Dynamic inquisitive semantics - Looking ahead and looking back

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DOI
10.1515/tl-2023-2017

Publication date
2023

Document Version
Final published version

Published in
Theoretical Linguistics

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https://doi.org/10.1515/tl-2023-2017

We thank all commentators for their thoughtful contributions. Our response is divided into two sections. Section 1 looks ahead, discussing some of the open issues identified by the commentators for dynamic inquisitive semantics and tentatively suggesting how these issues may be addressed in future extensions and refinements of the framework. Section 2 looks back, clarifying how dynamic inquisitive semantics builds on previous frameworks for question semantics.

1 Looking ahead: potential avenues for further refinements of Inq_{D}

1.1 Mention-some/mention-all questions and weak/strong donkey anaphora

Consider (1a–b):

(1) a. Who has been invited to the workshop?
b. Who has a bike that I could borrow?

(1a), under its most prominent interpretation, requires the addressee to specify *all* people who were invited (a mention-all reading), while (1b), under its most prominent interpretation, can be resolved by specifying just *one* person with a bike that I could borrow (a mention-some reading).

To capture these two readings we assume that wh-words like *who* are ambiguous —they can be interpreted with or without the max* operator. Without the max*

We dedicate our work on dynamic inquisitive semantics to the memory of our dear friend and mentor Jeroen Groenendijk, who recently passed away. Jeroen has made groundbreaking contributions to dynamic semantics and inquisitive semantics, which evidently have had an enormous influence on our work.

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operator a mention-some reading is derived; with the max* operator a mention-all reading is derived.

Biezma's commentary critically discusses this proposal. Before addressing Biezma's concerns, let us first point out, as we did in the target article, that the main advantage of this analysis of mention-some and mention-all readings is that it relies on mechanisms that have been motivated independently in Brasoveanu's account of donkey anaphora (Brasoveanu 2008). In that account, indefinites with the max* operator give rise to strong readings of donkey anaphora, deriving the most prominent interpretation of sentences like (2a) (Bill peels *all* apples that he eats), while indefinites without the max* operator give rise to weak readings of donkey anaphora, capturing the most prominent interpretation of sentences like (2b) (Bill puts *some* dime that he has in the parking meter).

(2) a. If Bill eats an apple, he peels it first.
b. If Bill has a dime, he puts it in the parking meter.

Of course, the Inq_{D} analysis of mention-some and mention-all readings is independently motivated only under the assumption that Brasoveanu's account of donkey anaphora is indeed on the right track. This is what Biezma takes issue with. In particular, she discusses an alternative account of donkey anaphora proposed in Champollion et al. (2019). This approach eliminates the lexical ambiguity and the need for the max* operator in explaining weak and strong readings. Thus, Biezma argues, if that account is correct, it takes away the independent motivation for our analysis of mention-some and mention-all readings in questions.

In this section, we recast some essential ingredients of Champollion et al.'s analysis in Inq_{D}. As we will see, this indeed eliminates lexical ambiguity, and thus it may be preferable over Brasoveanu's analysis on grounds of simplicity, as Biezma points out. However, we will show that this elimination of ambiguity in the treatment of indefinites complicates the overall semantic account elsewhere, and this is true not just for our rendition of the account, but for Champollion et al. (2019) as well. Thus, it is far from obvious that this analysis is preferable over Brasoveanu's on conceptual grounds. Additionally, mention-some and mention-all readings pose a novel challenge for this account, if one indeed tries to transfer the account of donkey anaphora to the analysis of questions. Thus, we will conclude that Brasoveanu's account has advantages over the alternative account.

We start by showing how weak and strong readings of donkey anaphora can be analyzed, recasting the essential ingredients of Brasoveanu's analysis in Inq_{D}. First, to be able to analyze donkey anaphora, we have to include implication in the logical

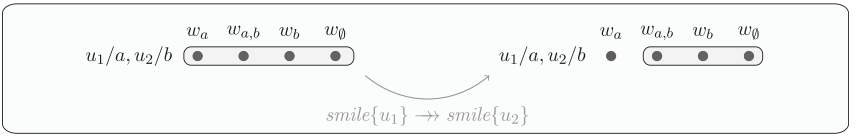

Figure 1: The update by $smile\{u_1\} \twoheadrightarrow smile\{u_2\}$.

vocabulary of Inq_D. We adopt a treatment of implication that is very close to the dynamic treatment of implication in Groenendijk et al. (1996) as well as the treatment of implication in Inq_B.

(3) $\mathcal{U}_\mathbf{T} \twoheadrightarrow \mathcal{U}'_\mathbf{T} := \lambda c_k \lambda s_i.$
$s \in c \ \wedge \ \forall t \subseteq s. \ (t \text{ subsists in } \mathcal{U}(c) \rightarrow t \text{ subsists in } \mathcal{U}'(\mathcal{U}(c)))$

Note that under this analysis, negation is closely related to implication. The states that end up in $\mathcal{U} \twoheadrightarrow \mathcal{U}'$ are the ones that are in the input context c and moreover have no substate t which subsists in $\mathcal{U}(c)$ but not in $\mathcal{U}'(\mathcal{U}(c))$. This interpretation follows the standard assumption that implications, just like negated sentences, are purely eliminative, externally static. A simple illustration of this treatment of implication is given in Figure 1.

