Cointensional questions, fragment answers, and structured meanings[1]

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Abstract. I discuss 'cointensional questions', questions which appear to have the same sense as each other, e.g. *how many fives ten contains* and *how many times ten contains five*. Fragment answers are sensitive to the distinction in form between these questions: the first of these can be answered by *two* but not *twice*, and vice-versa for the second. I argue that this casts light on the identity condition in (clausal) ellipsis, and in particular, requires a semantics for questions and focus which is more structured than propositional/Hamblin alternatives. Building on a proposal in Krifka (2006), I propose that the *backgrounds* of short answers must be in a subset relation to the background of their antecedent questions. I show that this proposal makes additional welcome predictions, capturing so-called 'inheritance of content' effects in clausal ellipsis.

Keywords: fragment answers, ellipsis, identity in ellipsis, structured meanings, questions, focus, inheritance of content

1. Introduction

This paper considers the data in (1)–(4).

(1) Q: How many signals did the machine send?
   a. (i) It sent TWO signals. (ii) TWO (signals).
   b. (i) ?It sent a signal TWICE. (ii) *TWICE.

(2) Q: How many times did the machine send a signal?
   a. (i) ?It sent TWO signals. (ii) *TWO (signals).[2]
   b. (i) It sent a signal TWICE. (ii) TWICE.

(3) Q: How often did the train take on water?
   a. (i) It took on water TWICE. (ii) TWICE.
   b. (i) ?It took on water in TWO PLACES. (ii) ?*In TWO PLACES.

(4) Q: In how many places did the train take on water?
   a. (i) ?It took on water TWICE. (ii) *TWICE.
   b. (i) It took on water in TWO PLACES. (ii) In TWO PLACES.

The questions in (1) and (2) seem to have the same sense: assuming a machine that sends signals sequentially, then if one knows the answer to (1), one knows the answer to (2), and vice versa. The same is true, assuming a train that makes a straight journey from A to B and only stops at any water stop once, for (3) and (4). I will call such pairs of questions *cointensional*.

[1]Thanks to reviewers for and attendees at SuB 21 for helpful comments. All errors are mine.

[2]Note that *two* on its own is not ungrammatical here if it can be interpreted as *two times*. I pick *two* because of the existence of *twice*, which blocks *two times* (or at least makes the latter unnatural).

This paper seeks to explain a mystery posed by cointensional questions, namely the asymmetry between the (i) answers – 'full' or clausal answers – and the (ii) answers, variably called in the literature 'short answers', 'term answers' or 'fragment answers'. The acceptability of the (i) answers, in all cases, shows that it is possible (if sometimes mildly degraded) to answer a question 'indirectly' with a full clausal answer – that is, with an answer which does not match the antecedent question in form, but which nevertheless 'answers' the question in some broader sense. However, this possibility is not open to the fragment answers in (ii). It is ungrammatical, as the diacritics in (1)–(4) indicate, to use a fragment answer to answer a question 'indirectly', even if the corresponding full answer makes a coherent contribution to the discourse, and even if the answer to the question is (intuitively) reconstructable from the fragment.

The paper considers two main theoretical issues: the nature of the link between fragment answers and clausal answers, and the proper analysis of questions and focus structures. Many analyses of fragment answers, so-called sententialist analyses (e.g. Morgan (1973); Merchant (2004); Reich (2007); Weir (2014b) a.o.), propose to derive fragment answers directly from the clausal answers via a process of clausal ellipsis; roughly speaking, deleting everything in the clausal answer except for a focused constituent (or a constituent containing the focus; for syntactic restrictions on this process, see Merchant (2004); Krifka (2006); Weir (2014b, 2015)). By contrast, nonsententialist analyses (e.g. Stainton (1998, 2006a, b); Ginzburg and Sag (2000); Culicover and Jackendoff (2005); Jacobson (2016) a.o.) propose that short answers are generated 'directly', without accompanying sentential structure.

(5) How many times did the machine send a signal?
   a. TWICE. (nonsententialist)
   b. ~~The machine sent a signal~~ TWICE. (sententialist)

There is a considerable amount of syntactic support for sententialist analyses, at least in clear-cut cases of answers to linguistically-expressed questions, such as those in (1)–(4).[3] However, on the face of it, data like those in (1)–(4) pose a problem for sententialist analyses; if the fragment answers are reductions of the clausal answers, why are some fragment answers unacceptable when their corresponding clausal answers are acceptable?

This paper locates the problem in the semantic identity condition that is operative in clausal ellipsis. The proposal is that the kind of semantic identity that is required between an elided clause and its antecedent is such as to enforce the kind of form-matching effects shown in (1)–(4). It will furthermore be shown that the kind of semantic identity condition required implies that questions and focus structures, at least at some level of their interpretation, must be more structured or 'categorial' in their meaning than a denotation based on propositional alternatives/Hamblin sets, as proposed by Hausser (1983); von Stechow (1990); Krifka (2001, 2006); Jacobson (2016) a.o. Furthermore, the analysis will be extended to capture two further phenomena associated with fragment answers, and clausal ellipsis more generally (e.g. sluicing). Firstly, the analysis is extended to 'inheritance of content' effects (Chung et al. (1995); Romero

[3] Antecedentless fragments, such as those discussed in Stainton (2006b) – e.g. *Fire!* or *A coffee, please* – pose further complications and may not ultimately be amenable to a sententialist analysis, as Merchant (2010) discusses, though see Weir (2014b):ch. 3 for a contrary view. I put these cases aside in this paper.

