

# How Questions and Answers Cohere

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## 1 The basic observation

When a declarative sentence is uttered in response to a question, the asserted content may be richer than the compositionally derivable content for that sentence. Here are some illustrative examples:

- (1) Q: What did Clara draw with her new pencil?  
A: She drew a dragon.  
*Asserted content:* Clara drew a dragon **with her new pencil**.
- (2) Q: What's Jane wearing for the wedding?  
A: She's wearing jeans and a t-shirt.  
*Asserted content:* Jane is wearing jeans and a t-shirt **for the wedding**.
- (3) Q: What's Harriet knitting for Henry?  
A: She's knitting a scarf.  
*Asserted content:* Harriet is knitting a scarf **for Henry**.

I provide here an account of the phenomenon in DRT (Kamp 1981), enriched with ideas from SDRT (Asher 1993). I posit a discourse relation *Direct Answer* (DirAns), which I take to be presumed whenever a question is followed by an assertoric response, and propose that the introduction of this relation triggers a special update rule which results in merging the contents of the question and its answer.

## 2 Representing questions

I assume that at some level of representation, a *wh*-question has the form shown in (4):

- (4) [ $wh_I$  ... [ $wh_n$  [ $S$  ...  $x_I$  ...  $x_n$  ... ]]

The embedded *S* can be treated by standard DRS construction rules, except for the *wh*-traces, for which I propose the rule in (5). (The DRS which results will be embedded under a  $\lambda$ -operator; I omit those details here. Cf. the treatment of questions in Krifka 2001.)

## (5) DRS construction rule for *wh*-traces

Given the syntactic configuration: [ $_{XP}$   $x_i$ ;  $\varphi_1 \dots \varphi_n$  ], ( $\varphi_1 \dots \varphi_n$  being the semantic type features derived from the *wh*-expression itself), where  $x_i$  is bound by a *wh*-expression:

- i. introduce a new discourse referent  $x_i$  into the universe of the DRS under construction, and conditions  $\varphi_1(x_i) \dots \varphi_n(x_i)$  into the set of conditions of that DRS.
- ii. Then, add a condition of the form ,  $?x_i$  to the set of conditions of the DRS.

The condition  $?x_i$  marks  $x_i$  as a *forward looking anaphor*, indicating that some new predication containing information about this d-ref is anticipated in the subsequent discourse. I propose that in order to maintain the relation DirAns between Q and S, update with S *must* provide this information: call this the *Answerhood Constraint*.

## 3 Providing a value does not suffice

Observing that an answer must provide a value for the forward-looking *wh*-anaphor leads to the idea that the only purpose of a full sentence answer is to provide that value. On this picture, the update rule for Direct Answers should simply "extract" the value for the *wh*-anaphor from the content provided by the answer. Two observations show that this is not correct. First: what is asserted by utterance of a declarative in response to a question may include content contained in the answer but not in the question, as shown in (6):

- (6) Q: What did Clara draw with her new pencil?  
A: In the morning, (she drew) a dragon, and in the afternoon, (she drew) a snake.

This shows that the full content of the answer is semantically relevant: we arrive at the

interpretation by *combining* the content of the question and the content of the answer.

Second: to count as an answer, it is not sufficient for a response to provide a potential value for the *wh*-anaphor. Consider (7):

(7) Q: Who did Jane see?

A: Frankie loves [<sub>F</sub> Billie].

The focus marking in (7)A unambiguously marks *Billie* as intended to provide the value for the *wh*-anaphor; but lack of match between contents of question and assertion render this unsuitable as an answer. Clearly, the content of the answer matters: for an utterance to count as a direct answer it must be construable as being, roughly, “about” the same thing as the question.

The first observation suggests that we should construct the content of answers by *merging* the linguistically expressed contents of question and answer. The second observation suggests that in this process of merge, we should seek to *unify* the content of the question with the content of the answer where possible.<sup>1</sup> The Answerhood Constraint requires that this procedure should provide an answer to the question.