Implication can be used in the translation of *if* in a straightforward way:[1]

(4) $[\![\text{if}]\!] := \lambda A_\mathbf{T}.\lambda B_\mathbf{T}.\ A \twoheadrightarrow B$

With this in place, let us turn to an example of donkey anaphora:

(5) If a man sleeps, he snores.

On Brasoveanu's approach, this sentence has two possible interpretations due to the fact that the indefinite is ambiguous. These two interpretations are spelled out in (6).

(6) a. $\left(\begin{array}{l} [u_1] \,;\, \mathbf{atom}\{u_1\} \,;\, man\{u_1\}; \\ sleep\{u_1\} \end{array} \right) \twoheadrightarrow \left(\mathbf{atom}\{u_1\} \,;\, snore\{u_1\} \right)$

b. $\left(\begin{array}{l} [u_1] \,;\, \mathbf{atom}\{u_1\} \,;\, man\{u_1\}; \\ sleep\{u_1\} \,;\, \max^*\{u_1\} \end{array} \right) \twoheadrightarrow \left(\mathbf{atom}\{u_1\} \,;\, snore\{u_1\} \right)$

The update effects of these two translations are shown in Figure 2. As we can see, these correspond to weak and strong readings, just as we would expect. The output context of (6a) includes those states in which at least one sleeping man snores. The output context of (6b) includes only those states in which all sleeping men snore.

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1 Following Brasoveanu (2008), this interpretation could be further refined by including distributivity. However, introducing distributivity in the Inq_D fragment goes beyond this reply. We leave this refinement for another occasion.

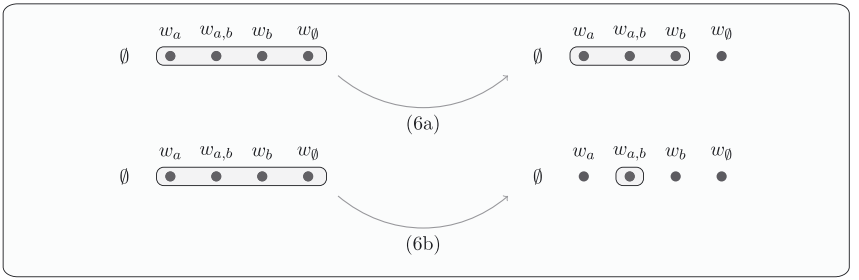

Figure 2: Update effect of the two possible interpretations of (5): the weak reading in (6a), and the strong reading in (6b). We assume that in the initial discourse, it is known that *a* and *b* are men who sleep. w_a represents a world in which *a* snores, $w_{a,b}$ represents a world in which *a* and *b* snore and similarly for the other worlds.

Let us now turn to the trivalent account pursued in Champollion et al. (2019) and let us see how it could be recast in Inq_D with as minimal changes as possible.

Briefly, the trivalent account makes the following assumptions:

1. The dynamic compositional semantics is trivalent (sentences can be **true**, **false** or **neither**).
2. Trivalence arises for a sentence if that sentence includes a trivalent element.
3. Quantifiers such as *every* and *no* are such trivalent elements. To extend the analysis to plain conditionals, one could say that those have a silent quantifier, like *usually*, or that the conditional itself is trivalent.
4. Trivalent meanings are shipped off to a pragmatic component, which decides whether the **neither** value should be treated as **true** or **false** depending on the question under discussion. This component of the proposal builds on Križ (2015) (see also illustrative examples of this component in Biezma's commentary).

Biezma's commentary mainly highlights the last point, but the pragmatic aspect of the analysis crucially relies on very specific assumptions about semantics, listed in points 1–3.

Focusing on those points, we could replicate this approach by assuming that indefinites have only one interpretation, namely, the weak reading (without max*). Implication would have to be reinterpreted using trivalence. In parallel with Champollion et al. (2019) we would have to assume that there are **true** states, **false** states and **neither** states. **True** states are those that survive both the 'strong reading update' and the 'weak reading update', while **false** states are those that do not survive either of these, and **neither** states are those that only survive the 'weak reading update'. Finally, we would have to assume that the conditional is associated

with all indefinites in its antecedent, which introduce discourse referents u_1, …, u_n (just like the Foc head in questions is associated with multiple wh-indefinites).