(1998); Barros (2013); Weir (2014a, b); Jacobson (2016) a.o.) illustrated in (6), (7); fragment answers (*John and Bill* and *Jane Austen* respectively below) obligatorily 'inherit' restrictions from the antecedent sentence, while this does not necessarily occur in the full answers:

(6) (Jacobson (2016)'s (14), adapted)
Which math students left the party early?
a. John and Bill left the party early, but they're not math students.
b. John and Bill, #but they're not math students.

(7) (from Weir (2014b):60, originally from Jeremy Hartman p.c.)
Which Brontë sister wrote *Emma*?
a. Jane Austen wrote *Emma*, you idiot.
b. #Jane Austen, you idiot. (entails that Jane Austen is a Brontë sister)

Secondly, the analysis also captures the (related) fact that, while a fragment can provide a 'more specific' (i.e. with a more specific NP restriction) answer than the question contains (8), the inverse (9a, b) is not possible, even if the full clausal answer is acceptable (9c, d). See Barros (2013) for discussion of similar facts with respect to sluicing.

(8) Which pastries did John eat? – Some croissants.

(9) Which pastries did John eat?
a. #Nothing.
b. #All the food on the table.
c. He ate nothing.[4]
d. He ate all the food on the table.

The paper proceeds as follows. Section 2 lays out some of the background issues: why a sententialist account of fragment answers is to be preferred on syntactic grounds, and some existing approaches to the semantic identity condition on clausal ellipsis. Section 3 discusses how the data discussed above pose a problem for many extant theories of this semantic identity condition. Section 4 argues that these facts should not be captured by reference to a syntactic or LF-isomorphism condition on ellipsis (such as those proposed by Chung (2013); Merchant (2013); Griffiths and Lipták (2014); Thoms (2015) a.o.). Section 5 makes the proposal that the semantic condition on clausal ellipsis must make reference to a structured semantic object, building on proposals by Krifka (2006), while section 6 provides a technical implementation of how this is done in the syntax. Section 7 proposes a modification to Krifka's proposal, which maintains the essential feature of capturing the data in (1)–(4), and has the additional benefit of capturing the 'inheritance of content' effects discussed above. Section 8 concludes.

[4] *He didn't eat anything* is better here, but the fragment answer *anything* is out for independent reasons (as the putatively elided clause, *he ate x*, contains no negator to license the NPI). The clausal answer in (9c) is nevertheless grammatical.

2. Fragments, ellipsis, and the semantic antecedence condition

I start from the position that, at least in question-answer sequences like that in (10), the fragment answer is derived via clausal ellipsis as in (11); and concretely, I adopt Merchant (2004)'s proposal that the fragment moves to a left-peripheral position prior to ellipsis of the rest of the clause (although we will see a refinement of this position in sections 4 and 6).

(10) What did John eat? – Chips.

(11) a. ~~John ate~~ chips.
b. $[_{CP}$ Chips$_1$ $[\sout{_{TP}\text{ John ate } t_1}]]$

Clausal structure can be diagnosed, for example, by the presence of binding and Case connectivity effects in the fragment (i.e. the fragment shows the binding and Case properties that it would in the full clause; Merchant (2004)). The existence of a movement dependency can be diagnosed by the existence of 'stranding' effects; for example, in languages in which prepositions must obligatorily be pied-piped along with their arguments, prepositions are also obligatory in the corresponding fragment answers (Merchant (2001, 2004)'s P-stranding generalization; see also Weir (2014b)). Space precludes a detailed defense of the sententialist position over 'bare' or 'subsentential' analyses, in which fragment answers are generated without clausal structure; on the basis of the evidence presented by the above authors, I assume that clausal ellipsis is indeed implicated in the creation of fragment answers.[5]

As in all cases of ellipsis, some kind of matching or identity relation must hold between the elided clause and some antecedent. One familiar candidate for such a condition is Merchant (2001)'s e-GIVENness:

(12) a. A clause may be elided if it is e-GIVEN.
b. A clause A is e-GIVEN if there is an antecedent clause E such that F-clo(A) $\Longleftrightarrow$ F-clo(E).
c. The focus closure (F-clo) of a clause is the denotation of that clause with all focused elements replaced by variables, and all variables (that is, traces plus focused elements which have been replaced) having been existentially closed.

This would rule in ellipses such as (11b) by matching two IPs which both contain existentially closed traces in object position:

(13) a. What did $[_{IP}$ John eat t]? – Chips $[_{IP}$ John ate t]
b. $\exists x$. John ate $x \Longleftrightarrow \exists y$. John ate y

This condition is likely too liberal; recent work on clausal ellipsis (e.g. Reich (2007); Ander-

[5]The claim made in this paper can be understood as a weaker, conditional one; *if* one accepts a sententialist/ellipsis view of fragments, *then* one will also have to accept a semantic condition on clausal ellipsis along the lines proposed here. It should be noted also that one of the main proponents of the nonsententialist view, Robert Stainton (e.g. Stainton (1998, 2006a, b)), has as his main concern antecedentless or discourse-initial fragments, and accepts that in question-answer sequences, fragments may be derived elliptically from full clauses.

