Uniqueness requirements of *wh*-questions in discourse

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In their target paper, Roelofsen & Dotlačil develops a type-theoretic dynamic inquisitive semantics framework ($\mathsf{Inq_D}$, for short). $\mathsf{Inq_D}$ combines Inquisitive Semantics (Ciardelli et al. 2018), which is a framework for studying questions, and Plural Compositional DRT (PCDRT, for short, Brasoveanu 2008, 2010), which is a dynamic framework for studying plural anaphora. Like Inquisitive Semantics, a context in $\mathsf{Inq_D}$ is modeled as a non-empty, downward closed set of information states; like PCDRT, an information state is modeled as a set of assignment worlds, i.e, pairs consisting of a possible world and a set of assignments. Combining dynamicness and inquisitiveness allows Roelofsen & Dotlačil to extend the dynamic machinery applying to indefinites in PCDRT to resolve a range of related empirical issues in questions, including mention-some and mention-all readings, pair-list readings, and uniqueness presuppositions.

This commentary focuses on their account for uniqueness presuppositions of *wh*-questions. According to them, the uniqueness presupposition invoked by a question with a singular *which*-expression results from the interaction of the maximality requirement of the *which*-expression and the operator forming inquisitiveness. This differs from the previous two approaches—the globalist approach, in which the uniqueness presupposition is triggered by a sentence-level operator (Dayal 1996; Fox 2013; Xiang 2022; a.o.), and the localist approach, in which the uniqueness presupposition is inherited from singular *wh*-expressions (Hirsch & Schwarz 2019; Uegaki 2021; a.o.). Roelofsen & Dotlačil show that their dynamic analysis can uniformly account for the (un)availability of uniqueness presuppositions in various questions.

Although $\mathsf{Inq_D}$ is a dynamic theory of question meaning, Roelofsen & Dotlačil (this volume) do not demonstrate its power in dealing with discourse phenomena involving questions. In this commentary, I examine $\mathsf{Inq_D}$ based on its predictions regarding uniqueness requirements of *wh*-questions in discourse and show that the relevant analysis in $\mathsf{Inq_D}$ is too weak. Specifically, it fails to explain why uniqueness requirements are usually attested when *wh*-expressions are referred to by singular pronouns. In addition, this commentary offers a generalization on the discourse conditions that allow the relevant uniqueness requirements to be obviated.

1 Single-*wh* and multiple-*wh* questions in $\mathsf{Inq_D}$

In $\mathsf{Inq_D}$, the meaning of the single-*wh* question in (1) is translated to (2). To simplify matters, I will only provide informal paraphrases of the logical formulas in (3) to avoid any unnecessary complications. Readers can find all formal definitions in the target paper.

(1) Which^u person called?

(2) $\dagger([u]; \mathsf{person}\{u\}; \mathbf{atom}\{u\}; \mathsf{called}\{u\}; \mathbf{max^*}\{u\}; \mathbf{?}u)$

(3) Given an input context c,

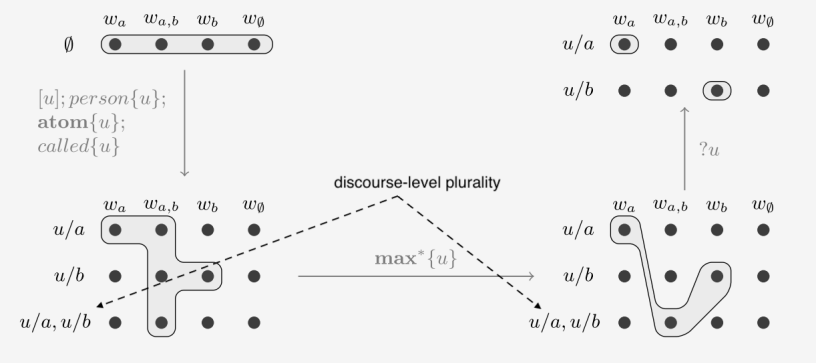

Figure 1: The update effect of (2)