To make this concrete, we would have to assume that there is a trivalence-inducing implication in the logical language, which in turn is used in the analysis of English conditionals. The implication would receive the following interpretation:

(7)
$$\mathcal{U}_{\mathbf{T}} \twoheadrightarrow \mathcal{U}'_{\mathbf{T}} := \lambda c_k \lambda s_i. \begin{cases} \textbf{true} \text{ if } & s \in c \wedge \forall t \subseteq s. \quad (t \text{ subsists in } (\mathcal{U}; \max^*\{u_1\}; \ldots; \max^*\{u_n\})(c) \\ & \qquad\qquad \rightarrow \\ & \qquad\qquad t \text{ subsists in } (\mathcal{U}; \max^*\{u_1\}; \ldots; \max^*\{u_n\}; \mathcal{U}')(c)) \\ \textbf{false} \text{ if } & s \in c \wedge \forall t \subseteq s. \quad t \text{ subsists in } \mathcal{U}(c) \text{ but } t \text{ does not subsist in } (\mathcal{U}; \mathcal{U}')(c)) \\ \textbf{neither} & \textit{otherwise} \end{cases}$$

This trivalent interpretation would then have to be combined with Križ' analysis of underspecification as adapted for dynamic compositional semantics in Champollion et al. (2019), which would ensure that (some) **neither** states are sometimes treated as **true** and sometimes as **false**, depending on the QUD.

There are non-trivial issues that one will encounter when developing a fully worked out trivalent semantics inside Inq_{D}, like the issue of how to ensure downward closure, how to transpose trivalent accounts into the analysis of questions, and whether QUDs should also operate on questions. But even if we do not address these issues, we now have a basis for making some general observations.

First, it is hard to tell which of the two analyses (our original ambiguity analysis or the trivalence account) is conceptually simpler. Crucially, even in the trivalent account, there still is a semantic component that distinguishes between weak and strong readings. This is necessary, otherwise the pragmatic component will not be able to choose the relevant reading. That is, it is not so that the underspecification account of indefinites is simpler overall. If we assume underspecification, we (and Champollion et al. 2019 for that matter) have to complicate the semantics elsewhere (for instance, providing a trivalent analysis of conditionals and quantifiers).

Second, not locating the weak-strong contrast on the indefinite but somewhere else (on the quantifier or the conditional) is unsatisfactory once we move to questions. The obvious problem is that questions have mention-some/mention-all readings even though there is no conditional or quantifier in the sentence. We could try to assume that the weak-strong distinction is located in the left periphery, for instance, on the Foc head. But then, we would lose the account of local uniqueness, i.e., uniqueness of wh-questions inside another operator. An example of local uniqueness discussed in the target article is given in (8).

(8) In which town was Shakespeare born or did Bach die?

Local uniqueness cases are crucial because they show that uniqueness, driven by max*, should be located on the indefinite, not in the left periphery.

Interestingly, the second problem that we just mentioned has a parallel in donkey anaphora. As Brasoveanu (2008) notes, the analysis in which the weak-strong distinction is located on the indefinite predicts that when one indefinite antecedes two pronouns, it should not be able to host a weak reading and a strong reading at the same time—a prediction that Brasoveanu argues is borne out. Consider the following case, from Brasoveanu (2008):

(9) Every man who bought a suit wore it at the morning ceremony, but refused to wear it at the evening party.

The sentence is odd in a situation in which a man has two suits and wears one at the morning ceremony but refuses to wear both at the evening party. The sentence is also odd to describe a case in which a man has two suits and wears one at the morning ceremony but refuses to wear the other one at the evening party. The oddness of both interpretations is predicted by Brasoveanu (2008) but not by Champollion et al. (2019) or our adaptation of the latter account in Inq_{D}.[2]

In sum, while it might be possible to recast the trivalence account of weak and strong readings of donkey anaphora in Inq_{D}, we do not see strong conceptual arguments that would make this analysis preferable to the one we pursue. Furthermore, there are empirical observations arguing against this option.[3]

1.2 Readings in multiple-wh questions

The commentaries of Sudo and Li provide a wealth of empirical observations concerning multiple-wh questions. As Sudo and Li note, some of their observations, like Sudo's discussion of the licensing conditions for D-linking and the resolution conditions of multiple-wh questions and Li's discussion of anaphora could arguably be accommodated in Inq_{D}. Given that the necessary extensions to Inq_{D} would be

2 Admittedly, the data are not entirely clear in this respect. Champollion et al. (2019) discuss the following example:

(i) Every man who has an umbrella takes it along on rainy days but leaves it home on sunny days.

The authors claim that the example can mean that men take one of their umbrellas on rainy days, but leave all of their umbrellas home on sunny days, which would support their analysis. They do not mention Brasoveanu's discussion and examples, which argue against their analysis. According to our own intuition, (i) does not have the suggested reading. The issue would have to be settled in an experimental study.

3 Another empirical argument against Champollion et al. (2019) was posed in Denić and Sudo (2022) based on a study of weak and strong readings in non-monotone environments. However, as the authors note, their data are problematic for virtually any account of weak and strong readings of donkey anaphora.

significant, however, we will leave the development of full-fledged accounts of these phenomena in Inq_{D} for future work (see the commentaries for some preliminary analyses).