Bois (2010, 2014); Barros (2014); Weir (2014a, b); Collins et al. (2015)) has been converging on the position that clausal ellipsis cannot find its antecedent simply anywhere in the preceding discourse, but must rather find its antecedent in the Question under Discussion (Roberts, 1996).[6] Reich (2007) proposes, for example, that the focus-semantic value of an elided clause, understood as a set of propositional alternatives (Rooth, 1985) must be equal to the value of the Question under Discussion, also understood as a set of propositional alternatives (Hamblin denotation for questions):

(14) What did John eat? — ~~John ate~~ chips.
a. $[\![\text{QUD}]\!] = [\![\text{What did John eat?}]\!] = \{\text{John ate chips, John ate cake, } \dots\}$
b. $[\![\text{John ate [chips]}_{\text{F}}]\!]^{\text{f}} = \{\text{John ate chips, John ate cake, } \dots\}$
$[\![\text{QUD}]\!] = [\![\text{John ate [chips]}_{\text{F}}]\!]^{\text{f}}$, so ellipsis is licensed.

I will assume, again without much discussion, that the Question under Discussion (or something very like it, such as the concept of 'live issue' in Inquisitive Semantics) is the anaphoric 'target' for the identity relation in clausal ellipsis; the reader is referred to the authors above for support for this position.

3. The problem for propositional alternatives

Many of the semantic accounts founder on the data presented in (1)–(4); the examples in (1) and (2) are repeated here:

(15) Q: How many signals did the machine send?
a. (i) It sent TWO signals. (ii) TWO (signals).
b. (i) ?It sent a signal TWICE. (ii) *TWICE.

(16) Q: How many times did the machine send a signal?
a. (i) ?It sent TWO signals. (ii) *TWO (signals).
b. (i) It sent a signal TWICE. (ii) TWICE.

The problem here is that, on a Hamblin-alternatives view of questions (and of focus), the questions in (15) and (16) above denote the same sets of sets of worlds, and so do the focus values of the answers.

(17) a. $[\![\text{How many signals did the machine send?}]\!]$
b. $[\![\text{the machine sent [two]}_{\text{F}} \text{ signals}]\!]^{\text{f}}$
c. $\{p \mid \exists d.p = \lambda w'.$ the machine sent d-many signals in $w'\}$
d. {the machine sent one signal, the machine sent two signals, ...}
e. {the machine sent a signal once, the machine sent a signal twice, ...}
f. $\{p \mid \exists d.p = \lambda w'.$ the machine sent a signal d-many times in $w'\}$
g. $[\![\text{the machine sent a signal [twice]}_{\text{F}}]\!]^{\text{f}}$
h. $[\![\text{How many times did the machine send a signal?}]\!]$

[6] AnderBois (2010, 2014)'s argument that clausal ellipsis is anaphoric to the 'live issue' can be seen as a variant on this, although the implementation in terms of Inquisitive Semantics is rather different.

The key point is that if the machine sent two signals, then it also sent a signal twice; if the machine sent a signal three times, then it also sent three signals; and so on. If we understand questions and focus-semantic values to consist of sets of sets of worlds (propositional alternatives), then each of (17a–h) is the same object: the same set of sets of worlds. But this is a problem for the semantic conditions reviewed in section 2. These semantic conditions rely on a characterization of focus-alternatives as being sets of propositions; if the sets of propositions denoted by two clauses (such as *the machine sent* TWO *signals* and *the machine sent a signal* TWICE) are identical, then from the point of view of these semantic identity conditions, 'mismatch' answers should be possible, such as the below discourse. Here Reich (2007)'s condition, where the QUD has to be identical to the focus value of the answer, is used to illustrate; but the same problem will afflict any condition that uses propositional alternatives in its formulation.

(18) How many signals did the machine send? — *~~The machine sent a signal~~ TWICE.

(19) $[\![$How many signals did the machine send?$]\!]$ = $[\![$the machine sent a signal [twice]$_F]\!]^f$
so ellipsis should be licensed in (18), contrary to fact.

One might initially think that the examples have not been constructed carefully enough; perhaps the set of worlds in which the machine sends two signals is not quite the same set of worlds in which the machine sends a signal twice. (Perhaps the machine can send two signals simultaneously.) Such a semantic difference between the two answers would be enough to cause the semantic conditions discussed above not to be met. However, we can illustrate the problem in general terms by using mathematical examples, such as (20), (21).

(20) Q: How many fives does ten contain?
a. (i) Ten contains TWO fives. (ii) TWO (fives).
b. (i) ?Ten contains five TWICE. (ii) *TWICE.

(21) Q: How many times does ten contain five?
a. (i) ?Ten contains TWO fives. (ii) *TWO (fives).
b. (i) Ten contains five TWICE. (ii) TWICE.

Because mathematical truths are assumed to hold at all possible worlds, we can be sure that the question and all of the answers above denote the same sets of sets of worlds (that is, the singleton set containing the set of all possible worlds). Despite the fact that the questions and the focus values of the answers in (20) and (21) are all cointensional, the same problem recurs: 'mismatches' of this sort are forbidden, as shown above.

It should be noted that this is not quite the same problem as classic cases of hyperintensionality, which demonstrate that a possible-worlds semantics for propositions is insufficient; e.g. the failure of (22a) to entail (22b), even though both of the clauses embedded under 'know' should denote the same sets of sets of worlds (i.e. the singleton set containing the set of all possible worlds).