a. $[u]$ introduces a discourse referent u into all possibilities involved in c.
b. $\mathsf{person}\{u\}$ says that each value assigned to u is a person.
c. $\mathbf{atom}\{u\}$ imposes a domain-level (relative to single assignments), rather than discourse-level (relative to sets of assignments), atomicity requirement on u. In particular, $\mathbf{atom}\{u\}$ does not prevent u from being associated with multiple individuals but these individuals must be atomic.[1]
d. $\mathsf{called}\{u\}$ says that the values of u called;
e. $\mathbf{max^*}\{u\}$ requires that no other individuals called relative to each possibility;
f. $\mathbf{?}u$, called 'witness request operator', raises an issue whose resolution requires identifying one or more witnesses for u. Informally, the issue could also be paraphrased as 'What is an individual that has the properties ascribed to u';
g. $\dagger$ imposes a presuppositional constraint that requires that any information provided by the *wh*-question must already be present in c.

The interaction of $\mathbf{atom}\{u\}$, $\mathbf{max^*}\{u\}$, and $\mathbf{?}u$ gives rise to a uniqueness requirement. Specifically, the update effect of (1) can be depicted in Figure 1 (cf. Figure 18 in the target paper): $\mathbf{atom}\{u\}$ makes sure that u is only associated with the atomic individuals a and b; $\mathbf{max^*}\{u\}$ gets rid of the possibilities where the world $w_{a,b}$ is paired with assignments associating u with either a or b; $\mathbf{?}u$ further removes the possibility where the value of u cannot be identified to a unique individual. In other words, $\mathbf{atom}\{u\}$ removes the possibilities with domain-level plurality, while $\mathbf{?}u$ the ones with discourse-level plurality. As a result, both alternative information states in the output context of $\mathbf{?}u$ assign *exactly one* individual to u. It is indicated that there was only one person who called.

On the other hand, the meaning of the multiple-*wh* question in (4) is translated in (5). Unlike a single-*wh* question, a multiple-*wh* question employs a generalized witness request operator $\mathbf{?}u_1...u_n$, which re-formalizes the core idea of the function approach to multiple-*wh* questions (Chierchia 1993; Dayal 1996; Xiang 2023; a.o.) and guarantees the existence of a functional

[1] I refer readers to Brasoveanu (2008) and Law (2019) for more details about the domain-level atomicity and the discourse-level atomicity.

relation between *wh*-expressions.

(4) Which^{u_1} student read which^{u_2} book?
Answer: Ann read *Catch-22*, and Bob *Dracula*.

(5) $$\dagger\left(\begin{array}{l}[u_1];\mathsf{student}\{u_1\};\mathbf{atom}\{u_1\};[u_2];\mathsf{book}\{u_2\};\mathbf{atom}\{u_2\};\\ \mathsf{read}\{u_1,u_2\};\mathbf{max^*}\{u_1\};\mathbf{max^*}\{u_2\};\mathbf{?}u_1u_2\end{array}\right)$$

(6) Given an input context c,

a. $[u_1]$ and $[u_2]$ introduce two discourse referents u_1 and u_2 into all possibilities involved in c;

b. u_1 is a student, u_2 is a book, they are atomic individuals ($\mathbf{atom}\{u_1\}$, $\mathbf{atom}\{u_2\}$), and u_1 read u_2;

c. for each possibility, u_1 and u_2 respectively store all the students and all the books that they read ($\mathbf{max^*}\{u_1\}$, $\mathbf{max^*}\{u_2\}$);

d. $\mathbf{?}u_1u_2$ raises an issue whose resolution requires identifying a witness function f, which maps any tuple of entities satisfying the properties ascribed to u_1 to a corresponding entity satisfying the properties ascribed to u_2;

e. $\dagger$ imposes a presuppositional constraint that requires that any information provided by the *wh*-question must already be present in c.

The output context of (5) can be displayed in Figure 2 (cf. Figure 23 in the target paper). All the alternative information states include functionally related entities. For example, in the possible world $w^{a\rightsquigarrow d}_{b\rightsquigarrow c}$, the students a and b are functionally related to the books d and c, i.e., a read d and b read c. The issue raised by $\mathbf{?}u_1u_2$ is identifying a function between two maximal sets of individuals, instead of identifying an individual being associated with every assignment. As a consequence, the multiple-*wh* question does *not* indicate that there are only one student u_1 and one book u_2 such that u_1 read u_2.