Here, we will focus on Sudo's observations on the interpretation of multiple-wh questions, which connect to the core of our proposal. The first of his observations, on functional answers and pair-list answers, supports our account of pair list readings in multiple-wh questions. To recall, in our analysis, we do not postulate a separate reading to accommodate functional answers to multiple-wh questions. Concretely, the fact that (10) can be answered as (10b) does not indicate that the question should be treated as ambiguous between a pair-list and a functional reading. Rather, the latter is just a particular way of resolving the issue raised by the multiple-wh question under its pair-list reading.

(10) Which boy read which novel during the summer holiday?
   a. John read The Lord of the Rings, Bill read The Magus.
   b. Each boy read his favorite novel.

Sudo provides interesting support for this position. First, as background, he summarizes previous findings showing that functional readings and pair-list readings should be treated as independent readings in quantified wh-questions like (11).

(11) Which novel did each boy read?

The evidence stems from the fact that (i) some quantifiers, like *no*, license functional answers but do not allow pair-list answers and (ii) only those questions that allow pair-list answers (and not just functional answers) show quantificational variability effects with adverbials such as *for the most part*.

Sudo also discusses an observation from Groenendijk and Stokhof (1984) that there is a contrast between pair-list answers and functional answers with respect to intuitions regarding partial and complete answers. Assuming that three Dutchmen—Jeroen, Martin and Frank—all love their wife and mother, and Jeroen and Frank also love Queen Beatrix but Martin does not, the extent to which the answers in (12a) and (12b), respectively, resolve the question in (12) seem to differ.

(12) Which women does every Dutchman love?
   a. Jeroen loves his wife Jenny and his mother Ineke, Martin loves his wife Madelief and his mother Maaike, and Frank loves his wife Fay and his mother Fenna.
   b. His wife and mother.

Concretely, (12a) feels like a partial answer, while (12b) sounds like a complete answer, despite the fact that it fails to mention that Jeroen and Frank love the queen. This is arguably because (12b) is a complete answer as far as the functional mapping between the Dutchmen and the women is concerned, and the contrasting intuition

regarding the two answers provides another argument that the functional and pair-list reading should be treated as distinct.

Against this background, Sudo notices that multiple-wh questions behave differently. This is in line with our account, in which functional answers to multiple-wh questions have no special status and are just particular ways of resolving the question under its pair-list reading. Given that, we would expect that one would find both (13a) and (13b) only partial resolutions of the question in (13).

(13) Which Dutchman loves which women?
   a. Jeroen loves his wife Jenny and his mother Ineke, Martin loves his wife Madelief and his mother Maaike, and Frank loves his wife Fay and his mother Fenna.
   b. Each of them loves his wife and mother.

This is precisely Sudo's intuition for these two answers, and we share this intuition. We would like to thank Sudo for pointing out this interesting datapoint.

More problematic for our analysis of multiple-wh questions is Sudo's discussion of single-pair readings. In the target article, we assume that multiple-wh questions do not have an independent single-pair reading (footnote 8). Sudo calls us on this assumption, pointing out that there are multiple-wh constructions which have a single-pair reading but seem to lack a pair-list reading. So-called *nested* multiple-wh questions are a clear example of such constructions and have already been discussed by Higginbotham and May (1981) in this connection. We would like to thank Sudo for drawing our attention to these cases. To take one example from Sudo's discussion, consider (14):

(14) Which^{u_1} novel by which^{u_2} English author did Andy read?

As Sudo points out, this question presupposes that Andy read exactly one novel by one English author. For example, the following answer feels infelicitous:

(15) He read Animal Farm by George Orwell, Bleak House by Charles Dickens, and Cold Comfort Farm by Stella Gibbons.

We share this intuition. We furthermore agree with Sudo's suggestion that the single-pair reading can be analyzed in Inq_D as a reading separate from the pair-list reading. While a pair-list reading requires a functional witness, a single-pair reading arises if the question is taken to raise an issue whose resolution requires identifying a witness for each discourse referent introduced by wh-elements. For instance, in (14), the witness request operator would raise an issue about u_1 and u_2 separately, as $?u_1$; $?u_2$.

There are various ways in which this reading could be obtained. One option is that the Foc head, which introduces the witness request operator, is in fact ambiguous. Under one reading, discussed in the target article, Foc carries a functional witness request operator $?u_1 \ldots u_n$, where $u_1 \ldots u_n$ are the discourse referents introduced by the associated wh-phrases. To accommodate the single pair reading, we could add that Foc can also request a witness for each wh-dref separately, $?u_1; \ldots; ?u_n$. Another way to derive single pair readings would be to assume that each wh-phrase can itself request a witness of the dref that it introduced, but this option is only used as a last resort, when Foc does not raise any issue.

A crucial question is what would block Foc from contributing a functional witness request operator, giving rise to a pair-list reading, in cases where the only possible reading is the single-pair reading, such as in nested multiple-wh questions. Descriptively speaking, the following generalization seems adequate:

(16) The possibility of interpreting Foc as contributing a functional witness request operator $?u_1 \ldots u_n$ is blocked if the wh-phrase introducing u_n is nested inside the wh-phrase introducing u_1.