(22) a. Little Johnny knows that two plus two makes four.
b. Little Johnny knows that the square root of 169 is 13.

The examples in (1)–(4) differ from examples like those in (22) because the questions, and their answers, in (1)–(4) really do appear, at least on the face of it, to have the same sense. For example, they can be substituted, *salva veritate*, under a verb like *know* in a way that the mathematical statements in (22) cannot.

(23) a. John knows how often the train took on water.
b. John knows in how many places the train took on water.[7]

(24) a. John knows how many fives ten contains.
b. John knows how many times ten contains five.

Despite the fact that these questions and answers seem in some way to share the same sense, that identity does not suffice for ellipsis matching in (1)–(4). One obvious way to explain the failure of ellipsis in these examples would be to suggest that there is a *syntactic* difference between the elided clause and the antecedent, combined with the idea that the identity condition in ellipsis is (partially or wholly) syntactic in nature. In the next section I will argue that, even if one agrees that there is a syntactic component to ellipsis identity, this will not suffice to solve the problem that cointensional questions pose.

4. Not due to syntactic isomorphism or LF-parallelism

On the face of it, the alternations discussed here look rather similar to other cases that have been discussed in the literature, where the propositional semantics of the antecedent and elided clauses are the same but the syntax is different. Examples include voice mismatches (Merchant, 2013) and argument structure mismatches (Chung, 2013; Merchant, 2013). In such cases also, clausal ellipsis (sluicing, fragments) is not licensed.

(25) *Voice mismatches* (Merchant, 2013)
a. *Someone ate the cake, but we don't know by who ~~the cake was eaten~~.
b. *Who ate the cake? — By John ~~the cake was eaten~~.
c. *The cake was eaten, but we don't know who ~~ate the cake~~.

(26) *Argument structure mismatches*
a. *It's known that they sent someone a silly message, but it's unclear to who ~~they sent a silly message~~. (Chung, 2013: ex. 6)
b. *They embroidered something with peace signs, but I don't know on what ~~they embroidered peace signs~~. (Merchant, 2013: ex. 43)

[7] One might again contest such examples by saying that there are situations which tease them apart; for example, if there is only one water stop on the track (which the train might have stopped at several times going forward and back), (23b) might be true (John knows there's only one place), but (23a) false. Again, the mathematical example in (24) is given to show that the problem is a general one, independent of the problems that might be found for specific examples.

It has been argued that the failure of such mismatches is due to a syntactic isomorphism condition in ellipsis. For example, Chung (2013) proposes that elided clauses must be identical to their antecedents in argument structure and the presence of Case-assigning heads. I do not want to argue against a syntactic identity condition in ellipsis (over and above the semantic identity condition to be developed in this paper) to capture these data; the cases discussed by Chung and Merchant are convincing in this respect. But I believe that this is not what is going wrong in the examples in (1)–(4). Consider the antecedent and ungrammatical elided clause (assuming movement of the fragment) that cause problems in (1), for example.

(27) a. $[_{CP}$ How many signals$_i$ $[_{TP}$ the machine $[_{vP}$ $[_{VP}$ send t$_i$]]]]]
b. *$[_{CP}$ Twice$_i$ $[_{TP}$ the machine $[_{vP}$ $[_{VP}$ send a signal] t$_i$]]]]

We can see two potential 'mismatches' here; firstly, the antecedent has a trace (of *how many signals*) where the elided clause has an indefinite (*a signal*); and the elided clause has a trace (of *twice*) where the antecedent has nothing. However, these cannot be what is ruling this question-answer pair out; similar 'mismatches' do not trouble clausal ellipsis in other cases. As discussed by (Merchant, 2001: 202ff), there are in general many cases where an antecedent for clausal ellipsis contains a trace in a position where a trace could not be in the elided clause. Merchant's strategy to deal with such cases is to assume that a pronoun is present in the ellipsis site, and it seems difficult to credit an alternative to this in cases such as the below.

(28) The FBI knows [which truck$_i$ they rented t$_i$], but figuring out [from whom$_j$ ~~they rented **it**$_j$~~] has proven difficult. (Merchant, 2001: 206)

(29) What did he eat t$_i$, and why ~~did he eat **it**$_i$~~?

(30) A: That natto, he ate t$_i$. B: Yes – with chopsticks ~~he ate **it**$_i$~~

The point can be generalized with indefinites in predicative position:

(31) Such a man$_i$, John might become t$_i$.
a. Tom, too. (=Tom$_j$ ~~t$_j$ might become **such a man**~~ too)
b. ... but I couldn't tell you when$_j$ ~~he might become **such a man** t$_j$~~

(32) What kind of man might John become t$_i$?
And when$_j$ ~~might he become **such a man** t$_j$~~?

Such cases indicate that a trace can clearly antecede something contentful in an elided clause.[8] Moreover, (31) and (32) appear to indicate that the contentful constituent in the elided clause can potentially be a full indefinite, not 'merely' a pronoun, given the degraded nature of (33b) on the relevant reading:

[8] One could argue that the moved phrase in the antecedent clause is subject to reconstruction, allowing matching; but then this should be available in cases like (27) as well.

