disjoined questions directly mirror independently attested variability in the way simple questions are interpreted. One class of disjoined questions has properties in common with simple *mention-all* questions, while the other class is interpreted exactly like simple *mention-some* questions. In this way, I connect disjoined questions with the broader interrogative typology.

The paper is organized as follows. In §2, I provide a more detailed overview of the consensus view that questions cannot be disjoined. In §3, I introduce new data identifying two classes of attested question disjunction. I develop the analysis in §§4-6. The analysis brings out a *semantic* parallel between one class of disjoined questions and mention-some questions. In §7, I show how further data can be understood if disjoined questions in this class also share *pragmatic* properties with mention-some questions. §8 sketches a possible alternative analysis, and points some shortcomings of the alternative. Finally, §9 concludes.

2 The consensus view

As noted, certain analyses of questions predict disjunction to be impossible. The clearest and most discussed case is the partition-based analysis of Groenendijk & Stokhof (1984, hence G&S). To establish the idea behind G&S's proposal, consider the simple question in (2), and suppose there are just two people in the domain, John and Mary.

(2) Who came to the party?

The question in (2) carves the space of possible worlds up into four non-overlapping subsets of worlds: (i) those worlds at which no one came, (ii) those at which only John came, (iii) those at which only Mary came, and (iv) those at which both came. By providing an answer to the question, the responder indicates in which cell the actual world is located. Formally, questions denote an equivalence relation between worlds, as in (3).

(3) $[\![$who came to the party$]\!]$ =
λw . λw' . $\forall$x [come(x, the party, w) $\leftrightarrow$ come(x, the party, w')]

Two worlds w and w' stand in the relation in (3) just in case the people who came to the party at w are exactly the same as the people who came to the party at w'. All the worlds within any one of cells (i)-(iv) stand in the relation with one another, while no two worlds in different cells stand in the relation. For a question to be well-formed for G&S, it is crucial that the question carve up the space of possible worlds into *non-overlapping* cells. They require that questions *partition* logical space, and mutually exclusivity of cells is one property of a partition. I state this property as (4), paraphrased: if w and w' are in one cell and w is not in the same cell as w", w' must not be in a cell with w" either.

(4) For a question Q to be well-formed, the relation R that Q denotes must be such that for any worlds w, w', and w", if R(w,w') & $\neg$R(w,w") $\rightarrow$ $\neg$R(w',w").

Disjoined questions are not licit in G&S's theory because they do not denote a partition. The disjunction in (1), repeated, would denote the relation in (5):

(1) What did Mary read? Or, what did Judy read?

(5) $[\![$(1)$]\!]$ = λw . λw' . $\forall$x [read(Mary, x, w) $\leftrightarrow$ read(Mary, x, w')]
$\vee$ $\forall$y [read(Judy, y, w) $\leftrightarrow$ read(Judy, y, w')]

Two worlds w' and w" stand in the relation in (5) just in case either Mary read the same things in w' and w", or Judy read the same things in w' and w". This relation does not respect the condition in (4). To illustrate, consider the three worlds in (6):

(6) a. w_1: Mary read Macbeth, Judy read Hamlet.
b. w_2: Mary read Macbeth, Judy read Othello.
c. w_3: Mary read Hamlet, Judy read Othello.

w_1 is in a cell with w_2 (because Mary read the same thing at w_1 and w_2), but not w_3 (because neither Mary nor Judy read the same things at w_1 and w_3). w_2, however, is in a cell with w_3 (because Judy read the same thing at w_2 and w_3). Hence, cells overlap: w_2 is both in a cell with w_1 and a cell with w_3, which are in different cells.

Despite their negative prediction, Groenendijk & Stokhof (1989) were, as far as I know, the first to suggest empirically that question disjunction is possible. To accommodate disjunction within a partition-based theory, G&S propose that questions are type-lifted to a generalized quantifier prior to being disjoined. Szabolcsi (1997, 2016) illustrates with an embedded question:

(7) Sue found out where you live or who you married.

The two disjuncts denote relations which, when applied to the actual world, output the propositions in (8-a) (*that you live where you actually live*) and (9-a) (*that you married who you actually married*), respectively. These propositions are Montague lifted (Partee 1986), as in (8-b) and (9-b), and the resultant meanings are disjoined, as in (10). The output is a set of sets of propositions. A set of propositions is an element of the set just in case it contains either the proposition in (8-a) or the proposition in (9-a) (or both).[1]

(8) a. $\lambda w' . \forall x\, [\text{live(you, x, } w_0) \leftrightarrow \text{live(you, x, w')}]$
b. $\lambda P_{stt} . P(\lambda w' . \forall x\, [\text{live(you, x, } w_0) \leftrightarrow \text{live(you, x, w')}])$

(9) a. $\lambda w'' . \forall x\, [\text{marry(you, y, } w_0) \leftrightarrow \text{marry(you, y, w'')}]$
b. $\lambda P_{stt} . P(\lambda w'' . \forall x\, [\text{marry(you, y, } w_0) \leftrightarrow \text{marry(you, y, w'')}])$

(10) $\lambda P_{stt} .\ P(\lambda w' . \forall x\, [\text{live(you, x, } w_0) \leftrightarrow \text{live(you, x, w')}])$
$\vee P(\lambda w'' . \forall x\, [\text{marry(you, y, } w_0) \leftrightarrow \text{marry(you, y, w'')}])$

The meaning in (10) is well suited to compose in an embedded environment such as (7). I assume the LF in (11), where the disjunction QRs, leaving a trace of proposition type:

(11) [[$_{orP}$ where you live or who you married] λ1 [Sue found out t_1]]

Found out denotes a relation between an individual and a proposition. Predicate Abstraction in (11) creates the set of propositions that Sue found out, which is the argument of (10). The sentence in (7) is correctly predicted to be true just in case either Sue found out that you live where you actually live, or Sue found out that you married who you actually married.

The effect of type-lifting is to require the question disjunction to be the argument of

[1]To facilitate exposition, I will switch between discussing sets and their characteristic functions in prose. This distinction has no role to play in the present paper.

some predicate of propositions. This is possible with embedding — but not in a matrix environment, where there is no appropriate predicate. Szabolcsi (1997) first noticed this issue: "[matrix interrogatives] are genuine questions. Thus it seems natural to interpret them in a way that directly links them to possible answers, which is what the unlifted interpretations do; and it is not natural to interpret them as lifted questions" (p. 324).

This leads to the empirical side of the controversy. Szabolcsi argues that disjoining questions does require type-lifting, and suggests that matrix disjoined questions are simply never attested. This represents a disagreement with G&S's empirical claim. Szabolcsi's idea is that data like (12) are not cases of genuine disjunction.

(12) a. What did Mary read? Or, what did Judy read?
b. Where do you live? Or, who did you marry?
c. Whom does Mary love? Or, whom does Judy love?

She notes that the two questions are written as separate sentences. Without a prosodic break marking a sentence boundary, she judges these data to be unacceptable, as in (13) for (12-b).

(13) ??Where do you live or who did you marry?

Szabolcsi suggests that *or* in (12-a)-(12-c) "does not really offer a choice, but, instead, is an idiomatic device that allows one to cancel the first question and replace it with the second" (p. 325). The sequence in (12-b) may, then, be paraphrased with *or rather*, as in (14).

(14) Where do you live? Or, rather, who did you marry?

Szabolcsi offers additional support for her position from Hungarian. First, she observes that sequences such as (12) are fully unacceptable in Hungarian, unless the morpheme *inkabb* ('rather; instead') is added, making the strings more parallel to (14). Second, there is a syntactic difference between conjunction and disjunction of questions in embedded environments: conjunction is possible with a single embedded complementizer above *and*, while disjunction requires a separate complementizer in each disjunct. Szabolcsi analyzes the embedded complementizer as an overt type-shifter, and takes this contrast as an indication that disjunction requires each question individually to be type-lifted.

In the remainder of the paper, I will focus exclusively on *matrix* disjoined questions. Accordingly, Szabolcsi's key conclusion can be stated as (15) for present purposes — a conclusion that has become the consensus view in subsequent literature.

(15) **Key conclusion**
Q_1 *or* Q_2 (with Boolean disjunction) is never possible as a matrix question.

Krifka (2001), for instance, agrees with (15), and adds further rationale for it. As noted in the introduction, he is interested in the possibility of coordinating speech acts. Krifka notes that Q_1 *or* Q_2 cannot be interpreted as a disjunction of two speech acts, each of which individually is a licit matrix question. Krifka argues for a broader generalization that speech acts cannot be disjoined, observing that performatives and imperatives pattern as in (16) and (17). In (17), the imperative can be understood as a single speech act giving a disjunctive command, biased by (17-a), but not as a true disjunction of speech acts, biased by (17-b).

(16) #I hereby baptize you John, or I hereby baptize you Mary.

(17) Pick up the ball or pick up the racket.

a. ?I don't care which. b. #... I don't know which.

Haida & Repp (2013, H&R) also agree with (15), though they again invoke different theoretical assumptions. They assume a question semantics after Karttunen (1977), by which questions denote a set of propositions, in particular the set of their true answers. They consider the disjunction in (18):

(18) How did Paul get home or when did Paul get home?

Suppose, as H&R do for illustration, that Paul got home only by bus and only at 3am. Then, the questions in the left and right disjuncts denote (19-a) and (19-b), respectively (shown with set notation for convenience). H&R assume that a disjunction Q_1 *or* Q_2 denotes the set of propositions which results by pointwise disjoining each element in the Karttunen set for Q_1 with each element in the Karttunen set for Q_2. The particular result for (18) is (19-c).

(19) a. $\{\lambda w$. Paul got home by bus in w$\}$
b. $\{\lambda w$. Paul got home at 3am in w$\}$
c. $\{\lambda w$. Paul got home by bus in w $\vee$ Paul got home at 3am in w$\}$

To answer Q_1 *or* Q_2, the speaker would have to provide the proposition in (19-c), and H&R argue that this is blocked pragmatically. Because questions denote the sets of their true answers, the proposition in (19-c) is formed by disjoining two true propositions. A disjunction both of whose disjuncts are true is infelicitous by Gricean reasoning, as the Maxim of Quantity requires a speaker to assert *p and q* instead of *p or q* if the speaker is opinionated that *p* and *q* are both true. H&R conclude that a question disjunction is unanswerable and, therefore, unacceptable.[2]

Overall, then, the consensus view is that matrix question disjunction is not attested. In the following section, I discuss empirical counter-evidence to the consensus view, and map out the different descriptive profiles of acceptable disjoined questions.

3 Where questions are disjoined

Szabolcsi's proposal — that Q_1 *or* Q_2 idiomatically cancels Q_1 and replaces it with Q_2 — predicts that, in answering Q_1 *or* Q_2, the responder must answer Q_2. Answering Q_1 should be uncooperative. I refer to this answering pattern as the *cancellation schema*, illustrated in (20), where A_1 signifies an answer which completely resolves Q_1, and A_2 signifies an answer which completely resolves Q_2.