However, arriving at a more general characterization of the conditions under which pair-list readings are blocked requires further work (see Elliott 2016 for recent discussion). Because of that, we do not propose a full-fledged theoretical analysis here, leaving this as a challenge for future refinements of Inq_D.

Multiple-wh questions are also the main topic of investigation in Li's commentary. We agree with his observation that Inq_D can be used to account for dependent anaphora with wh-antecedents, as in the example in (17), taken from Li's commentary.

(17) Which^{u_1} girl bought which^{u_2} dress and how much^{u_3} did she$_{u_1}$ pay for it$_{u_2}$?

We also agree with Li that the analysis would fully work if we introduced a distributive operator into the system. This would bring the Inq_D analysis of dependent anaphora close to approaches like PCDRT, which assume that depedent anaphora in declaratives, as in (18), are only possible if the second conjunct includes distributivity (Brasoveanu 2008; Nouwen 2007).

(18) Each boy read a book and they (each) liked it.

Unfortunately, including a distributive operator in Inq_D would take us too far afield. We leave this as another desideratum for possible future refinements.

1.3 Existential presupposition

Biezma as well as Bianchi and Cruschina point out that our account predicts what has been labeled as an 'existential presupposition' in wh-questions. For instance, questions such as (19) are predicted to presuppose that someone voted for Prof. Jones.

(19) Who voted for Prof. Jones?

Both commentaries take issue with this prediction, referring to Abusch (2010), who argues that speakers uttering a question can also consider it possible, or even likely, that nobody satisfies the property expressed by the question nucleus, as in the following example:

(20) *Context: Students cast their votes for the Lecturer of the Year. Prof. Jones is very unpopular among students. Ann knows the results of the election, Bill doesn't. Bill asks Ann:*
Who voted for Prof. Jones? Nobody I guess.

We agree that such cases require a further refinement of our proposal. One possible approach would be to build on Biezma (2020, pages 18–22), who suggests that a discourse can make salient other alternatives than those introduced by lexical elements. In particular, next to the alternatives introduced by wh-questions, a context might make an additional, 'null' alternative salient as well (nobody voted for Prof. Jones). Such an alternative is entertained by the speaker in (20).

This idea could be formalized in Inq_{D}. We could assume that in some contexts, the composition of the semantic value of a wh-question may involve the ? operator.[4] In (20), this would result in the introduction of an additional alternative, that nobody voted for Prof. Jones. Aside from capturing the resolution conditions of (20), this approach would also predict that in such contexts a wh-phrase cannot antecede a pronoun in subsequent discourse. This predictions seems to be borne out, as illustrated in (21).

(21) *Context: Junior and Senior students cast their votes for the Lecturer of the Year. Prof. Jones is very unpopular among students. Ann knows the results of the election, Bill doesn't. Bill asks Ann:*
Who voted for Prof. Jones? Nobody I guess.
#Are they (=the people voting for him) mostly juniors or seniors?

A challenge for this approach concerns wh-questions with singular *which*-phrases, such as (22):

(22) Which student voted for Prof. Jones?

The alternatives triggered by the Foc head associated with the wh-phrase are those states in which exactly one student voted for Prof. Jones. If we add the ? operator on top, we end up with an extra alternative that includes the 'null' case (no student voted for Jones) but also situations in which *more than one student* voted for Jones. This is

4 This operator would have to apply before the † operator.

unsatisfactory since the question cannot be continued by stating (23) (assuming that Bill and John are students).[5]

(23) Probably Mary and Sue did.

So the challenge for this approach is that the extra alternative would have to be further restricted once we go beyond simple cases like (20).

Another approach to account for the fact that wh-questions do not always carry an existential presupposition would be to assume that the set of individuals associated with the discourse referents introduced by non-singular (i.e., plural or number-neutral) wh-phrases can be richer than assumed in the target article, not only containing atomic and plural individuals but also a 'null' individual. The assumption that the domain of individuals includes such a 'null' individual is arguably needed independently to account for the meaning of *zero* (see Bylinina and Nouwen 2018).

This approach would correctly predict the contrast between (20) and (22). In particular, it would predict that (22) obligatorily carries an existential presupposition, because singular number morphology would be taken to eliminate both plural and 'null' individuals as possible witnesses for the discourse referent introduced by the wh-phrase. A further prediction would be that (22) contrasts with (24). The latter, with plural number morphology, would be predicted not to carry an obligatory existential presupposition. This prediction seems correct.

(24) Which students voted for Prof. Jones? Probably Mary and Sue did, but I can't imagine anyone else did.

While the details of this approach remain to be worked out, we consider it a promising avenue for a future extension of the basic account developed in the target article.

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5 There is a complication here. Namely, some questions with singular *which*-phrases, such as (i), have a rhetorical interpretation under which they clearly do not carry an existential presupposition, unlike non-rhetorical cases like (22).