(33) What kind of man might John become?
a. And when might he become such a man?
b. ??And when might he become one?
(only: when might he become a man, not: when might he become such a man)

Any putative ban on a trace anteceding a non-trace cannot therefore account for the badness of the cases under discussion here, as there is evidence against the existence of such a ban. The 'inverse' problem – that a trace is present in the elided clause that is not present in the antecedent – is also present in the example in (27).[9] But this also is not generally a problem for clausal ellipsis; this is simply so-called 'sprouting'.

(34) He's dancing, but I don't know [with who]$_i$ ~~he's dancing t$_i$~~.

(35) He ate natto. — Yes, [with chopsticks]$_i$ ~~he ate natto t$_i$~~.

Examples like (34) and (35) show that we cannot locate the problem simply in the fact that the elided clause contains a trace that the antecedent does not contain.

A somewhat different kind of syntactic isomorphism has been proposed by many authors in the form of '(LF) Parallelism' (Fiengo and May (1994); Fox and Lasnik (2003); Griffiths and Lipták (2014); Thoms (2015) a.o.). Under this conception, what is relevant in ellipsis identity is syntactic identity at LF up to variables, and correspondence at LF between the scopes of ellipsis remnants and of their antecedents; any variable-binding relationships should be identical between antecedent clause and elided clause.[10] This captures, for example, the fact that the indefinite correlates of *wh*-remnants in sluicing take wide scope, in parallel with the *wh*-phrase:

(36) Most people ate something, but I don't know what ~~most people ate t~~.

(37) a. Antecedent LF: something 1 [most people ate t_1]
b. Elided clause: what 1 [most people ate t_1]

The LFs of the antecedent and elided clause are identical, up to the identity of the binders, and so ellipsis is licensed. It might be thought that an LF Parallelism constraint of this sort can explain why the mismatch cases in (1)–(4) are ungrammatical. In particular, the variable-binding relations in 'mismatch' cases differ: in (38) a trace is being bound in object position in the antecedent but in adjunct position in the elided clause, and vice versa in (39).

[9]This is true if we assume movement of the fragment. This view will be discussed and (partially) revised below and in section 6. However, the key point here is just that arguments and adjuncts can 'sprout' under ellipsis, without any corresponding antecedent, so that by itself should not cause a problem for the 'mismatch' cases under discussion here.

[10]The term 'Parallelism' is somewhat ambiguous. The literature is agreed that, as a matter of *interpretation*, elided clauses must have the same scope relations as their antecedents. What is not clear is whether this is enforced only at the level of semantic interpretation, or whether it is a *syntactic* constraint at LF, concerning the positions of variables and their binders. (An indefinite could for example have a 'wide-scope' interpretation by dint of being the only scope-bearing element in the sentence, without actually taking syntactic scope at LF.) Here I am discussing this latter understanding of Parallelism as a basically syntactic (LF-level) constraint.

(38) a. How many signals 1 [the machine [$_{vP}$ [$_{VP}$ send t_1]]]
b. Twice 1 ~~[the machine [$_{vP}$ [$_{VP}$ send a signal] t_1]]~~

(39) a. How often 1 [the machine [$_{vP}$ [$_{VP}$ send a signal] t_1]]
b. Two signals 1 ~~[the machine [$_{vP}$ [$_{VP}$ send t_1]]]~~

There are two reasons not to believe that this is the problem in the cases under discussing here, however. The first is that the examples in (3) and (4), repeated below, seem to involve binding into the same position, namely a vP-level adjunct; so it is not clear that a failure of binding parallelism alone should be the culprit.

(40) a. How often did the train take on water? – *In two places ~~the train took on water~~.
b. In how many places did the train take on water? – *Twice ~~the train took on water~~.

(41) a. How often 1 [the train [$_{vP}$ [$_{VP}$ took on water] t_1]]
b. In two places 1 [the train [$_{vP}$ [$_{VP}$ took on water] t_1]]

The second counterargument is that it is not clear that fragments move at LF in the way that the LF Parallelism account would suggest. Weir (2014b, 2015) provides a number of arguments that fragments do move (in the way proposed by Merchant (2004) and discussed in section 2) – but only at PF, not at LF. The most important of these arguments is the availability of NPI fragments (see also den Dikken et al. (2000); Valmala (2007)).

(42) a. I know what John did buy, but what didn't he buy? — Any wine.
b. Which of these computers should I not touch? — Any of them!

As NPIs must be in the scope of their licensor at LF, and never take wide scope, then the LF movement which Parallelism accounts appeal to is not available for fragments like (42). It is therefore not clear that Parallelism is to be correctly understood as a *syntactic* constraint on ellipsis. However, I wish to argue for a version of the leading idea of the LF Parallelism approach – that a condition on ellipsis is that lambda abstractions in the antecedent and the elided clause must 'match' in some way. However, I argue that this is not to be located in the syntax, but rather in a more structured *semantics* for questions and focus structures.

5. The solution: congruence with structured meanings

In this section I will argue for two main conclusions:

(a) Questions, and focus structures, must be understood (at some level of semantic representation) to have a more structured, 'categorial'-style denotation than Hamblin sets of propositional alternatives, as in for example Hausser (1983); von Stechow (1990); Krifka (2001, 2006); Jacobson (2016).