[2]Note that H&R's main focus is on embedded contexts, where they disagree to some extent with Szabolcsi, as they identify what they interpret as genuine embedded question disjunction. Szabolcsi (2016), however, provided a compelling counter-argument to H&R's conclusion and, since the focus in this paper is on matrix questions, I will not pursue this issue further.

(20) **Cancellation schema: possible answers to Q_1 *or* Q_2:**

a. #A_1

b. ✓A_2

The cancellation schema contrasts with Groenendijk & Stokhof's (1989) original intuition that the responder can choose to provide an answer to either of the disjoined questions. I refer to this answering pattern as the *choice schema*, illustrated in (21).

(21) **Choice schema: possible answers to Q_1 *or* Q_2:**

a. ✓A_1

b. ✓A_2

I take the choice schema to be the hallmark of true question disjunction, with controversy surrounding the existence of question disjunction centering around the question of whether or not any examples in fact instantiate the choice schema.

Departing from consensus, Ciardelli et al. (2015) recently argued that the choice schema *is* attested. They observed the datum in (22), where each of the answers in (22-a) (addressing Q_1) and (22-b) (addressing Q_2) are acceptable and resolve the question.

(22) Where might we rent a car, or who might have one we could borrow?

a. We might be able to rent a car at Avis.

b. John might have one we could borrow.

In the following, I introduce further data which I believe clearly instantiate the choice schema, showing that the pattern is productive. Moreover, I identify two categories of examples, which differ in their descriptive profile. It will be useful to look at the data in this bifurcated way as we develop the analytical proposal.

3.1 Class 1: only one question answerable

Class 1 data have the following profile. One of Q_1 and Q_2 has a true answer, while the other does not. The questioner knows that one question has a true answer, but is uncertain which question is answerable. The questioner wants to leave it up to the responder to provide an answer to whichever question that is, in fact, answerable.

To illustrate, consider (23). Speaker A informs speaker B that the department made a staffing change, but B does not know the nature of the staffing change.

(23) a. A: The department made a staffing change this weekend.

b. B: Really?! Who got hired or who's leaving?

Assuming there was exactly one staffing change, one of *Who got hired?* and *Who's leaving?* has a true answer, but B does not know which one. B, therefore, is not in a position to cancel Q_1. Rather, B wishes to give A the option to answer whichever question A wishes. If John got hired, A should answer as (24-a) and, if John's leaving, A should answer as (24-b).

(24) Who got hired or who's leaving?
  a. ✓A: John got hired.
  b. ✓A': John's leaving.

A similar example where the context is perhaps more natural is (25). Suppose that the speaker comes up to a church yard and hears bells. The speaker knows that church bells signify that either a wedding or a funeral is happening, but the speaker is uncertain which one is, in fact, happening. The speaker may ask:

(25) Who's getting married, or who's funeral is it?

An internet search reveals that disjoined questions are quite widely attested. The three data points that follow are adapted from different websites:

(26) Who did Bob kill, or what other crime did he commit?

(27) *(Trying to get a product the interlocutor has received.)*
Who did you call, or what else did you do?[3]

(28) *(The interlocutor has finally started feeling better in life.)*
Who did you meet or what did you read that helped you?[4]

These seem at least likely to have the profile of Class 1. The question in (26), for instance, is felicitous if Bob committed one crime, and the speaker is uncertain whether it was a murder, or something else. The intuition is similar for the other two examples.

3.2 Class 2: both questions answerable

The second class of disjoined questions has a different profile. In Class 2 data, both questions have a true answer, and knowing the answer to either question is enough to achieve some conversational goal. The questioner provides both questions to the interlocutor, who has the option to answer either question.

The disjunction in (29) is felicitous and illustrates the Class 2 profile. Suppose the questioner is a customer service agent, and the interlocutor requires assistance. To find the interlocutor's file, the questioner requires one of two personal identifiers: either the name, or the social security number. The interlocutor may ask:

(29) What's your name or what's your SSN?
  a. My name is Aron.
  b. My SSN is 123-45-6789.

Assuming the questioner is interacting with a US resident, both questions in (29) must have a true answer, as the interlocutor necessarily has both a name and an SSN. The responder can give either answer, per the answering pattern shown, and either answer is sufficient to achieve the goal of locating the interlocutor's file.

[3] http://www.whattoexpect.com/forums/march-2015-babies/topic/breastpumps-covered-through-united-healthcare.html

[4] http://www.nustm.org/wp-content/uploads/2015/08/1.Nat-Article.pdf

Data like (29) are again quite widespread. A parallel example is given in (30). In this case, the questioner is filling out a form for some third party and the form requires information about one biological parent. The questioner asks their interlocutor to identify one parent of the third party. Either an answer like (30-a) (to Q_1) or an answer like (30-b) (to Q_2) is sufficient to achieve the goal of completing the form, and it's again up to the interlocutor to choose which answer to give.

(30) Who's the mother or who's the father?
  a. Mary is the mother.
  b. John is the father.

A final illustrative datum is (31), which is adapted from a website and likely is Class 2. Assuming the interlocutor has a preferred superpower and a spirit animal, both questions in (31) have a true answer. The goal in the context is to learn some piece of information about the interlocutor to begin a conversation. Either an answer like (31-a) or one like (31-b) is sufficient to achieve this goal, and the choice of how to answer is left to the interlocutor.

(31) What's your superpower or what's your spirit animal?[5]
  a. My superpower is flying.
  b. My spirit animal is a polar bear.

3.3 Analytical desiderata

I take the data in the preceding subsections, together with Ciardelli et. al.'s example, as conclusive evidence that disjoined questions exist and are productively available as matrix questions. This falsifies the consensus view that disjoined questions are not attested. Given the new empirical generalization, the theory of questions must generate disjoined questions, and capture both Class 1 and Class 2 profiles. At the same time, the theory must still explain why some disjoined questions, including those in the previous literature, are degraded. I develop the analysis in the remainder of the paper.

4 How questions are disjoined

Since different approaches to questions predict disjunction to be impossible, the first step is to ask: how might *or* operate on questions to yield a well-formed output?

Since Groenendijk & Stokhof's (1989) partition semantics rules out disjunction, my analytical point of departure is the alternative classical idea that a question denotes a set of propositions. In particular, I take a question to denote the set of its possible answers, as in Hamblin (1973). I first spell out the approach for a simple question (§4.1), and then show how disjunction fits in (§4.2).

The critical result will be that a disjunction Q_1 *or* Q_2 is interpreted as a single question, denoting the union of the Hamblin sets of the two disjoined questions.

[5] http://www.businessinsider.in/Heres-what-Richard-Branson-Elon-Musk-and-22-other-successful-people-ask-job-candidates-during-interviews/Whats-your-superpower-or-spirit-animal/slideshow/49924546.cms

(32) **The Union Hypothesis**[6]

A disjunction of two questions Q_1 *or* Q_2 is interpreted as a single question with its Hamblin set $Q_1 \cup Q_2$.

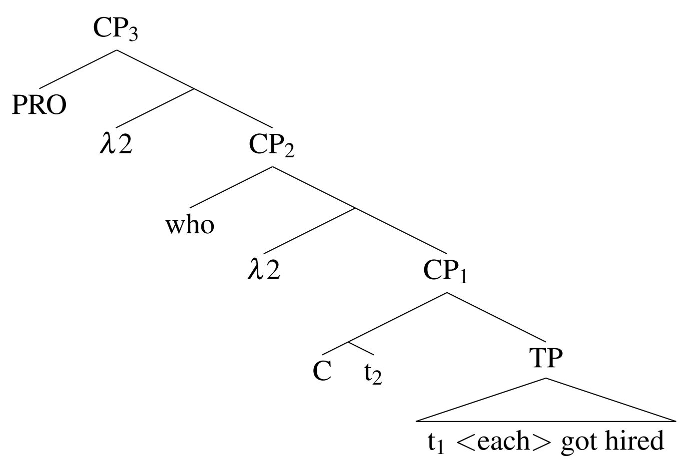
I show that the Union Hypothesis "follows for free" from the analysis of simple questions in §4.1, and is a promising direction to pursue to analyze disjoined questions, since the union $Q_1 \cup Q_2$ does contain the intuitively possible answers to Q_1 *or* Q_2. The proposal so far will apply equally to Class 1 and Class 2 data. Differences between classes will emerge later on.

4.1 A familiar syntax and semantics for questions

First, I first spell-out the assumptions I make about how questions are built syntactically and interpreted, illustrating with the simple question in (33).

(33) Who got hired?

(34) **LF for (33) (to be revised)**



The syntax I adopt for (33) in (34) mostly follows Karttunen (1977).[7] The interrogative complementizer, defined in (35), equates two propositions:

(35) **Defining the interrogative complementizer**

$$[\![C]\!] = \lambda p_{st} \,.\, \lambda q_{st} \,.\, p = q$$

Its sister is a covert pronoun PRO, which moves to adjoin on the clausal spine (modifying Karttunen, following Heim 2000, Fox 2013). PRO leaves a trace, which is interpreted as a variable of type <s,t>. This variable saturates the first argument of C. The second

[6]Biezma & Rawlins (2011) pursued a similar idea for disjoined polar questions (*Is it a bird or is it a plane?*). This is also the approach to disjoined constituent questions in Ciardelli et al. (2015). They formulate their analysis in Inquisitive Semantics, and I adopt different syntactic and semantic assumptions, but I don't believe these framework differences are crucial to the conclusions in this section.

[7]Internal to this paper, this is primarily an expositional choice. Within the context of the dissertation, I make this choice because, as we will see, it allows *or* to be analyzed as basic logical disjunction without type-shifting.

argument of C is saturated by the TP, out of which *who* has moved. *Who* is interpreted ex situ as an existential quantifier binding its trace, (36). *Who* quantifies over atomic and plural individuals, and covert *each*, (37), results in a distributive interpretation. So, CP_2 provides the equation *p* = *that every atom of X got hired*, with *X* existentially bound.

(36) **Defining *who***

$[\![\text{who}]\!] = \lambda f_{et} \,.\, \exists X\ [f(X)]$

(37) **Defining covert *each* (Link 1983)**

$[\![\text{each}]\!] = \lambda f_{et} \,.\, \forall x <_{AT} X\ [f(x)]$

Movement of PRO targets a position just above CP_2. PRO is not itself interpreted, but triggers Predicate Abstraction (Heim & Kratzer 1998), binding the propositional variable *p*. This creates (the characteristic function for) a set of propositions of the form *that every atom of X got hired* — the traditional Hamblin set for *Who got hired?*.