#### 4 Merge + Unification

The Merge+Unification procedure is triggered by introduction into the SDRS (omitted here) of the condition  $\text{DirAns}(Q,A)$ , where  $Q$ ,  $A$  are discourse segments.

##### Merge

If  $\text{DirAns}(Q,A)$ , then revise  $K(A)$  to  $K(Q+A)$  as follows:

- i.  $U(K(Q+A)) = U(K(Q)) \cup U(K(A))$
- ii.  $\text{Con}(K(Q+A)) = \text{Con}(K(Q)) \cup \text{Con}(K(A))$

##### Unify

$\forall x \in U(K(Q+A))$ , if  $\exists y \in U(K(Q+A))$  s.t. positing  $x=y$  does not lead to inconsistency, then add  $x=y$  to  $\text{Con}(K(Q+A))$ .

##### Example

(8) Q: What did Clara draw with her new pencil?

A: In the morning, she drew a dragon.

- i.  $K_Q: \lambda x_3 [e_1, x_1, x_2, x_3 : x_1=\text{Clara, her-new-pencil}(x_2), \text{draw}(e_1), \text{Ag}(e_1, x_1), \text{Instr}(e_1, x_2), \text{Th}(e_1, x_3), \text{non-person}(x_3), ?x_3 ]$
- ii.  $K_A: [e_2, y_1, y_2: \text{female}(y_1), y_1=?, \text{draw}(e_2), \text{Ag}(e_2, y_1), \text{Th}(e_2, y_2), \text{dragon}(y_2), e_2 \subseteq \text{the-morning} ]$

iii. Assume:  $\text{DirAns}(Q,A)$

iv. Merge: Revise  $K_A$  to  $K(Q+A)$ :

[  $e_1, x_1, x_2, x_3, e_2, y_1, y_2: x_1=\text{Clara, her-new-pencil}(x_2), \text{draw}(e_1), \text{Ag}(e_1, x_1), \text{Instr}(e_1, x_2), \text{Th}(e_1, x_3), \text{non-person}(x_3), ?x_3, \text{female}(y_1), y_1=?$ ,  $\text{draw}(e_2), \text{Ag}(e_2, y_1), \text{Th}(e_2, y_2), \text{dragon}(y_2), e_2 \subseteq \text{the-morning} ]$

v. Unify: [  $e_1, x_1, x_2, x_3, e_2, y_1, y_2: x_1=\text{Clara, her-new-pencil}(x_2), \text{draw}(e_1), \text{Ag}(e_1, x_1), \text{Instr}(e_1, x_2), \text{Th}(e_1, x_3), \text{non-person}(x_3), \text{female}(y_1), \text{draw}(e_2), \text{Ag}(e_2, y_1), \text{Th}(e_2, y_2), e_2 \subseteq \text{the-morning}, \text{dragon}(y_2), e_1=e_2, x_1=y_1, x_3=y_2 ]$

Here, it is consistent to identify  $e_1$  and  $e_2$ , as both are drawing events, and the information about participants is compatible. This forces us to identify the *wh*-anaphor with  $y_2$  (the dragon), satisfying the Answerhood Constraint. More complex examples will require us to further elaborate and refine the unification procedure.

The account does not yet solve the problem posed by (7), where the *wh*-anaphor could be identified with the d-ref corresponding to *Billie* without inconsistency. However, whereas in (7), identification of these d-refs is merely allowable, in the felicitous (8), identification is necessitated by the overall pattern of unification of referents. I propose that this is what is required to satisfy the Answerhood Constraint; mere consistency does not suffice.

As a side-benefit, this approach allows for a straightforward characterization of direct answers: utterances whose interpretation results in satisfaction of the Answerhood Constraint. No restrictions on the form of the utterance or the logical form of its content are required.

#### 5 References

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<sup>1</sup> This is in accord with the principle of Hobbs et al. 1993 to eliminate redundancies wherever possible.