(b) It is this structured meaning, or a part of it, which (the semantic component of) the identity condition on clausal ellipsis makes reference to.[11]

The proposal I would like to make here builds directly on a proposal in Krifka (2006). Krifka proposes that questions, and focus structures (e.g. answers to questions), have the structured denotations shown in (43) and (44) below (after Krifka's (77, 78) respectively).[12]

(43) $[\![\text{who}_i \text{ John introduced } t_i \text{ to Sue}]\!]$
$= \langle \text{PERSON}, \lambda x.\text{introduced}(\text{sue})(x)(\text{john})\rangle$
where PERSON is the alternatives that the question word can range over.

(44) $[\![\text{John introduced [Bill]}_F \text{ to Sue}]\!]$
$= \langle \text{bill}, A, \lambda x.\text{introduced}(\text{sue})(x)(\text{john})\rangle$
where A is the focus alternatives (in the sense of Rooth (1985), and possibly restricted by context) to the focused term (i.e. here $A = \text{ALT}([\![\text{Bill}]\!]) = \{\text{Tom, Mary, Harry, } \dots\}$)

Following the literature on structured-meaning approaches to focus and questions, call the lambda-terms in (43) and (44) the *backgrounds* of the question and the focus structure. Given these denotations, Krifka proposes the question-answer congruence condition in (45) (Krifka's (79), adapted).

(45) A question-answer pair $\langle W, B\rangle$ — $\langle F, A, B'\rangle$ is congruent iff:
$B = B'$ and $W \subseteq A$ (or $W = A$).
If congruent, the answer asserts $B(F)$.

Furthermore, Krifka states that 'the identity of backgrounds allows for short, or term answers, in which the background of the answer is deleted' (p. 130). The requirement that the backgrounds – that is, the lambda abstractions created by abstracting over the *wh*-term in the question and the focused term in the answer, respectively – must be identical is not met in the case of the cointensional questions. Crucially, even though the intensions/senses of cointensional questions are the same, their structured meanings are not; in particular, the backgrounds in the 'mismatch' cases are different, if we assume that the background in a case like (46) is a lambda-abstraction over signals, and the background in a case like (47) is a lambda-abstraction over intervals of time.

[11] This formulation contains two caveats. Firstly, as discussed in section 4, I do not want to make the strong assertion here that the identity condition on ellipsis is purely semantic; there may also be a syntactic component to it, as proposed in Chung (2013); Merchant (2013) a.o. Secondly, the proposals made here are made only for *clausal* ellipsis, and not for other forms of ellipsis such as verb phrase ellipsis, which seem to have different antecedence conditions (see e.g. discussion in AnderBois (2010); Weir (2014b)).

[12] These denotations have been adapted from the originals in two ways. Firstly, the interpretations Krifka gives to these structures is not strictly speaking the structured denotation itself, but rather the speech act which contains this structured denotation as content; but I have suppressed this distinction here (and in subsequent discussion). Secondly, and more importantly, Krifka presents the denotation in (44) as the interpretation of a logical form which contains movement of the focused phrase; however, as discussed in section 4, I do not want to assume that fragments (or foci in general) move at LF in this way. I will discuss the matter of how exactly the lambda term in (44) should be created in section 6; for the present I simply assume that the structured denotation in (44) can be derived in some way or another.

(46) Question: How many signals did the machine send?
Background: λx. the machine sent x, x a signal

(47) Question: How many times did the machine send a signal?
Background: λt. the machine sent a signal at interval t

The corresponding focus-structures will have the same lambda abstractions as their backgrounds:

(48) Answer: The machine sent [TWO signals]$_{\text{F}}$.
Background: λx. the machine sent x, x a signal

(49) Answer: The machine sent a signal [TWICE]$_{\text{F}}$.
Background: λt. the machine sent a signal at interval t

The key point here is that if (46) is answered with (49), or (47) with (48), the backgrounds will not match. Adopting Krifka's question-answer congruence condition in (45) as a condition on clausal ellipsis therefore captures the data in (1)–(4).[13] Additional support for this comes from some cases where such 'mismatches' *are* possible. A *how many* or *how often* question does not always have to receive a numerical short answer, as long as the background of the answer is a lambda-abstraction which matches the background of the question (i.e. abstracts over a variable in the same position), as (50) and (51) illustrate.

(50) How many people came to the party? (Weir, 2014b: 79)
a. Six (people).
b. John, Paul, George, Sarah, Mary and Helen.
(background in both cases: λx. x came to the party)

(51) In how many places did the train take on water?
a. Three (places).
b. Cleveland, Albany and Springfield.
(background in both cases: λx. the train took on water in x)

6. Implementation

How do we get access to backgrounds in focus and question structures? That is, how do we create the lambda abstractions involved? Krifka proposes that this is done via movement: *wh*-words and foci move at LF, and this movement creates a lambda abstraction in the normal way (following e.g. Heim and Kratzer (1998)'s rule of Predicate Abstraction).

(52) LF: [Who 1 [did John introduce t_1 to Sue]]
Background: λx. John introduced x to Sue

[13] Krifka's proposal is actually intended to be a condition on question-answer congruence generally, not just in elliptical structures. That seems too strong, given that full clausal 'mismatches' are only mildly degraded (*How many signals did the machine send? — ?It sent a signal* TWICE), even though their backgrounds do not appear to match.