(38) **Hamblin denotation at CP_3**

$[\![CP_3]\!] = \lambda p_{st} \,.\, \exists X\ [p = \lambda w \,.\, \forall x <_{AT} X\ [x \text{ got hired in } w]]$

4.2 Disjunction follows for free

The analysis of questions in the last subsection provides all the ingredients needed to derive a well-formed meaning for a question disjunction. If questions denote sets of propositions, a natural hypothesis is that the disjunction of two questions yields a single new question corresponding to the union of the two disjuncts. The Union Hypothesis "follows for free" as a predicted consequence of the compositional system just sketched.

Consider the underlined example in (39) (a Class 1 datum) as an illustrative test case:

(39) A: The department made a staffing change this weekend.
B: Really! Who got hired or who's leaving?

Compare the simple question from above to the example in (33), reproduced side-by-side in (40). (40-b) differs minimally from (40-a) in the addition of the second disjunct.

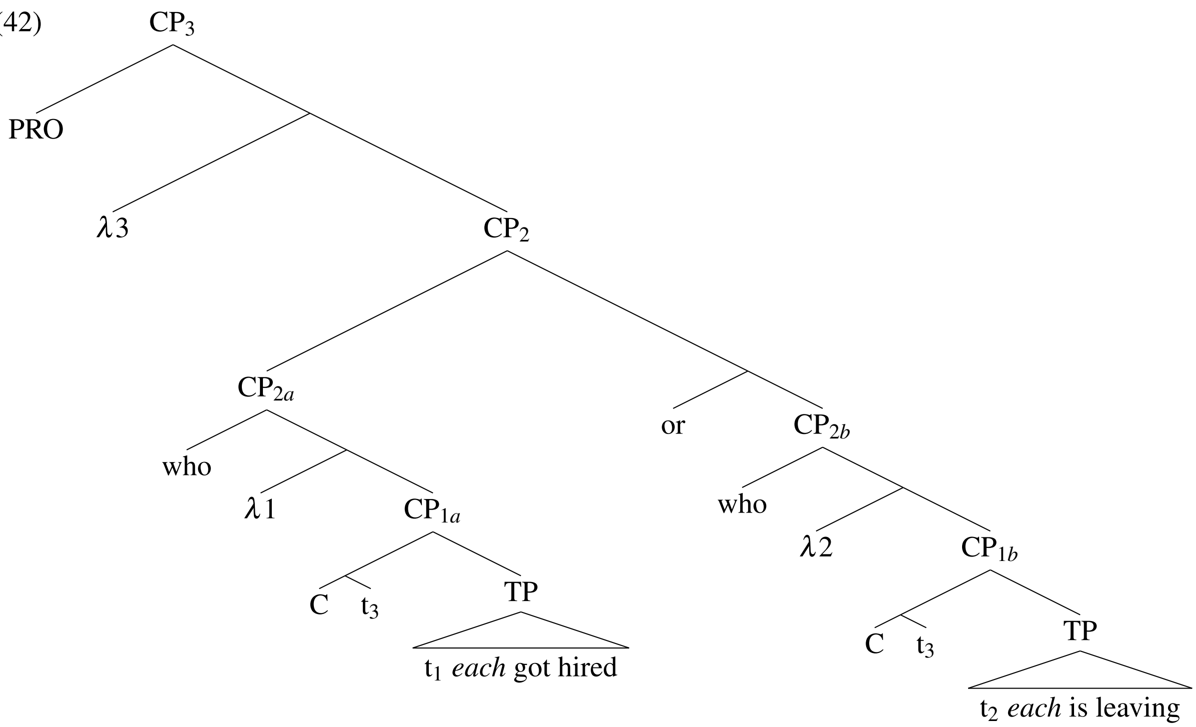
(40) a. Who got hired?
b. Who got hired or who's leaving?

I assume that *or* is analyzed as logical disjunction, with the lexical entry in (41). Given (41), *or* is of type <t,<t,t>>. Partee & Rooth (1983) propose a generalized type-shifting schema by which *or* could shift its type to disjoin expressions of any type ending in *t*. As we will see, however, the basic lexical entry in (41) is sufficient to analyze our data.

(41) $[\![\text{or}]\!] = \lambda p_t \,.\, \lambda q_t \,.\, p \vee q$

The structure for (40-a) in (34) above has multiple scope sites for disjunction. With *or* type <t,<t,t>>, disjunction could scope at any type t node — TP, CP_1, and CP_2. With type-shifting, disjunction could scope at other nodes as well, among them CP_3 and CP_4. Since *who* occurs twice in (40-b), the structure for (40-b) must have *or* scope at least as high as CP_2. I propose that an appropriate LF for (40-b) is (42), where *or* scopes directly at CP_2.

(42)



PRO moves across-the-board (ATB) above the disjunction to form CP_3, and the predicted meaning at CP_3 is (43): a set of propositions, containing both propositions of the form *that every atom of X got hired* and propositions of the form *that every atom of Y got fired*.

(43) **Prediction for CP_3**

$$[\![CP_3]\!] = \lambda p . \quad \exists X\, [p = \lambda w . \forall x <_{AT} X\, [x \text{ got hired in } w]] \\ \vee \exists Y\, [p = \lambda w . \forall y <_{AT} Y\, [y \text{ is leaving in } w]]$$

The effect of disjunction at CP_2 is, therefore, to create the union of the Hamblin sets of the two disjoined questions: the set characterized in (43) is the union of the sets characterized in (44-a) (Hamblin set for *Who got hired?*) and (44-b) (Hamblin set for *Who's leaving?*).

(44)
a. $\lambda p . \exists X\, [p = \lambda w . \forall x <_{AT} X\, [x \text{ got hired in } w]]$
b. $\lambda p . \exists X\, [p = \lambda w . \forall x <_{AT} X\, [x \text{ is leaving in } w]]$

The Union Hypothesis seems a promising point of departure. In Hamblin semantics, a question should denote the set of its possible answers — and (43) does contain the possible answers to (40-b). Recall from §3 an illustrative answering pattern for (40-b):

(45) Who got hired or who's leaving?
a. ✓A: John got hired.
b. ✓A': John's leaving.

If John got hired, the speaker should answer (45-a), and if John is leaving, the speaker should answer (45-b). The propositions expressed by both answers are elements of (43).

4.2.1 Comparison with pointwise composition

The Union Hypothesis differs critically from assumptions in Haida & Repp (2013), who also adopt an analysis of questions as sets of propositions (for them, the set of their true answers; Karttunen 1977). As discussed earlier (see ex. (18)), they took *or* in Q_1 *or* Q_2 not to union Q_1 and Q_2, but rather to pointwise disjoin each proposition in Q_1 with each proposition in Q_2. The result was pathological.

If questions denote the set of their *possible* answers, rather than the set of their *true* answers, Haida & Repp's particular pathology is avoided. But, pointwise composition still yields problematic results.

Suppose the propositions in (45-a) were pointwise disjoined with the propositions in (45-b). The question in (39) would then, in effect, have the denotation in (46), containing propositions like those in (47).

(46) λp . $\exists$X$\exists$Y [p = λw . $\forall$x $<_{AT}$ X [x got hired in w] $\vee$ $\forall$y $<_{AT}$ Y [x is leaving in w]]

(47) a. {λw . John got hired in w or Mary's leaving in w,
b. λw . Mary got hired in w or John's leaving in w, ...}

If this were right, the possible answers to the question should be disjunctions, contrary to intuitions, as the responder in (48) does not seem to resolve the question asked:

(48) A: Who got hired or who's leaving?
B: #John got hired or Mary's leaving.

A similar point can be made by embedding (39) under *know*, as in (49). The sentence is intuitively false if the dean knows a disjunction such as (47-a) or (47-b), but does not know either exactly who was hired or exactly who is leaving.

(49) The dean knows who got hired or who's leaving.

The particular compositional analysis adopted here correctly predicts a meaning like (46) to be absent. Observe that (46) involves two existential quantifiers, but just one $=$ operator, with disjunction scoping inside the proposition $=$ equates with *p*.

(50) λp . $\exists$X$\exists$Y [p = λw . $\forall$x $<_{AT}$ X [x got hired in w] $\vee$ $\forall$y $<_{AT}$ Y [x is leaving in w]]

Under the present proposal, existential quantifiers are contributed by *who*, and $=$ comes from interrogative C. To have two existential quantifiers in a disjunction, *or* must scope above *who* at LF. But, *who* is interpreted in the specifier of the CP headed by interrogative C, so if *or* scopes above *who*, it also scopes above interrogative C, and two occurrences of $=$ are introduced also. There cannot be two existentials, but one $=$. Hence, the proposal derives the union analysis — and blocks a clearly incorrect alternative.

4.3 Section summary

This section has show that a well-formed meaning for a disjunction of matrix questions "follows for free" from familiar syntactic and semantic mechanisms for questions. The key result: Q_1 *or* Q_2 is predicted to be interpreted as a single question denoting $Q_1 \cup Q_2$.

5 Analyzing Class 1

I now zero in on Class 1 data, and ask: how does the Union Hypothesis capture the choice schema in these examples? Pre-theoretically, Q_1 *or* Q_2 seems to offer the responder a choice between two questions. If the Union Hypothesis is right, however, this cannot be the analysis, as Q_1 *or* Q_2 is formally a single question. I propose that the choice schema, in fact, reflects variability in how a single question is answered.

5.1 Answerhood conditions

The Hamblin set for a question indicates the space of all answers that are, in principle, possible — but it does not directly predict how a question should be answered in a given circumstance. To understand the choice schema, we must first make explicit the answerhood conditions for a question.

To do so, I consider again the simple question in (33), and its Hamblin set in (38). Suppose that exactly two people got hired at w_0: John and Mary. Then, the Hamblin set contains exactly three proposition that are true at w_0, as in (51)

(33) Who got hired?

(38) λp_{st} . $\exists$X [p = λw . $\forall$x $<_{AT}$ X [x got hired in w]]

(51) **True propositions at $\mathbf{w_0}$**

a. λw . John got hired in w,

b. λw . Mary got hired in w,

c. λw . John got hired in w and Mary got hired in w

Intuitively, to completely resolve the question, the responder must provide the *strongest* of the true propositions in the Hamblin set — they must provide (51-c) and cannot co-operatively provide (51-a) or (51-b) (except as partial answers). The responder must, then, indicate *everyone* who was hired. For this reason, (33) is referred to as a "mention-all" question, which we will contrast with "mention-some" later on.

To capture this, we can incorporate into the LF an ANS operator, after Dayal (1996). ANS, defined in (52), takes as its arguments a world *w* and a set of propositions *Q*. ANS introduces a presupposition that *Q* contains some proposition that is true at *w* and stronger than any other true proposition in *Q*. ANS returns that unique strongest true proposition. With ANS in play, the answerhood conditions for a question may be stated as (53).