(i) Which sane human being would vote for Prof. Jones after everything that happened this year?

As illustrated in (ii), these two cases also contrast in their NPI licensing potential, something that has been argued to correlate with the presence or absence of an existential presupposition (see Jeong and Roelofsen 2023; Schwarz 2017).

(ii) a. %Which student ever voted for Prof. Jones? (only licensed under rhetorical reading)
b. Which sane human being would ever vote for Prof. Jones?

We leave the derivation of rhetorical readings of singular *which*-questions, and the anti-existential implication that is characteristic for such readings, as an open issue for future work.

1.4 The syntax of the left periphery

Bianchi and Cruschina provide a detailed examination of the left periphery in Spanish, Italian and Dutch dialects with regards to Inq_{D}. We thank them for sharing their thoughtful observations.

They propose several alternatives to our approach on how the syntax of the left periphery could be mapped onto semantics. We believe that such alternative mappings should be further explored. Here we only want to focus on two such alternatives. We do so in order to discuss what challenges they face, which are avoided in the syntax-semantics mapping proposed in the target article.

As a reminder, we repeat the order of the heads in the left periphery assumed in the target article in (25). The interpretation of individual heads of the left periphery is shown in (26).

(25) Dec/Int > Foc > Fin

(26) a. $[\![\text{Foc}_{u_1 \dots u_n}]\!] \coloneqq \lambda \mathcal{U}_{\mathbf{T}}.\ !\mathcal{U}\,;\, \max^*\{u_1\}\,;\,\dots\,;\,\max^*\{u_{n-1}\}\,;\,?u_1 \dots u_n$
where $u_1, \dots, u_n$ are the discourse referents introduced by the associated wh-phrases

b. $[\![\text{Int}]\!] = \lambda \mathcal{U}_{\mathbf{T}}.\ \dagger\, \langle ? \rangle \mathcal{U}$

c. $[\![\text{Dec}]\!] = \lambda \mathcal{U}_{\mathbf{T}}.\ !\mathcal{U}$

We assume that the Fin head is semantically vacuous and used only to host auxiliaries in auxiliary inversion. One proposal of Bianchi and Cruschina is to avoid the semantic emptiness of Fin by dividing the semantic contribution of the Foc head between the Fin and the Foc heads. Concretely, their proposal could be summarized as follows:

(27) a. $[\![\text{Fin}]\!] \coloneqq \lambda \mathcal{U}_{\mathbf{T}}.\ !\mathcal{U}$ **(B&C)**

b. $[\![\text{Foc}_{u_1 \dots u_n}]\!] \coloneqq \lambda \mathcal{U}_{\mathbf{T}}.\ \mathcal{U}\,;\, \max^*\{u_1\}\,;\,\dots\,;\,\max^*\{u_{n-1}\}\,;\,?u_1 \dots u_n$ **(B&C)**
where $u_1, \dots, u_n$ are the discourse referents introduced by the associated wh-phrases

This proposal is arguably supported by data regarding "recomplementation" that Bianchi and Cruschina discuss. Moreover, a conceptual advantage is that under this proposal no head in the left periphery is semantically vacuous.

One problem we see for this proposal, however, concerns questions with disjunctions. A crucial example is repeated in (28).

(28) In which town [$_{FinP}$ was Shakespeare born] or [$_{FinP}$ did Bach die]?

Under the assumption that Fin hosts auxiliaries, we clearly deal with a disjunction of Fin phrases in (28). If we followed the proposal of Bianchi and Cruschina, the

disjunction would scope higher than the ! operator and the issue raised by the disjunction would not be discharged. Empirically speaking, such a proposal would predict that (28) is not fully resolved by (29a) or (29b), but only by (29c) or (29d). Our intuitions do not align with this prediction. Rather, (29a) and (29b) seem to provide enough information to resolve the question.

(29) a. In Stratford upon Avon.
b. In Leipzig.
c. Shakespeare was born in Stratford upon Avon.
d. Bach died in Leipzig.

The second modification that Bianchi and Cruschina consider pertains to the semantic contribution of Int. They suggest that this head, which appears in interrogatives, could be taken to always introduce the ? operator, rather than the $\langle ? \rangle$ operator proposed in the target article:

(30) $[[\text{Int}]] = \lambda \mathcal{U}_{\mathbf{T}}. \dagger ?\mathcal{U}$ **(B&C)**

On our proposal, see (26), Int only introduces inquisitiveness when its complement FocP is not inquisitive. The analysis of Bianchi and Cruschina could be used to explain why wh-questions do not (always) carry an existential presupposition, as discussed in Section 1.3. However, we also noted challenges for this type of explanation for cases without existential presupposition. In addition, the treatment of Int given in (30) is also problematic for the interpretation of alternative questions. The following example, repeated from the target article, would be incorrectly interpreted as asking whether it is raining, or snowing, or neither of the two.