(53) LF: [Bill 1 [John introduced t_1 to Sue]]
Background: λx. John introduced x to Sue

I assume that this is indeed how backgrounds are created in *wh*-questions. However, given the evidence reviewed in section 4 that fragments do not move at LF (Weir, 2014b, 2015), I do not wish to derive the backgrounds of the answers via LF movement as such. In this section I wish to sketch a method of obtaining the same effect – i.e. the creation of a lambda abstraction over the focused phrase, but without actual syntactic movement of that phrase.[14]

I propose that a Focus head is inserted in the clausal left periphery, co-indexed with the focused phrase in the clause (see Constant (2014) for a similar recent proposal for a contrastive topic head; on the technology of focus indices, see Kratzer (1991)). This Foc head, furthermore, is endowed with an [E] feature (Merchant, 2001) which enforces the semantic condition on clausal ellipsis as a presupposition; this $\text{Foc}_{[\text{E}]}$ head has a syncategorematic interpretation when it combines with a TP, given in (54).[15]

(54) **Implementation of ellipsis condition on E-feature (to be refined)**
Let n be an index. Then,
$[\![\text{Foc}_{[\text{E}]\text{n}}\ \text{TP}]\!] = [\![\text{TP}]\!]$, iff there is an antecedent question/Question under Discussion whose background is equal to $[\![\text{n TP}]\!]$; otherwise undefined.

The interpretation of $[\![\text{n TP}]\!]$ is given by the rule of Trace Conversion (Fox, 2002):

(55) $[\![[\text{n} [\ldots \text{XP}_\text{n} \ldots]]]\!]$
$= \lambda x.\ [\![\ldots \text{XP} \ldots]\!]$, where the head of XP is replaced by the head the_x,
where $[\![\text{the}_x]\!] = \lambda P.\iota y.[P(y) \wedge y = x]$

So, for example, the structure in (56a) is interpreted as in (56b):

(56) a. [3 [the machine sent [two signals]$_3$]]
b. λx. the machine sent the_x signals
$= \lambda x$. the machine sent $\iota y.[\text{signal}(y) \wedge y = x]$
$\approx \lambda x$. the machine sent the signals which are x

And the structure in (57) – i.e. the structure underlying the elliptical answer *two signals* – is interpreted as shown. (The [E]-feature prompts ellipsis of the clause, as in Merchant (2001), and the focused phrase will move at PF to a left-peripheral position to escape ellipsis; see Weir (2014b, 2015) for details.)

[14] But this is not crucial for the rest of the analysis being presented here. Readers who are unconvinced by the arguments against the movement of fragments, and/or who wish to assume that foci move at LF, can continue to assume this, and can assume that focus backgrounds are created by movement (which is indeed perhaps an easier way to do it than the proposal here). What will be key, though, is the appeal to mechanisms of Trace Conversion discussed below.

[15] It may seem to be a disadvantage of the proposal that it requires the syncategorematic rule in (54). However it should be noted that Merchant (2001)'s original [E]-feature also in effect has to be interpreted syncategorematically, as Weir (2014b):319 discusses.

(57) $[\![[\text{Foc}_{[E]3}$ [the machine sent [two signals]$_3$]]$]\!]$
= $[\![$the machine sent two signals$]\!]$
iff there is an antecedent question/Question under Discussion whose background is equal to $[\lambda x.$ the machine sent the signals which are $x]$

The presupposition in (57) will be met if the antecedent question has the background '$\lambda x.$ the machine sent the signals which are x', but not if it has the background '$\lambda t.$ the machine sent the signals at interval t', capturing the data in (1)–(4).

7. Refining the matching condition

Krifka's matching condition therefore captures the data this paper began with. I wish here, however, to propose a modification to Krifka's proposal, while retaining the core idea that it is the backgrounds of question and answer which are important in clausal ellipsis. The necessary refinement comes from question-answer pairs such as the below, from Jacobson (2016).

(58) Which math students came to the party?
a. John and Bill came to the party, but they're not math students.
b. John and Bill (#but they're not math students)

As can be seen, the full clausal answer in (58a) does not commit the speaker to John and Bill's being math students. That is, the restriction of the question is not necessarily inherited in a full clausal answer. By contrast, in a fragment answer, the restriction of the question is obligatorily inherited (and see Chung et al. (1995) for similar data for sluicing).

The question-answer congruence proposal made in Krifka (2006) does not quite capture this. Let us suppose first that the restrictions in the questions and answers are encoded in the way that Trace Conversion would deliver, as below:

(59) a. Q: Which math students came to the party?
b. B: $\lambda x.$ the math students who are x came to the party

(60) a. A: [John and Bill]$_F$ came to the party
b. B': $\lambda x.$ John and Bill, who are x, came to the party

Saying that these backgrounds have to match is too strong a condition. This would require that the partial function which maps math students to True if they came to the party and False otherwise, is identical to the partial function which maps {John, Bill} to True if they came to the party and False otherwise; that is, it would entail not merely that John and Bill are math students, but that they are the only math students. To avoid this problem, we could try removing the restriction within the lambda term, making the backgrounds in both cases '$\lambda x.$ x came to the party', but we then need to understand why the short answer in (58b) is restricted to math students. The second clause of Krifka's condition, which states that the range of the *wh*-word in the question must be a subset of the focus-alternatives of the focused term in the answer ('$W \subseteq A'$' in (45)), does not quite capture this; in fact it is not clear that we wish to impose this

precise condition on question-answer congruence, at least not in this form, given the availability of generalized quantifiers as the focused phrase in answers:

(61) Which pastries did John eat? — (A lot of croissants, but) fewer than three danishes.