(52) **Defining ANS (Dayal 1996)**

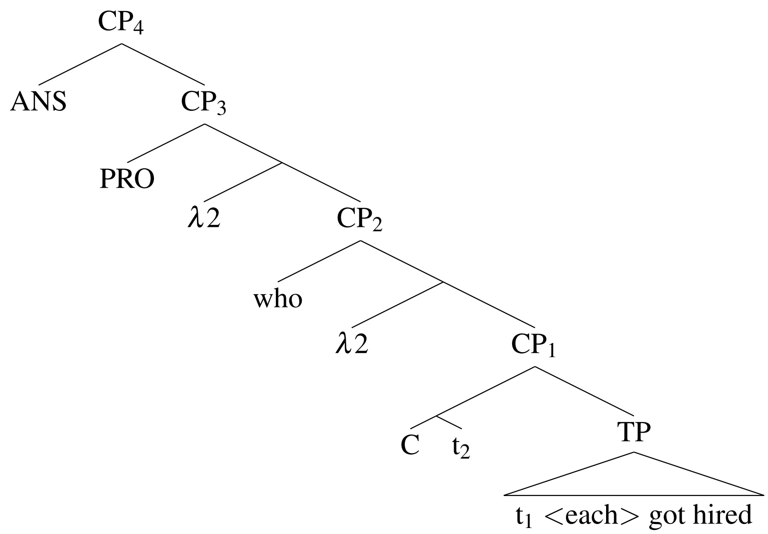
$$[\![\text{ANS}]\!] = \lambda Q_{stt} \,.\, \lambda w : \exists p\, [w \in p \in Q \;\&\; \forall p' \in Q\, [w \in p' \rightarrow p \subseteq p']] \,.\, \iota p\, [w \in p \in Q \;\&\; \forall p' \in Q\, [w \in p' \rightarrow p \subseteq p']]$$

(53) **Answerhood condition for a question Q (first pass; to be revised in §7)**

To resolve Q at w, the responder must provide the proposition given by ANS(Q)(w).

Concretely, ANS integrates into the LF for (33) as in (54). Applying ANS at w_0 to the Hamblin denotation for CP_3 returns as the denotation of CP_4 the proposition *that John got hired and Mary got hired*, as in (55). Because that proposition is true and entails both of the other true proposition in the Hamblin set, the presupposition of ANS is met. To resolve the question, the speaker must provide that proposition.

(54)



(55) **Result for CP_4 at w_0**

$[\![\text{ANS}]\!]([\![CP_3]\!])(w_0)$

$= \lambda w \,.\, \forall x <_{AT} \text{John}\oplus\text{Mary}\ [x \text{ got hired in } w]$

$= \lambda w \,.\, \text{John got hired in } w \;\&\; \text{Mary got hired in } w$

In sum, a sub-constituent of the question denotes the Hamblin set, which is presupposed to contains a unique strongest true answer. The question as a whole denotes that answer, and the responder must provide it to resolve the question.

To set the stage for how a parallel analysis of a Class 1 disjoined question can capture the choice schema, let us consider two worlds which differ in who got hired. Suppose that John is the only hiree at w_1, and that Mary is the only hiree at w_2. Then, the result of applying ANS to the Hamblin set at w_1 is (56), and at w_2 is (57).

(56) **Result for CP_4 at w_1**

$[\![\text{ANS}]\!]([\![CP_3]\!])(w_1) = \lambda w \,.\, \text{John got hired in } w$

(57) **Result for CP_4 at w_2**

$[\![ANS]\!]([\![CP_3]\!])(w_2) = \lambda w$. Mary got hired in w

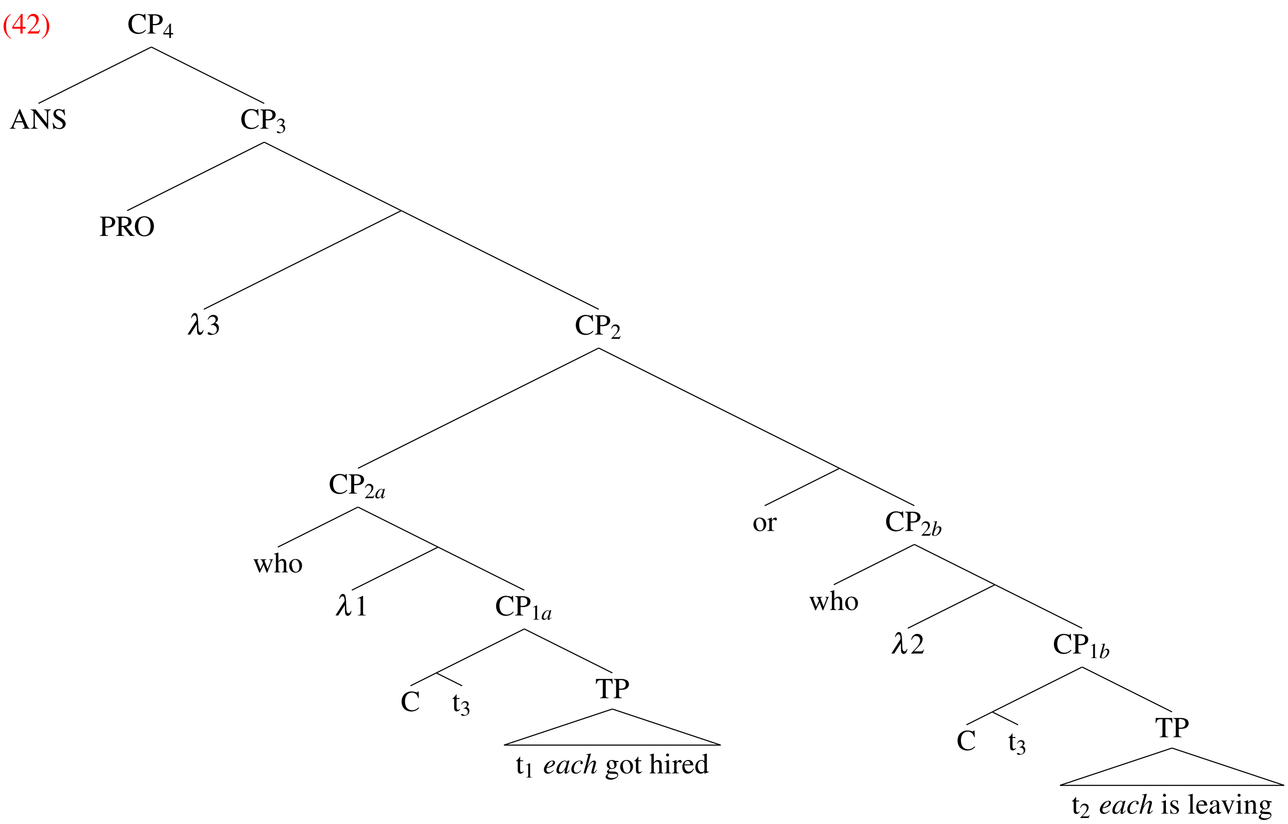
Which proposition in the Hamblin set is the strongest true one varies by world and, in turn, how the question should be answered varies. The responder must provide the proposition *that John got hired* at w_1, but the proposition *that Mary got hired* at w_2. This observation is rather unremarkable — and I show that the choice schema with Class 1 disjoined questions follows from this same sort of familiar variability.

5.2 The choice schema with Class 1 data

Let us now re-consider the Class 1 datum in (39), and add to its LF an ANS operator, as in (42). The Hamblin denotation at CP_3 is (43), repeated from above.

(39) A: The department made a staffing change this weekend.
B: Really! Who got hired or who's leaving?

(42)



(43) **Hamblin denotation at CP_3**

$[\![CP_3]\!] = \lambda p$. $\exists X\ [p = \lambda w\ .\ \forall x <_{AT} X\ [x \text{ got hired in } w]]$
$\vee\ \exists Y\ [p = \lambda w\ .\ \forall y <_{AT} Y\ [y \text{ is leaving in } w]]$

With these pieces in place, we can capture the choice schema. Suppose, as we did earlier, that the department made exactly one staffing change: either one person got hired, or one person is leaving. The set in (43) then contains exactly one true proposition, so the presupposition of ANS is met. ANS applies to return that proposition, which is the answer to the question. Which proposition in (43) is the true one varies with the circumstances.

Now, since (43) was composed via union, the unique true proposition in (43) may have been contributed by either *Q1* (*Who got hired?*) or *Q2* (*Who's leaving?*), depending on whether the staffing change was a hiring or a leaving. Consider two different worlds. First, w_1, at which John got hired and no one is leaving. The true proposition in (43) at w_1 is the proposition *that John got hired*, which ANS outputs, as in (58). *That John got hired* is an element of the union in (43) because it is an element of the Hamblin set for *Who got hired?*.

(58) **Result for CP_4 at w_1**

$$[\![\text{ANS}]\!]([\![\text{CP}_3]\!])(w_1) = \lambda w \,.\, \text{John got hired in w}$$

Alternatively, consider w_2, at which John is leaving and no one got hired. In that case, the true proposition in (43) is *that John is leaving*, and ANS outputs this proposition, as in (59). *That John is leaving* is an element of the union because it is an element of the Hamblin set for *Who's leaving?*.

(59) **Result for CP_3 at w_2**

$$[\![\text{ANS}]\!]([\![\text{CP}_3]\!])(w_2) = \lambda w \,.\, \text{John is leaving in w}$$

The choice schema reflects variability in whether the true proposition in $Q1 \cup Q2$ comes from the Hamblin set for *Q1* or *Q2*. The answer to *Q1 or Q2* is thus an answer to *Q1* or an answer to *Q2*, depending on which question has a true answer.

5.3 Section summary

This section has show that Class 1 disjoined questions receive a straightforward analysis under the proposal: Q_1 *or* Q_2 is interpreted as a single question with its denotation $Q_1 \cup Q_2$, and the choice intuition does not reflect a choice between *questions*, but variability in whether the true *answer* in $Q_1 \cup Q_2$ comes from Q_1 or Q_2.

6 Incorporating Class 2

I now turn attention to Class 2 data, which do not fit into the analysis presented so far (§6.1). The problems Class 2 data pose, however, also arise independent of disjunction with a different type of simple question, namely *mention-some* ('MS') questions (§6.2). I amend the analysis to accommodate MS, following ideas in the literature (§6.3), and argue that Class 2 data should be analyzed just like MS (§6.4). Critically, all analytical changes are independently motivated by simple MS questions. Once these changes are in place, Class 1 data and Class 2 data *both* "follow for free" as a predicted consequence of the system.