(31) Is it raining$^{\uparrow}$ or is it snowing$^{\downarrow}$?

This is a good point to re-emphasize that the target article aims to make two distinct contributions. On the one hand, it presents a logical framework, Inq_{D}, for the analysis of declarative and interrogative sentences across languages. On the other hand, it presents a specific account of declarative and interrogative sentences in English, using Inq_{D}, focusing in particular on wh-interrogatives. It is important to note that this specific account is by no means the only account of declarative and interrogative sentences in English, or other languages for that matter, which could be formulated in Inq_{D}. Further developing and refining such accounts would require a synthesis of insights from theoretical cross-linguistic syntax and formal semantics. We wholeheartedly agree with Bianchi and Cruschina that this could be a highly fruitful avenue of future research.

2 Looking back: three generations of logical frameworks for question semantics

We are grateful to Boritchev, Enguehard and Biezma for pointing out several connections between our work and other approaches to question semantics, besides the connections already discussed in the target article. Here, we place our proposal in a somewhat broader historical context. In doing so, we focus on the logical framework we developed, Inq_{D}, rather than the particular account of English declaratives and interrogatives that we articulated within this framework. We think of Inq_{D} as a 'third generation' framework, building on two earlier generations. Evidently, we cannot discuss all previously proposed logical frameworks for question semantics in detail here. Our aim will merely be to identify some general differences and commonalities between them, and clarify how our own framework builds on them.

2.1 First-generation frameworks

Among first-generation frameworks, a high-level distinction can be made between *proposition-set* frameworks and what we will call *multi-type* frameworks. In proposition-set frameworks, the semantic value of a question is a set of propositions (or an equivalence relation over possible worlds, which can be identified with a set of propositions). The most prominent first-generation frameworks falling under this header are *alternative semantics* (Hamblin 1973; Karttunen 1977) and *partition semantics* (Groenendijk and Stokhof 1984).

In multi-type frameworks, different kinds of questions are given different types of semantic values. For instance, the semantic value of a question with a single wh-phrase is a function of type $e(st)$, and the semantic value of a question with two wh-phrases is a function of type $e(e(st))$. Polar and alternative questions have yet another semantic type. Prominent frameworks falling under this header include the *categorial* framework (Hausser and Zaefferer 1978), the *structured meanings* framework (Krifka 2001; von Stechow 1991), and the *situation semantics* framework (Ginzburg 1996; Ginzburg and Sag 2000).

These first-generation frameworks differ in how they strike a balance between expressive power on the one hand and what we will call 'logical well-behavedness' on the other. Partition semantics is logically well-behaved (e.g., it has proper notions of question entailment and conjunction, and question-embedding predicates can be treated as having a single semantic type, no matter what kind of question they take as their complement) but its expressive power is restricted (e.g., mention-some

readings are difficult to deal with, and accommodating them in the framework takes away some of the logical well-behavedness; see, e.g., Ciardelli 2017 for discussion).

Alternative semantics has more expressive power than partition semantics (e.g., it can deal straightforwardly with mention-some readings), but is logically less well-behaved (e.g., it does not have proper notions of question entailment and conjunction; see, e.g., Groenendijk and Stokhof 1984; Roelofsen 2013 for discussion). Also, its expressive power has been argued to be too high in some regards (Ciardelli and Roelofsen 2017).

Multi-type frameworks have even more expressive power than alternative semantics (e.g., they assign different semantic values to *Is the door open?* and *Is the door closed?*, which are semantically equivalent in partition semantics and alternative semantics), but are also even more problematic from a logical point of view (they do not only lack proper notions of question entailment and conjunction, but also make it impossible to treat question-embedding predicates as having a single semantic type; see Groenendijk and Stokhof 1984, 1997 for discussion).

2.2 Second generation frameworks

We refer to logical frameworks for question semantics that aim to improve in fundamental ways on one or several of the first generation frameworks as second generation frameworks. There are at least five such frameworks (see Figure 3), which can be divided into two groups. The first group consists of three frameworks which each extend one of the first generation frameworks with a dynamic layer. We refer to these as *dynamic extensions*. The second group consists of two frameworks which each build on two of the first generation frameworks and seek to establish a synergy between these. We refer to these as *synergy frameworks*.

2.2.1 Dynamic extensions

Dynamic partition semantics (Haida 2007; van Rooij 1998) adds a dynamic layer to classical partition semantics to capture anaphora with wh-antecedents, intervention effects, and the affinity between wh-elements and indefinites. Dynamic alternative semantics (Li 2021a, 2021b) adds a dynamic layer to alternative semantics, with an empirical focus on capturing Mandarin wh-conditionals, short answers, and anaphoric reference to dependencies established in multiple wh-questions. Dynamic multi-type semantics (Aloni et al. 2007) re-casts the multi-type approach in a dynamic setting, aiming to overcome the logical shortcomings of classical multi-type approaches. In a dynamic setting, conjunction can be defined as update sequencing, and entailment can be defined in terms of contextual support.