Here, the set of alternatives to the focused phrase (*fewer than three danishes*) presumably contains generalized quantifiers, as in (62).

(62) ALT(⟦fewer than three danishes⟧)
= {⟦fewer than three croissants⟧, ⟦more than three danishes⟧, ⟦five croissants⟧, ...}

The contents of the set in (62) are of the wrong type for the '$W \subseteq A'$' condition to be met; in (61), this would require the set of entities denoted by ⟦pastries⟧ to be a subset of the set in (62), but (62) is a set of generalized quantifiers, not entities.

I propose a solution to the above which comprises two main ingredients. Firstly, I assume that backgrounds of questions and of focus structures are indeed structured in the way in which Trace Conversion would deliver, that is, they are partial functions of the kind in (59), (60). Secondly, I propose that the background-matching condition on clausal ellipsis is as in (63).

(63) **Background-matching condition on clausal ellipsis (final version)**
Given a question with background Q and an answer with background A, the answer can be elided (up to the focused phrase) only if $A \sqsubseteq Q$.

Where '$\sqsubseteq$' is a notion of generalized entailment defined over functions:

(64) $A \sqsubseteq B \iff \forall x.A(x) \rightarrow B(x)$

It is probably easiest to understand this definition in terms of set talk; the definition states that, understood extensionally as sets, the background of the answer must be a subset of the background of the question. This can then be encoded in the Foc head/[E]-feature as follows, a revision of (54):

(65) **Implementation of ellipsis condition on E-feature (final version)**
Let n be an index. Then,
⟦$\text{Foc}_{[\text{E}]\text{n}}$ TP⟧ = ⟦TP⟧, iff there is an antecedent question/Question under Discussion with background B such that ⟦n TP⟧ $\sqsubseteq B$; otherwise undefined.

Such a condition captures the cases discussed by Jacobson (2016). The backgrounds of the question and answer are as shown in (66) and (67) respectively:

(66) Question: Which math students came to the party?
Background: λx. the math students who are x came to the party

(67) Answer: [John and Bill] ~~came to the party~~
Background: λx. John and Bill who are x came to the party

If it is a condition on clausal ellipsis that the elided clause's background must be a subset of the antecedent question – i.e. the background in (67) is a subset of the background in (66), or equivalently, satisfying the predicate in (67) entails satisfying the predicate in (66) – then this forces John and Bill to be math students. The same effect can be seen in the below case, which is simply ungrammatical (from Weir (2014b):60, originally due to Jeremy Hartman p.c.)

(68) Which Brontë sister wrote *Emma*?
a. Jane Austen wrote Emma, you idiot.
b. #Jane Austen, you idiot.

(69) Background of question: λx. the Brontë sister who is x wrote *Emma*
Background of answer: λx. Jane Austen who is x wrote *Emma*
Background of A $\not\sqsubseteq$ background of Q, so ellipsis is not licensed.

Such a subset condition also captures the fact that one can move from 'superset' NP restrictors in a question to 'subset' restrictors in the fragment, but not vice versa, as (70) and (71) show:

(70) Q: Which pastries did John eat? (Background: λx. John ate the pastries which are x)
A: Three croissants ~~John ate~~. (Background: λx. John ate the croissants which are x)
Background of A $\sqsubseteq$ background of Q, so ellipsis is licensed.

(71) Q: Which pastries did John eat? (Background: λx. John ate the pastries which are x)
A: *Nothing ~~John ate~~. (Background: λx. John ate the thing which is x)
Background of A $\not\sqsubseteq$ background of Q, so ellipsis is not licensed.[16]

(72) Q: Which pastries did John eat? (Background: λx. John ate the pastries which are x)
A: *All the food at the buffet ~~John ate~~.
(Background: λx. John ate the food at the buffet which is x)
Background of A $\not\sqsubseteq$ background of Q, so ellipsis is not licensed.

Note in these cases that full clausal answers are possible; in other words, the problem is not that the answer is per se incoherent, but rather that some condition proprietary to short answers/clausal ellipsis is not met.

(73) Which pastries did John eat?
a. John ate NOTHING.
b. John ate ALL THE FOOD AT THE BUFFET.

[16]Note also that the condition proposed in Jacobson (2016), which proposes that the background of the question must compose with the denotation of the fragment, does not quite capture this data (although it captures the data in (66) and (68)). The fragment *nothing* (i.e. '$\lambda P.\neg\exists x.P(x)$') could compose with the question's background here (which would result in the proposition '$\neg\exists x$. John ate the pastries which are x', i.e. that John didn't eat any pastries). What goes wrong in (71) rather seems to be the fact that the backgrounds are not in the proper subset relation.

The background-matching condition proposed here is argued to be proprietary to clausal ellipsis, and so captures this asymmetry.

8. Conclusion

In this paper, I have argued that cointensional questions and their short answers pose a challenge to semantic conditions on ellipsis that work only at the level of propositional alternatives. I have argued, following Krifka (2006), that the correct account of such cases requires a structured-meaning treatment of questions and focus structures; and have proposed an implementation of a semantic matching constraint: the focus background of an answer must entail/be a subset of the background of the antecedent question.

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