6.1 The system so far does not capture Class 2

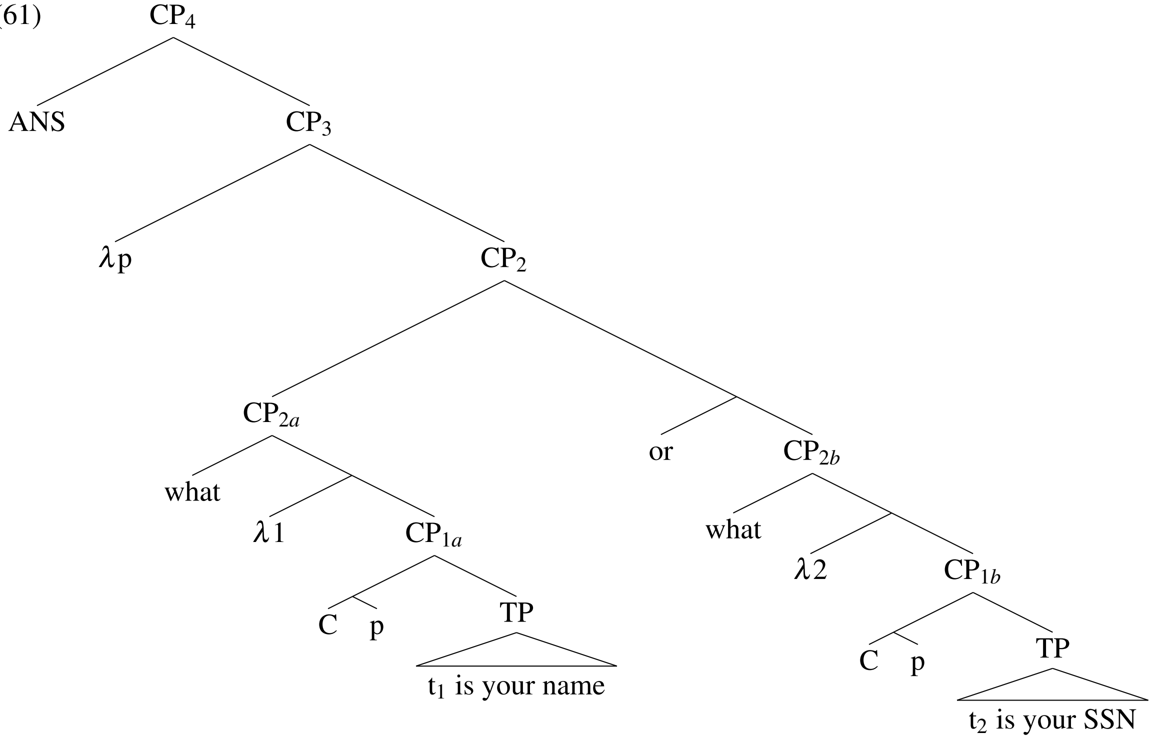
The example in (60) is a prototypical Class 2 datum. Assuming the responder is a US resident, both questions have a true answer, and the responder can provide either answer:

(60) What's your name or what's your SSN?

a. ✓My name is Aron.
b. ✓My SSN is 123-45-6789.

What goes wrong if we apply the system developed so far to the question in (60)? The LF would be (61), with disjunction scoping at CP_2, just above *what*.

(61)



As before, disjunction scoping at CP_2 unions the Hamblin sets of the disjoined questions. The predicted meaning for CP_3 in (61) is (62): a set of propositions, containing propositions of the form *that x is my name* and propositions of the form *that y is my SSN*.

(62) **Prediction for CP_3**

$$[\![CP_3]\!] = \lambda p \,.\; \exists x\,[p = \lambda w \,.\, x \text{ is your name in } w] \\ \vee\; \exists y\,[p = \lambda w \,.\, y \text{ is your SSN in } w]$$

Unlike with Class 1 data, the union in (62) contains two true propositions, rather than just one. At w_0 with me the responder, the two true propositions are (63-a) and (63-b).

(63) **True propositions at w_0**

a. λw . my name is Aron at w

b. λw . my SSN is 123-45-6789 at w

The derivation crashes when ANS integrates. Since the two true propositions are logically independent of one another, the presupposition of ANS fails: (62) does not contain a unique true proposition that entails all other true propositions. Presupposition failure results in CP_4 not having a defined semantic value.

(64) **Result for CP_4**

$[\![ANS]\!]([\![CP_3]\!])(w_0)$ ... *undefined!*

Where does the problem lie? If all questions involve Dayal's (1996) ANS operator, the overall analysis must be on the wrong track: at least for Class 2 data, Q_1 *or* Q_2 cannot be a single question with its Hamblin set $Q_1 \cup Q_2$. There is, however, independent evidence that at least certain questions do *not* involve Dayal's ANS. I discuss mention-some questions.

6.2 Parallel with mention-some

The question in (65) is ambiguous: (65-a) is the now familiar mention-all ('MA') reading, and (65-b) is the mention-some ('MS') reading. For illustration, I will assume in discussion that the committee has exactly one chair, and John and Bill are both potential chairs at w_0.

(65) Who can chair the committee?

a. "Tell me all the people who can chair." *(mention-all; MA)*

b. "Tell me some person who can chair." *(mention-some; MS)*

Simple MS questions resemble Class 2 disjunctions descriptively and in their theoretical profile. Descriptively, the responder can choose freely between different answers when replying to a MS question, just as they can choose freely between different answers with Class 2 data. At w_0, the question in (65) must be answered as in (66) on the MA reading — but (67-a) and (67-b) are both possible on the MS reading.

(66) Who can chair the committee? *(MA)*

John and Bill can chair the committee.

(67) Who can chair the committee? *(MS)*

a. ✓John can chair the committee.

b. ✓Bill can chair the committee.

Theoretically, MS questions resemble Class 2 data in that the system presented in §5 fails to derive them. There are two possible LFs for (65), as noted in Fox (2013). I will consider each in turn and demonstrate that neither derives the MS reading. The first LF is (68), where the covert distributive operator scopes above the possibility modal.

(68) **LF1 for (65)**

$[_{CP4}$ ANS $[_{CP3}$ λp [who λX [[C p] [[X ~~each~~] [can chair the committee]]]]]]

The Hamblin denotation predicted at CP_3 is (69), which is a set of propositions of the form *for every atom x of X, x can chair the committee*. This set includes, for instance, the propositions in (69): (69-a) derives if *X* = John; (69-b) derives if *X* = Bill; and (69-c) derives if *X* = the plurality John$\oplus$Bill.

(69) **Hamblin denotation at CP_3**

$[\![CP_3]\!] = \lambda p\ .\ \exists X\ [p = \forall x <_{AT} X\ [\Diamond[\text{chair(x, committee)}]]]$

(70) **Illustrative members of the Hamblin set**

a. $\Diamond$[chair(John, committee)]
b. $\Diamond$[chair(Bill, committee)]
c. $\Diamond$[chair(John, committee)] & $\Diamond$[chair(Bill, committee)]

The Hamblin set in (69) is closed under conjunction, which (70) illustrates, as the conjunction of (70-a) and (70-b) is (70-c). It follows that, if the set in (69) contains any true proposition, it necessarily contains a unique strongest true proposition — and the presupposition of ANS is thus met. If John and Bill are both potential committee chairs at w_0, applying ANS to (69) at w_0 returns the proposition in (70-c) as the denotation for CP_4.

(71) **Result for CP_4**

$[\![ANS]\!]([\![CP_3]\!])(w_0)$

$= \forall x <_{AT}$ John$\oplus$Bill [$\Diamond$[chair(x, committee)]]

= $\Diamond$[chair(John, committee)] & $\Diamond$[chair(Bill, committee)]

In this way, the analysis predicts that the responder should have to provide the proposition in (71) as the answer to (65). This is the MA answering pattern in (66) — leaving MS unaccounted for.

The alternative LF to consider for (65) is (72), where the covert distributive operator scopes *below* the possibility modal, rather than above.

(72) **LF2 for (65)**

$[_{CP4}$ ANS $[_{CP3}$ λp [where λX [[C p] [can [[X ~~each~~] chair the committee]]]]]]

The predicted Hamblin denotation at CP_3 is then (73), which is a set of propositions of the form *it's possible that every atom of X all chair the committee* (i.e. simultaneously). This set includes (73-a)-(73-c), with *X* as John, Bill, and John$\oplus$Bill, respectively.

(73) **Hamblin denotation at CP_3**

$\lambda p\ .\ \exists X\ [p = \Diamond[\forall x <_{AT} X\ [\text{chair(x,committee)}]]]$

(74) **Illustrative members of the Hamblin set**

a. $\Diamond$[chair(John, committee)]

b. $\Diamond$[chair(Bill, committee)]

c. $\Diamond$[chair(John, committee) & chair(Bill, committee)]

Comparing (70) and (74), note that the scope of the distributive relative to the modal makes no difference when X is an atomic individual, but does have an effect when X is a plurality. (70-a) and (70-b) are equivalent to (74-a) and (74-b) — but (70-c) is not equivalent to (74-c). The result is that the set in (73) is not closed under conjunction. The conjunction of (74-a) and (74-b) is (70-c) — not (74-c).

The set in (74), therefore, contains exactly two true propositions at w_0: (74-a) and (74-b). Given that the committee can have only one chair, (74-c) is false. Because (74-a) and (74-b) are logically independent of one another, the presupposition of ANS fails. CP_4 has no defined semantic value, and the derivation crashes — just like with Class 2 disjunctions

(75) **Result for CP_4**

$[\![ANS]\!]([\![CP_3]\!])(w_0)$ ... *undefined!*

Hence, the system developed so far with Dayal's ANS cannot account for MS questions. Either a MA reading is derived (as with LF1), or the presupposition of ANS catastrophically fails (as with LF2). The question now becomes: what is the mechanism for MS, and does this mechanism extend to derive our Class 2 data? I present the analysis of MS in Fox (2013), which extends directly to Class 2.

6.3 Analyzing mention-some: Fox (2013)

Fox's point of departure is the observation that not all questions allow both MA and MS readings (after George 2011; see also Xiang 2016). Consider the question in (76), which differs critically from (65) in that the modal is removed. Supposing that the committee chair rotates on a monthly basis, (76) can have the MA reading in (76-a), but not the MS reading in (76-b) (for experimental evidence, see Xiang & Cremers 2016).

(76) Who chaired the committee this year?

a. "Tell me all the people who chaired the committee this year."

b. "Tell me some person who chaired the committee this year."

Fox concludes that the distribution of MS is grammatically constrained, and proposes that whether a question is interpreted as MA or MS is predictable from the make-up of the Hamblin set. MA and MS questions have the defining properties in (77):

(77) **Fox's generalization**

a. If the Hamblin set for Q contains a true proposition that entails all other true propositions in the set, Q is MA.

b. If the Hamblin set for Q contains multiple true propositions that are logically independent of one another, Q is MS.