2 Uniqueness requirements in discourse

Although Roelofsen & Dotlačil focus on the meaning of an independent *wh*-question, $\mathsf{Inq_D}$ as a dynamic framework also makes predictions regarding how questions are used in discourse. For example, $\mathsf{Inq_D}$ inherits merits from PCDRT and is able to predict that a multiple-*wh* question supports dependent anaphora (van Rooy 1998; Li 2020, 2021), an example of which is (7). In this example, the multiple-*wh* question admits a pair-list answer and presupposes that there are multiple girls who bought one dress each. In the subsequent question, the singular pronouns do not refer to particular individuals. The pronoun *she* refers to each girl and, for each girl, the pronoun *it* refers to the dress that she bought.

(7) Which^{u_1} girl bought which^{u_2} dress and how much^{u_3} did she$_{u_1}$ pay for it$_{u_2}$?
Answer: Annie bought the blue dress and payed $200; Becky bought the red dress and payed $150.

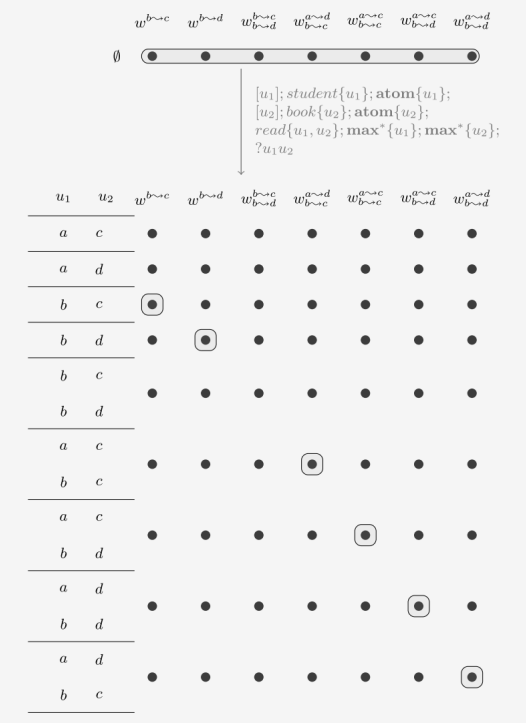

Figure 2: The output context of (5)

Based on Inq_D, the meaning of (7) can be represented as (8).

$$(8) \qquad \dagger \left(\begin{array}{l} [u_1]; \mathsf{girl}\{u_1\}; \boxed{\mathbf{atom}\{u_1\}}; [u_2]; \mathsf{dress}\{u_2\}; \boxed{\mathbf{atom}\{u_2\}}; \\ \mathsf{bought}\{u_1, u_2\}; \mathbf{max*}\{u_1\}; \mathbf{max*}\{u_2\}; \mathbf{?}u_1u_2 \\ [u_3]; \mathsf{price}\{u_3\}; \underline{\mathbf{atom}\{u_1\}}; \underline{\mathbf{atom}\{u_2\}}; \mathsf{payed\text{-}for}\{u_1, u_3, u_2\}; \\ \mathbf{max*}\{u_3\}; \mathbf{?}u_3 \end{array} \right)$$

$\mathbf{?}u_1u_2$ makes sure the existence of a function mapping the values of u_1 to those of u_2, which underlines the pair-list answer. In the subsequent question, the singular pronouns also impose the atomicity requirements (marked by underlines) that match the atomic properties of the *wh*-expressions (marked by boxes). Since in Inq_D atomicity is defined at the domain level (see (3-c)), the singular pronouns allow that u_1 and u_2 store multiple atomic individuals and hence they preserve possibilities where different girls bought different dresses. Thus, Inq_D naturally explains the pattern of dependent anaphora.

In addition to accounting for dependent anaphora, Inq_D also predicts that a multiple-*wh* question does not have a uniqueness requirement even when the *wh*-expressions are referred to by singular pronouns in discourse. This is because the atomicity condition in Inq_D does not prevent a discourse referent from being plural at the discourse level.