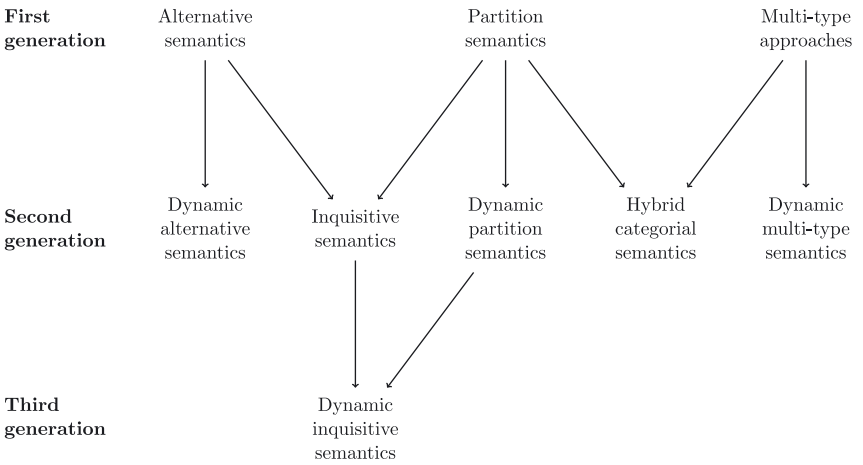

Figure 3: First, second, and third generation approaches.

It is worth noting that dynamicity plays a rather different role in dynamic multi-type semantics than in dynamic partition semantics and dynamic alternative semantics. Namely, in dynamic partition semantics and dynamic alternative semantics, dynamicity mainly plays a role in the internal *composition* of question meanings. In particular, these works show that a dynamic treatment of wh-phrases as introducing discourse referents which need to be accessed by an operator in the left periphery makes it possible to account for anaphora with wh-antecedents, intervention effects, wh-conditionals, and the indefinite-interrogative affinity.

In contrast to that, in the dynamic multi-type semantics of Aloni et al. (2007), dynamicity does not play a major role in the internal composition of question meanings, but rather in representing incremental updates of the context in a conversation. Questions, even if they are of a different type, all result in a context update: essentially, the function that they denote is added to a question under discussion stack. A conjunction of two questions can then simply be treated as a sequence of updates. If the two questions produce functions of different semantic types, this is no longer problematic. And similarly for entailment between two questions: in a dynamic setting, this need not be defined directly in terms of the functions that the two questions produce (this would be problematic), but can rather be defined in terms of the context updates that they give rise to.

2.2.2 Synergy frameworks

Inquisitive semantics (Ciardelli et al. 2018) builds on alternative semantics and partition semantics, aiming to overcome their respective limitations while

preserving their attractive features. In terms of expressive power it is intermediate between these two frameworks, avoiding some of the under-generation problems of partition semantics and the over-generation problem of alternative semantics. Like partition semantics, it is logically well-behaved: it has proper notions of question entailment and conjunction, and question-embedding predicates can be treated as having a single semantic type, no matter what kind of question they take as their complement. It also enables a logically well-behaved treatment of disjunction, negation and implication that applies uniformly across declaratives and interrogatives, something that was not available in partition semantics. Like alternative semantics and partition semantics, inquisitive semantics is also a proposition-set framework.

A second synergy framework is the 'hybrid categorial' framework of Xiang (2020). This approach aims to combine some of the benefits of the categorial (i.e., multi-type) approach (in particular, its expressive power) with those of partition semantics (in particular, its natural treatment of question conjunction). Xiang (2020) also provides novel empirical arguments for a multi-type approach, based on free relative constructions, quantificational variability effects, and short answers. Accounting for such constructions, she argues, requires an approach that has more expressive power than proposition-set approaches do. Interestingly, Li (2021a, 2021b) makes similar arguments for his dynamic extension of alternative semantics. The other two second generation frameworks, inquisitive semantics and dynamic partition semantics, do not have sufficient expressive power to deal with the phenomena that Xiang (2020) and Li (2021a, 2021b) discuss.

2.3 Third generation

We think of $\mathrm{Inq}_{\mathrm{D}}$ as a third generation framework, building most directly on static inquisitive semantics and dynamic partition semantics, see Figure 3. Note that $\mathrm{Inq}_{\mathrm{D}}$ diverges from static inquisitive semantics in a rather fundamental way, namely, it is no longer a proposition-set framework. Contexts in $\mathrm{Inq}_{\mathrm{D}}$ are more fine-grained semantic objects than sets of propositions. Because of this additional fine-grainedness, $\mathrm{Inq}_{\mathrm{D}}$ does not only inherit the beneficial features of its most immediate predecessors, static inquisitive semantics and dynamic partition semantics, but, as noted in Enguehard's commentary, also has sufficient expressive power to handle the empirical phenomena which motivated Xiang (2020) and Li (2021a, 2021b) to develop the hybrid categorial approach and a dynamic extension of alternative semantics, respectively.

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