Fox's generalization captures the availability of MA and MS in (65), and the absence of MS in (76). As discussed earlier, there are two possible LFs for (65). The first LF, with *each* $>$ *can*, yields a Hamblin set that is closed under conjunction, so necessarily contains a strongest true proposition. The second LF, with *can* $>$ *each*, yields a Hamblin set that is not closed under conjunction, so there may be multiple independent true propositions, as illustrated above. The first Hamblin set has the defining property of MA, and the second has the defining property of MS.

In (76), there is no modal with which covert *each* could scopally interact, so there is only one LF to consider. The LF is given in (78), and yields a Hamblin set with the defining property of MA.

(78) **LF for (76)**

$[_{CP4}$ ANS $[_{CP3}$ λp [who λX [[C p] [[X ~~each~~] [chaired the committee this year]]]]]]

The Hamblin set predicted at CP_3 is (79), which contains propositions of the form *for every atom x of X, x chaired the committee this year*. This set is closed under conjunction, as (80-a)-(80-c) illustrate. These propositions are each elements of the Hamblin set, and (80-c) is the conjunction of (80-a) and (80-b).

(79) **Hamblin denotation at CP_3**

λp . $\exists$X [$\forall$x $>_{AT}$ X [chair(x,committee)]]

(80) **Illustrative members of Hamblin set**

a. λx . chair(John, committee) *(X = John)*
b. λx . chair(Bill, committee) *(X = Bill)*
c. λx . chair(John, committee) & chair(Bill, committee) *(X = John$\oplus$Bill)*

Just like the Hamblin set predicted from the first LF for (65), the Hamblin set for (76) necessarily contains a unique strongest true member — predicting MA.

Fox's generalization is the most critical aspect of his work for our purposes here, but I will adopt the analytical proposal he develops to capture his generalization for concreteness.

To provide a uniform account of MA and MS, Fox re-formulates ANS. For exposition here, I will present Fox's "first stab" re-formulation, given in (81):

(81) **Re-defined ANS**

$[\![\text{ANS}]\!] = \lambda Q_{stt} \,.\, \lambda w : \exists p\, [w\in p\in Q \,\&\, \neg\exists p'\, [w\in p' \,\&\, p'\subset p]]$
$\quad .\ \underline{\lambda p \,.\, w\in p\in Q \,\&\, \neg\exists p'\, [w\in p' \,\&\, p'\subset p]}$

Whereas Dayal's ANS presupposes that Q contains a unique true proposition that entails all other true propositions in Q, Fox's ANS has a weaker presupposition: ANS presupposes that Q contains at least one proposition which is true and not entailed by any other true proposition in Q. I will heretofore use the term "strongest true" to refer to any such proposition. Fox modifies the assertion of ANS in kind: ANS returns the set of all strongest true propositions in Q.[8] The answerhood condition for a question may then be re-stated:

[8]Fox's first stab ANS incorrectly predicts MS readings with singular *which* questions. *Which professor can*

(82) **Answerhood condition for a question Q (revised)**

To resolve Q at w, the responder must provide some proposition in the set ANS(Q)(w).

How does Fox's ANS predict MA and MS? Let us consider how ANS applies to a Hamblin set with the defining property of MA, and one with the defining property of MS, illustrating with the two LFs for (65).

The first LF is repeated in (83), along with an illustration of the Hamblin set, in (84). ANS is now interpreted as in (82).

(83) **LF1 for (65)**

$[_{CP4}$ ANS $[_{CP3}$ λp [who λX [[C p] [[X ~~each~~] [can chair the committee]]]]]]

(84) **Hamblin set exemplified**

{(a) ◊[chair(John, committee)], (b) ◊[chair(Bill, committee)],
(c) ◊[chair(John, committee)] & ◊[chair(Bill, committee)], ...}

With John and Bill potential chairs at w_0, the Hamblin set contains three true propositions: (84-a)-(84-c). (84-a) and (84-b) are each entailed by (84-c), while (84-c) is not entailed by either (84-a) or (84-b). Accordingly, (84-c) is the only proposition in the Hamblin set which qualifies as strongest true. The existential presupposition of ANS is satisfied, and ANS returns the singleton set containing (84-c), as in (85).

(85) **Result for CP_4**

$[\![\text{ANS}]\!]([\![\text{CP}_3]\!])(w_0)$

$\approx$ {◊[chair(John, committee)] & ◊[chair(Bill, committee)]}

Because (84-c) is the only proposition in the set ANS outputs, the responder must provide (84-c) as the answer to the question. This is the MA answering pattern.

The second LF is repeated in (86), with an illustration of the associated Hamblin set:

(86) **LF2 for (65)**

$[_{CP4}$ ANS $[_{CP3}$ λp [where λX [[C p] [can [[X ~~each~~] chair the committee]]]]]]

(87) **Hamblin set exemplified**

{(a) ◊[chair(John, committee)], (b) ◊[chair(Bill, committee)],
(c) ◊[chair(John, committee) & chair(Bill, committee)], ...}

At w_0, the propositions in (87-a) and (87-b) are true, while (87-c) is false. Since neither (87-a) entails (87-b) nor vice versa, both (87-a) and (87-b) qualify as strongest true. With ANS re-formulated, the presupposition is met, and ANS outputs the doubleton containing (87-a) and (87-b) as elements, as in (88).

---

chair the committee? carries a uniqueness presupposition that exactly one professor can chair, and does not have a MS reading. Accounting for uniqueness with *which* was a central motivation for Dayal's ANS. Fox proposes a further revision to ANS which accounts both for his generalization and uniqueness with *which*. I refer the reader to Fox's work for further details and, to facilitate exposition, set this issue aside.

(88) **Result for CP_4**

$[\![ANS]\!]([\![CP_3]\!])(w_0)$

$\approx \{\Diamond[\text{chair(John, committee)}], \Diamond[\text{chair(Bill, committee)}]\}$

To resolve the question, the responder must provide some proposition in (88), predicting either (87-a) or (87-b) should be co-operative answers completely resolving the question — the MS answering pattern.

6.4 Class 2 disjoined questions as mention-some

With an analysis of MS in hand, let us return to Class 2 disjoined questions. Recall the question in (60), repeated as (89-a), which is associated with the Hamblin set in (89-b), according to the proposal that the Hamblin set for a disjoined question Q_1 *or* Q_2 is the union $Q_1 \cup Q_2$.

(89) a. What's your name or what's your SSN?

b. $\lambda p . \exists x\, [p = \lambda w . \text{ x is your name in w}]$
$\vee \exists y\, [p = \lambda w . \text{ y is your SSN in w}]$

As discussed in Section 4.1, assuming the responder lives in America, the Hamblin set in (89-b) necessarily contains two true propositions, for me at w_0, (90-a) and (90-b).

(90) **True propositions in Hamblin set at w_0**

a. λw . my name is Aron at w

b. λw. my SSN is 123-45-6789

Whereas applying Dayal's ANS to the Hamblin set in (89-b) resulted in presupposition failure, the discussion of MS questions in the preceding subsection offers a new perspective.

Given Fox's generalization, the question in (89-a) has the defining property of MS. The two true propositions in (90) are independent of one another, and a question whose Hamblin set contains multiple independent true propositions is MS. By integrating the proposal with Fox's ideas about MS, we thus predict a Class 2 example to be interpreted as MS. Since Class 2 data have a parallel descriptive profile to MS, the properties of Class 2 follow.

The LF for (89-a) was provided earlier, and is repeated as a bracketed diagram in (91). Now, ANS is interpreted as Fox's ANS, instead of Dayal's. CP_3 denotes the Hamblin set in (89-b), and applying ANS at w_0 returns the doubleton containing the propositions in (90-a) and (90-b), as in (92).

(91) **LF for (89-a)**

$[_{CP4}$ ANS $[_{CP3}$ PRO $\lambda 3$ $[_{CP2}$ $[_{CP2a}$ what $\lambda 1$ [C t_3] $[_{CP1a}$ t_1 is your name]]
$[_{CP2b}$ what $\lambda 2$ [C t_3] $[_{CP1b}$ t_2 is your SSN]]]]]

(92) **Result at CP_4**

$[\![ANS]\!]([\![CP_3]\!])(w_0)$

$\approx \{\lambda w$. my name is Aron at w, λw. my SSN is 123-45-6789$\}$

As the responder may provide either proposition in (92), the choice schema is captured. As with Class 1 data, the choice schema does not reflect a choice between questions. For Class 2 data, the choice is between multiple possible answers to a single MS question.

Note that the idea of linking disjoined questions with MS has a precedent in the earlier literature. In particular, Szabolcsi (1997) proposed that single questions containing disjunction should receive MS analyses, matching (93-a) with the paraphrase in (93-b). An idea reminiscent of MS was also briefly entertained in Groenendijk & Stokhof (1989), based on ideas in Bennett (1979) and Belnap (1982).

(93) a. Who did Fido or King bite?
b. "Tell me someone who is such that either Fido or King bit him."

6.5 Fitting Class 1 data into the new system

Class 1 data fit into the new system with Fox's ANS as easily as they fit into the original system with Dayal's ANS. Recall the prototypical Class 1 example in (94-a), with the LF in (94-b), and the associated with the Hamblin set in (94-c).

(94) a. Who got hired or who's leaving?

b. $[_{CP4}$ ANS $[_{CP3}$ PRO $\lambda 3$ $[_{CP2}$ $[_{CP2a}$ who $\lambda 1$ [C t_3] $[_{CP1a}$ t_1 got hired]]
$[_{CP2b}$ who $\lambda 2$ [C t_3] $[_{CP1b}$ t_2 is leaving]]]]]

c. $\lambda p . \exists x [p = \lambda w . \text{ x got hired in w}] \vee \exists y [p = \lambda w . \text{ y is leaving in w}]$

Assuming one staffing change, the Hamblin set contains exactly one true proposition, for instance (95-a) at a world where John was hired, and (95-b) at a world where John is leaving. ANS returns the singleton set containing (95-a) or (95-b) at the relevant world, as in (96).

(95) **True propositions in Hamblin set**
a. **At w_1:** λw . John is hired at w
b. **At w_2:** λw . John is leaving at w

(96) **Result at CP_4**
a. $[\![\text{ANS}]\!]([\![\text{CP}_3]\!])(w_1) = \lambda w$. John is hired at w
b. $[\![\text{ANS}]\!]([\![\text{CP}_3]\!])(w_2) = \lambda w$. John is leaving at w

To reply to the question, the responder must provide the proposition in the singleton set ANS returns. Just as in the original analysis with Dayal's ANS, the choice schema reflects variability in whether that proposition was contributed to the Hamblin set for Q_1 *or* Q_2 by Q_1 (as at w_1) or Q_2 (as at w_2).