However, this prediction is not borne out when a multiple-*wh* question is followed by a declarative sentence, as exemplified in (9). Akin to those in (7), the *wh*-expressions in the

multiple-*wh* question of (9) are referred to by the singular pronouns in the subsequent declarative sentence, but the answer to the multiple-*wh* question must meet a uniqueness condition. That is, in this situation, it is presupposed that there is only one girl who bought exactly one dress.

(9) Which^{u_1} girl bought which^{u_2} dress? I heard she$_{u_1}$ spent a lot on it$_{u_2}$.
Answer: #Annie bought the blue dress and Becky the red dress.

The same issue also appears when a number neutral *wh*-expression in a single-*wh* question is referred to by a singular pronoun. Consider (10). Before asking these two questions, the speaker must already know that there is exactly one female athlete who won the game.

(10) Who^{u_1} won the game? How many points did she$_{u_1}$ get?

In Inq_D, the discourse referent u_1 serving as the antecedent of the singular pronoun can be plural at the discourse level. Consequently, the two questions in (10) would felicitously be used to inquire about the result of a women's doubles match.

The problem observed in (9) and (10) can be resolved if singular pronouns impose atomicity requirements at the discourse level. It would require that the antecedent of a singular pronoun introduce a discourse referent being uniformly associated with one atomic individual. However, simply shifting the domain-level atomicity to the discourse-level atomicity would also sacrifice the elegance of Inq_D in accounting for the dependent anaphora shown in (7).

In PCDRT or any version of dynamic plural logic (van den Berg 1996; Nouwen 2007; a.o.), dependent anaphora is usually derived through embedding a singular pronoun in the scope of a distributive operator δ, which splits a set of assignments into multiple singleton sets of assignments. As a consequence, the singular pronoun is evaluated relative to each assignment, instead of the whole set of assignments. If it is assumed that, in (7), the subsequent question involves a distributive operator in its semantic representation (see also van Rooy 1998), the singular pronouns could encode a discourse-level atomicity but still maintain the pattern of dependent anaphora. As exemplified in (11), the multiple-*wh* question in (7) generates a possibility where the set of assignments stores multiple girls and dresses. Then, δ encoded in the subsequent question divides the set of assignments into singleton sets where only one girl and one dress are involved. The singular pronouns in the scope of δ are evaluated based on these singleton sets and hence their discourse-level atomicity requirements are satisfied.

(11)

u_1	u_2
a	d_1
b	d_2

$\xrightarrow{\delta}$

u_1	u_2	
a	d_1	how much did she$_{u_1}$ pay for it$_{u_2}$

u_1	u_2	
b	d_2	how much did she$_{u_1}$ pay for it$_{u_2}$

Although positing a distributive operator can technically resolve the problem, it still needs an independent justification. If we follow van Rooy (1998) and assume that every interrogative sentence independently contributes a distributive operator, dependent anaphora would always be observed when a question follows a sentence establishing a functional dependency between

discourse referents. However, this is not the case, as evidenced by (12).

(12) #I know every^{u_1} boy bought a^{u_2} gift, but who^{u_3} will he$_{u_1}$ send it$_{u_2}$ to?

In this example, the universal quantifier in the first sentence establishes a dependency between u_1 and u_2, i.e., each value of u_1 is correlated with a (different) value of u_2. However, the singular pronouns in the subsequent question cannot be interpreted relative to each boy–gift pair.

Another potential solution is assuming that the conjunctor *and* encodes a distributive operator. In contrast to (9), the two sentences in (7) are conjoined by *and*. In Roelofsen & Dotlačil's own example (i.e., example (9) in their paper), which is repeated in (13), the occurrence of the conjunctor *and* is also crucial to the interpretation of dependent anaphora. Removing *and* from the follow-up question results in the infelicity of answering A and B's questions with a list of woman–dress–cost triples, as shown in (15). In this situation, the use of the singular pronouns also indicates that there was only one woman who bought one dress.

(13) A: Which^{u_1} woman bought which^{u_2} dress?
B: And how much did she$_{u_1}$ pay for it$_{u_2}$?

(14) A: Which^{u_1} woman bought which^{u_2} dress?
B: How much did she$_{u_1}$ pay for it$_{u_2}$?
C: #Annie bought the blue dress and payed $200; Becky bought the red dress and payed $150.