Looking at disjoined questions from the perspective developed here, they not only exist, but they exhibit the same range of empirical variability that simple questions do. There are MA and MS simple questions — and parallel disjoined questions. Class 1 disjoined questions have the defining property of MA, and Class 2 disjoined questions have the defining property of MS.

6.6 Section summary

This section amended the system from §5 to accommodate MS questions, following Fox (2013). With the amendment in place, the Union Hypothesis predicts that Class 2 disjoined questions should be interpreted as MS questions — and a MS analysis accounts for the choice intuition in these data. Hence, Class 1 data have properties in common with MA, and Class 2 data are interpreted just like MS.

7 Taking into account the pragmatics

It has been observed in the literature that MS questions are associated with a signature pragmatics. In this section, I demonstrate that Class 2 data share the pragmatic signature of MS, and show how taking into account the pragmatics can explain: (i) further data which initially appear not to fit in either Class 1 or Class 2; and (ii) why felicitous disjoined questions are sometimes hard to find.

7.1 A pragmatic parallel with MS

Van Rooij (2003) suggests that speakers ask a question to resolve a "decision problem" and that MS questions are acceptable only when a MS answer has equal utility to a MA answer to resolve the decision problem. I state this as the pragmatic generalization in (97)

(97) **Pragmatic condition on MS questions**
For a question Q to be felicitous as a MS question, the utility of Q under a MS reading must be equal to the utility of Q under a MA reading.

Although I have adopted Fox's grammatical analysis of MS questions, rather than van Rooij's analysis which makes use of Bayesian decision theory, I believe that van Rooij's pragmatic generalization is correct, and applies in addition to the grammatical constraints Fox captures. I will remain agnostic about where utility should be encoded.[9]

Consider how (97) applies to a simple MS question, illustrating with (98) on its MS reading. The decision problem a speaker would want to address by asking (98) is the dilemma of who to install as chair, as stated in (98-a). Since the committee requires just one chair, knowing a single person who can serve as chair has as great utility as knowing all potential chairs.

(98) Who can chair the committee?
a. *Problem*: dilemma of who to install as chair.
b. *Pragmatic condition met*: one chair is all that's needed.

Extending to disjoined questions, consider first Ciardelli et al.'s (2015) example in (99). This datum clearly satisfies the pragmatic condition on MS. We require one car, and knowing one place we can obtain a car thus has as great utility as knowing all such places.

[9] One possibility is that ANS should be re-defined to not just return the set of all strongest true answers, but rather the set of all strongest true answers that have maximal utility relative to a decision problem. I will not, however, pursue this further here.

(99) Where might we rent a car, or who might have one we could borrow?

a. *Problem*: dilemma of where to find a car.
b. *Pragmatic condition*: one place to find a car is all that's needed.

Example (99) has a notable property: that both disjoined questions are themselves MS questions. The analysis developed in §6 predicts that Class 2 disjoined question are MS, even when the individual disjuncts do not have MS readings in isolation.

Accordingly, all Class 2 data should show the pragmatic signature of MS. This is borne out for our familiar test example, (100), as well as for all of the other Class 2 data from §3:

(100) What's your name or what's your SSN?

a. *Problem*: dilemma of how to identify the interlocutor.
b. *Pragmatic condition*: one identifier is as useful as two.

(101) Who's the mother or who's the father?

a. *Problem*: dilemma of how fill out a form requiring one bio. parent.
b. *Pragmatic condition*: one parent is as useful as two.

(102) What's your superpower or what's your spirit animal?

a. *Problem*: dilemma of how to begin a conversation.
b. *Pragmatic condition*: one piece of information is as useful as two.

7.2 The pragmatics helps explain further data

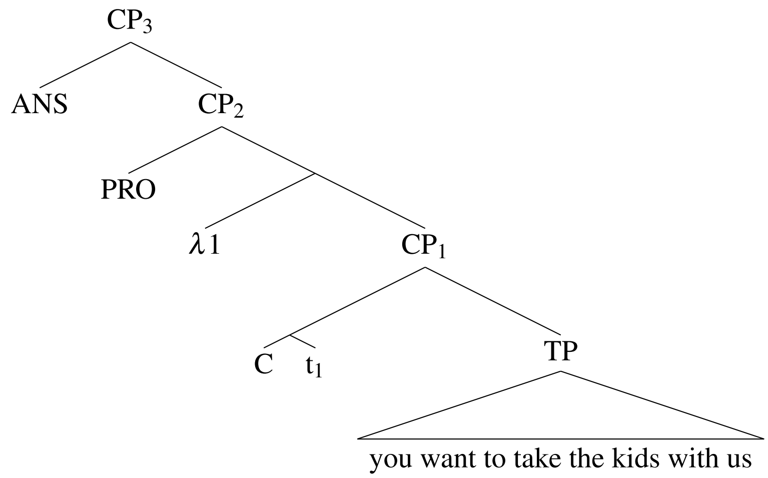
Let us now consider a new data point, not introduced in §3. Example (103) involves a disjunction of a constituent question and a polar question:

(103) Who can take care of the kids, or do you want to take them with us?

Consider first the polar question in isolation, as in (104). The syntax for questions I have assumed attributes to (104) the structure in (105), predicting the Hamblin set in (106).

(104) Do you want to take the kids with us?

(105) **LF for (104)**



(106) **Hamblin set predicted at CP_2**

$[\![CP_2]\!] = \lambda p \, . \, p = \lambda w \, . \, \forall w' \in F(you)(w)$ [we take the kids in w']

The Hamblin set in (106) is the singleton set containing the proposition that you want to take the kids with us. This predicted Hamblin set appears to be incorrect. If the interlocutor does not want to take the kids with us, the presupposition of ANS fails, since the Hamblin set contains no true proposition. Yet, the question may be answered as (107-a) or (107-b).

(107) Do you want to take the kids with us?

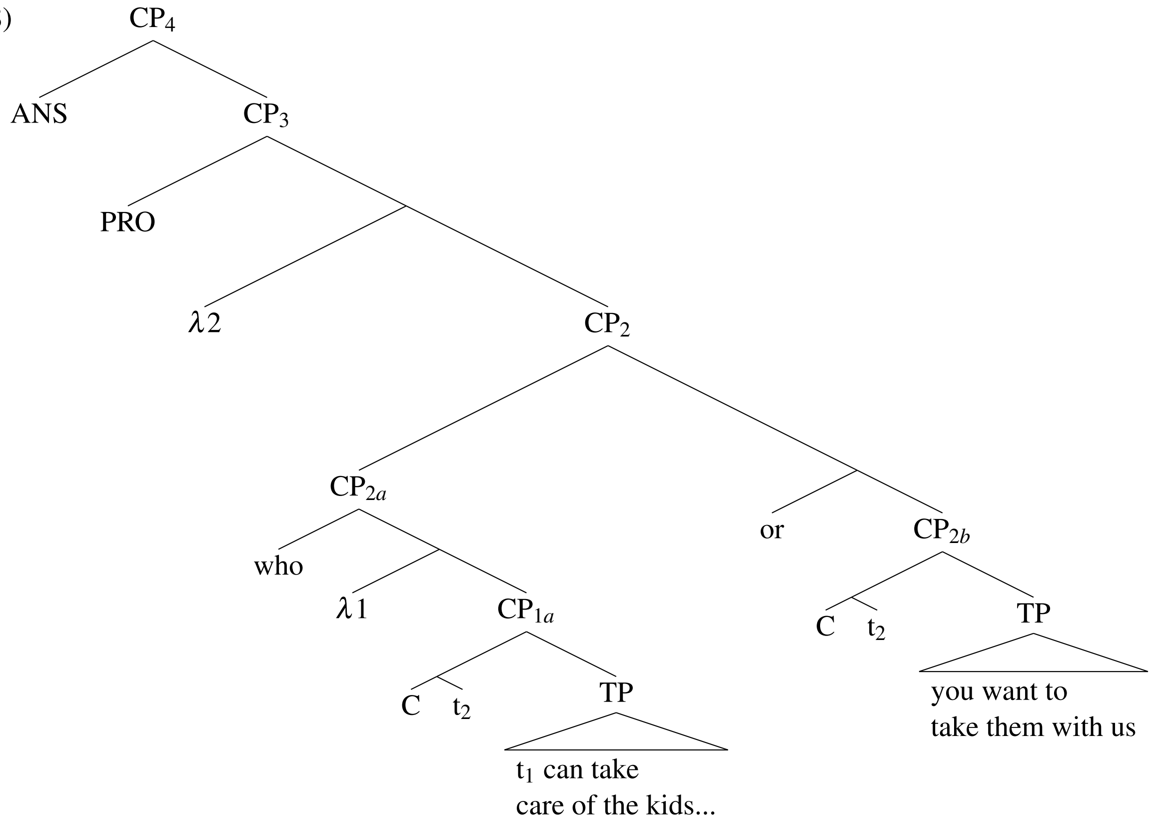
a. Yes, I do want to take them with us.

b. No, I don't want to take them with us.

Despite this, the idea that polar questions have a singleton Hamblin set is actually quite widespread in the literature (Karttunen 1977, Biezma & Rawlins 2008, Uegaki 2014). One way to avoid the problematic prediction is to introduce a coercion mechanism where a singleton Hamblin set containing a proposition p may be coerced into the doubleton containing p and $\neg p$ when necessary to satisfy the presupposition of ANS (after Biezma & Rawlins 2008). I will adopt this view, but since I will not be discussing polar questions in isolation any further, the coercion mechanism will not play a crucial role here.

With the LF for (104) in hand, it is clear that the assumed syntax for questions attributes a well-formed structure to the disjunction in (103), parallel to the structures it assigns to disjunctions where both disjuncts are constituent questions. I take the LF for (103) to be (108), which predicts the Hamblin set in (109) as the denotation for CP_3.

(108)



(109) **Hamblin denotation at CP_3**

$$[\![CP_3]\!] = \lambda p\ .\ \exists x\ [p = \lambda w\ .\ \text{x can take care of the kids in w}]$$
$$\vee\ p = \text{you want to take the kids with us in w}$$

As before, the effect of disjunction is to union the Hamblin sets of the two disjoined questions. The set in (109) contains propositions of the form *that x can watch the kids* (i.e. elements of the Hamblin set for *Who can watch the kids?*) and the proposition *that you want to take the kids with us* (i.e. the sole element of the singleton Hamblin set for *Do you want to take the kids with us?*).

To see the problem that arises, suppose that the state of affairs at w_0 is such that John can take care of the kids, but the responder in fact wants to take them along. Then, the Hamblin set in (109) contains two true propositions: (110-a) and (110-b). Since these propositions are independent of one another, (103) is predicted to be MS, and the responder should have the choice to provide either (110-a) or (110-b) as their answer to the question.

(110) a. λw . John can take care of the kids in w
b. $\lambda w\ .\ \forall w' \in F(you)(w)$ [we take the kids in w']

Empirically, the MS prediction does not seem correct. If the speaker wants to take the kids, they must respond with (111-a) and it is infelicitous to respond with (111-b).

(111) **Observed answering pattern at w_0**

Who can take care of the kids, or do you want to take them with us?

a. I want to take them with us. b. #John can take care of the kids.

So, in the scenario considered, (103) seems to have the theoretical profile of Class 2, but the empirical profile of Class 1. The Hamblin set contains multiple strongest true propositions, but the disjoined question only has one acceptable answer. We must ask, then: does (103) belong to a new Class 3?

I suggest that (103) does belong to Class 2 and is semantically a MS question. The more restricted answering pattern is a consequence of the pragmatics. In asking (103), the decision problem the speaker is attempting to resolve is the dilemma of what to do with the kids. (111-a) and (111-b) are both acceptable answers to (103), as both equally well resolve the decision problem. However, they resolve it in different ways — and the questioner will act based on how the responder's answer resolved the decision problem. If the responder provides (111-b), the questioner will send the kids to John, and if the responder provides (111-a), the questioner will bring the kids. If the responder's goal is to bring about the effect that they bring the kids, the responder must, then, answer (111-a).

7.3 Why disjoining questions isn't fully productive

This paper has argued that disjoined questions are attested and analytically predicted. Yet, the literature has largely accepted that disjoined questions do not exist. While the data presented in Section 2 conclusively demonstrate the existence of disjoined questions, it remains to be explained: why are disjoined questions not fully productive?

I agree with a suggestion in Ciardelli et al. (2015) that the answer lies in the pragmatics. Two of the degraded examples discussed in the literature are given in (112).

(112) a. What did Mary read or what did Judy read?
b. Who did you marry or where did you live?

These examples appear to be intended to be of Class 2, assuming that Mary and Judy both read something in (112-a), and that the interlocutor is both married and lived somewhere in (112-b). Accordingly, these examples are subject to the pragmatic condition on MS — and they do not easily meet the pragmatic condition. As Ciardelli et al. (2013) state, "it is difficult to see what kind of motivation (or what kind of decision problem, to follow van Rooij 2003) a speaker could have that would lead her to raise or even consider the issue expressed by [these disjunctions]." Re-casting slightly in the present analysis, it is difficult to see what decision problem could be equally well addressed by an answer to either one of the two disjoined questions in (112-a) or (112-b).

7.4 Section summary

Class 2 disjoined questions have the pragmatic signature of MS: they are felicitous only when a MS answer is sufficient to resolve a decision problem. The pragmatics reconciled (103) with the analysis developed in the preceding sections and, following Ciardelli et al. (2015), explained why disjoining questions is not fully productive.

8 An alternative analysis?

In this final section, I raise a possible alternative to the analysis developed so far, and point out respects in which the analysis already proposed seems superior.

The alternative involves a version of Ross's (1970) performative hypothesis. Ross's idea is that the abstract structure for every sentence includes a covert performative verb indicating its illocutionary force. A first attempt at a performative analysis of questions may attribute to (113-a) the same abstract structure as (113-b), with *I hereby ask* the covert performative in (113-a).

(113) a. What is your name?
b. I hereby ask what your name is.

As mentioned earlier, Krifka (2001) noted that speech acts cannot be disjoined. Consistent with this, (114-b) is deviant and, accordingly, (114-b) cannot be the abstract structure for (114-a), which is our fully acceptable prototypical Class 2 datum. Intuitively, (114-b) suggests that the speaker is asking a particular question, but somehow does not know what that question is — while the speaker in (114-a) is knowingly asking a disjoined question.

(114) a. What's your name or what's your SSN?
b. #I hereby ask what your name is or I hereby ask what your SSN is.

There is, however, a way to modify the performative hypothesis to accommodate (114-a). Suppose that the performative layer is not just *I hereby ask*, but rather contains an additional level of embedding. For instance, the covert material could be *I hereby ask you to tell me*. (114-a) could then have the same abstract structure as (115), where disjunction scopes between the two levels of the performative layer (*ask* > *or* > *tell*). (115) is a single speech act and is fully acceptable, just like (114-a).

(115) I hereby ask you [to tell me what your name is] or [to tell me what your SSN is].

To evaluate the plausibility of this approach, we should ask two questions. First, is there independent evidence for covert *I hereby ask you to tell me*? And second, can this approach account for the full range of data discussed throughout the paper?

Regarding the first question, I am aware of one data point supportive of a decomposed performative layer. Sauerland (2009) and Sauerland & Yatsushiro (2014, S&Y) consider a question like (116). They focus on counterpart data in German and Japanese, but the English example is sufficient to make the point here.

(116) What is your name again?

They observe that *again* in (116) does not necessarily presuppose that the speaker has asked the question before, nor does it necessarily presuppose that the interlocutor has told the questioner their name before. (116) allows a "remind-me" reading, paraphrased: "I used to know your name (having learned it one way or another), but now I forget. Could you remind me what your name is?" (adapted from S&Y p. 2).

To derive the remind-me reading, S&Y propose that *again* scopes at an intermediate level of a complex performative layer, informally paraphrased as (117) (see §3 in S&Y for formal details). The presupposition *again* introduces in (117) is simply that the interlocutor's name was previously known to the questioner.

(117) I hereby ask you to make it again known to me what your name is.

If disjunction can scope at the same level as where *again* scopes in (117), (114-a) is captured, though the paraphrase is slightly different from (115):

(118) I hereby ask you to make it [known to me what your name is] or [known to me what your SSN is].

There are reasons to be skeptical, however. For one, only a small set of operators seem able to scope at intermediate levels of the performative layer. The additive focus particle *too*, for instance, cannot take intermediate scope, despite being ostensibly very similar to *again*: (119) is not licensed by someone other than the interlocutor having announced their name, or by the speaker previously knowing the birth date of the interlocutor.

(119) #What is your name too?

As far as Y&S can tell, it appears that only particles like *again* that trigger a repetitive presupposition can take intermediate scope in English and German. In Japanese, even those particles can't: intermediate scope seems to be restricted to a special suffix *kke* whose sole function is to trigger remind-me presuppositions. Thus, while I cannot conclusively prove that disjunction is unable to take intermediate scope, it seems unlikely, given how the vast majority of other operators behave.

Moreover, it is not clear that the performative approach could account for the full set of data in this paper in any case. As discussed in §7.3, the proposal offers an account of why data like (120) are unacceptable: (120-a)-(120-b) are MS questions, and do not meet the pragmatic condition on MS.

(120) a. What did Mary read or what did Judy read?
b. Who did you marry or where did you live?

On the performative view, (120-a) and (120-b) should be judged as parallel to (121-a) and (121-b). While (121-a)-(121-b) may seem to be odd requests, they are naturally interpretable. (120-a) and (120-b) seem considerably more marked and difficult to interpret.

(121) a. I hereby ask you to tell me what Mary read or to tell me what Judy read.
b. I hereby ask you to tell me who you married or to tell me where you live.

Overall, it would be premature to dismiss the performative approach entirely, but I believe an analysis rooted in the Union Hypothesis and MS has greater plausibility and empirical success. I leave further consideration of the alternative to future research.

9 Conclusion

This paper has supported the empirical result in Ciardelli et al. (2015) that questions can be disjoined, in opposition to much previous work. I have proposed an analysis of disjoined questions in a Hamblin semantics based on the Union Hypothesis that the Hamblin set for Q_1 *or* Q_2 is $Q_1 \cup Q_2$. From this perspective, disjoined questions come in the same empirical flavors as simple questions, with some disjoined questions having the signature property of MS. The choice intuition is envisioned not as a choice between two questions, but rather as reflecting predictable variability in how a single question is answered.

References

Biezma, Maria & Kyle Rawlins. (2008). Responding to alternative and polar questions. *Linguistics and Philosophy* 35(5): 361-406.

Ciardelli, Ivano, Jeroen Groenendijk, & Floris Roelofsen. (2015). Inquisitive Semantics. ESSLLI 2015 lecture notes. http://semanticsarchive.net/Archive/DkxNDY5Z/esslli-2015-lecture-notes.pdf.

Dayal, Veneeta. (1996). *Locality in WH Quantification*. Kluwer.

Fox, Danny. (2013). Mention-some readings of questions. Lecture nodes, MIT. http://lingphil.mit.edu/papers/fox/class1-3.pdf

George, Benjamin Ross. (2011). *Question embedding and the semantics of answers*. PhD dissertation, UCLA.

Groenendijk, Jeroen Martin Stokhof. (1989). Type-shifting rules and the semantics of interrogatives. In Gennaro Chierchia, Barbara Partee Raymond Turner (eds.), Properties, types and meaning, vol. 2, 21?68. Dordrecht: Kluwer Academic Publishers.

Groenendijk, Jeroen & Martin Stokhof. (1984). *The Semantics of Questions and the Pragmatics of Answers*. PhD dissertation, University of Amsterdam.

Haida, Andreas & Sophie Repp. (2013) Disjunctions in wh-questions. In S. Kan, C. Moore-Cantwell, and R. Staubs (eds.), *Proceedings of NELS 40*, 259-272. Amherst, MA: GLSA Publications.

Heim, Irene. (2000). Notes on interrogative semantics. Lecture notes, MIT.

Heim, Irene & Angelika Kratzer. (1998). *Semantics in generative grammar*. Blackwell.

Hamblin, Charles. (1973). Questions in Montague English. *Foundations of Language* 10: 41-53.

Karttunen, Lauri. (1977). The Syntax and Semantics of Questions. *Linguistics and Philosophy* 1: 3-44.

Krifka, Manfred. (2001). Quantifying into question acts. *Natural Lang. Semantics* 9: 1-40.

van Rooij, Robert. (2003). Questioning to resolve decision problems. *Linguistics and Philosophy* 26: 727-763.

Sauerland, Uli. (2009). Decomposing questions acts. *Snippets*, 62?63.

Sauerland, Uli & Kazuko Yatsushiro. (2014). Remind-me presuppositions and speech-act decomposition: Japanese *kee* and German *wieder*. Ms, ZAS Berlin.

Szabolcsi, Anna. (2016). Direct vs. indirect disjunction of wh-complements, as diagnosed by subordinating complementizers. Ms., NYU.

Szabolcsi, Anna. (1997). Quantifiers in pair-list readings. In A. Szabolcsi (ed.), *Ways of Scope Taking*, 311-348. Kluwer.

Uegaki, Wataru. (2014). Japanese alternative questions are disjunctions of polar questions. In *Proceedings of SALT 24*.

Xiang, Yimei. (2016). Questions with non-exhaustive answers. Ph.D. dissertation, Harvard.

Xiang, Yimei & Alexandre Cremers. (2016). Mention-some readings of plural-marked questions: experimental evidence. Talk at NELS 47.