However, the conjunctor does not always facilitate the interpretation of dependent anaphora. For example, if a multiple-*wh* question is followed up by a declarative sentence in discourse, the appearance of the conjunctor could not obviate the uniqueness requirements imposed by singular pronouns. Consider the conversation in (15).

(15) A: Do you know which^{u_1} woman bought which^{u_2} dress?
B: And I also heard she$_{u_1}$ payed for it$_{u_2}$ with cash.

In this conversation, A was asking the addressee which woman bought which dress and B provided additional information to help the addressee identify the woman and the dress. Although *and* was used in the follow-up declarative sentence, the uses of the singular pronouns indicate that B assumes that there was only one woman who bought one dress.

Moreover, a uniqueness requirement is also attested when the *wh*-expressions in a multiple-*wh* question serve as antecedents of singular pronouns appearing in a subsequent polar question. Consider (16), which is not felicitously uttered in the given scenario.

(16) Scenario: Two girls bought a bunch of clothing from a store. After leaving, the manager comes up to the cashier and wants to know for the purposes of collecting data what the clothing was each of them bought and what they paid with. So the manager says:

Hi! Just collecting data again on that blonde and brunette who just left with the dresses. #Which^{u_1} girl bought which^{u_2} dress and did she$_{u_1}$ pay for it$_{u_2}$ with cash?

3 Conclusion and outlook

Based on what has been discussed, when a singular pronoun refers to a *wh*-expression in discourse, there is usually a uniqueness requirement on the answer to this *wh*-expression. The exceptional cases that have been noticed so far involve two conditions:

- A multiple-*wh* question is followed by another *wh*-question;
- The two questions are conjoined by *and*.

A sequence of questions fulfilling both conditions seems to have a closer relation in discourse. In other words, such a sequence of questions is likely to be interpreted as a single question.[2] An adequate dynamic theory of question meaning would need to explain the correlation between the discourse closeness of questions and the obviation of uniqueness requirements.

At the end of this commentary, I briefly summarize a dynamic analysis that could be re-implemented in $\mathsf{Inq}_{\mathsf{D}}$. In particular, Li (2020, 2021) argues that the sequence of questions in (7) can form a single question speech act. Following the family-of-question approach (Szabolcsi 1997; Willis 2008; Fox 2012; Kotek 2014; a.o.), he assumes that the pair-list reading of a multiple-*wh* question is derived from the conjunction of the answers to several sub-questions. Within the scope of the same speech act, each sub-question is accessible to a following conjoined question, as exemplified in (17). The second question is conjoined with each sub-question in a point-wise manner and hence, *she* refers to *Annie* or *Becky*, while *it which dress*.

(17) Speech Act $\left(\left\{ \begin{array}{l} \text{which}^{u_2} \text{ dress did Annie}^{u_1} \text{ buy} \\ \text{which}^{u_2} \text{ dress did Becky}^{u_1} \text{ buy} \end{array} \right\}_{\text{which girl bought which dress}} \text{and how much did she}_{u_1} \text{ pay for it}_{u_2} \right)$

= Speech Act $\left\{ \begin{array}{lll} \text{which}^{u_2} \text{ dress did Annie}^{u_1} \text{ buy} & \text{and} & \text{how much did she}_{u_1} \text{ pay for it}_{u_2} \\ \text{which}^{u_2} \text{ dress did Becky}^{u_1} \text{ buy} & \text{and} & \text{how much did she}_{u_1} \text{ pay for it}_{u_2} \end{array} \right\}$

However, this analysis is challenged by conversations like (13). In this example, it is not convincing that the questions uttered by different people form a single speech act. A potential solution is to assume that the appearance of *and* in the follow-up question signals the existence of an elliptical antecedent clause, which would be reconstructed as the same multiple-*wh* question as the previous one. Of course, this solution needs to be justified by independent evidence in future research.

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[2] Dayal (2000) notices another case where a sequence of questions is interpreted as one question. In English, a sequence of *wh*-questions like *What do you think? Who will Mary see?* is also likely to be understood as one question asking 'who do you think Mary will see?'.

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