Information Structure and the Interpretation of "otherwise"

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ABSTRACT. We have been investigating whether and how the interpretation of discourse connectives is sensitive to the Information Structure (IS) of the clauses or sentences they relate. Here we focus on the anaphoric connective "otherwise" and show how the IS of its antecedent affects what condition it can be "otherwise" to. This work is part of a larger enterprise aimed at understanding what role(s) sentence-level IS plays in the interpretation of larger units of discourse.

1 Introduction

It is well-known that *Information Structure* (**IS**) influences the interpretation of individual sentences. Of the famous sign in the London Underground, "Dogs must be carried", Halliday (1970) observes that this text can be pronounced with different intonation patterns, e.g., (1) vs. (2) reflecting different IS. Thereby, different instructions (here, paraphrased in italics) are conveyed to passengers. One supposes that (2) was not the intention of the London Transport Authority.

(1) Dogs must be CARRIED.
H* LL%
If there is a dog, carry it.

(2) DOGS must be carried.
H* LL%
Carry a dog.

In English, IS is most often conveyed by intonation. In languages with freer word order, differences in IS are most often conveyed by different word ordering. For example, the Czech counterparts of (1) and (2), conveying the same instructions to the hearer, are (3) and (4), respectively:

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(3) Psi se musí NÉST.
Dogs$_{nom}$ refl must$_{3pl}$ carry$_{inf}$

(4) Musí se nést PSI.
Must$_{3pl}$ refl carry$_{inf}$ dogs$_{nom}$

Over the past decade, the understanding of IS within the sentence has been enriched by intensive research in formal semantics. It is now widely accepted that IS affects both interpretation and realization, even though there is no uniform account. However, much less is known about what, if any, use is made of IS beyond clause and sentence boundaries and how IS interacts with other aspects of discourse structure and semantics. Our work extends the repertoire of IS-sensitive accounts in this direction. In this paper, we concentrate on how the IS of a previous sentence or clause can affect the meaning projected through the subsequent adverbial discourse connective "otherwise" ("jinak", in Czech). We show that an IS-based account of its meaning provides access to contextually appropriate interpretations that are unavailable to accounts that ignore IS.

Webber *et al.* (1999) have argued that "otherwise" contributes meaning to the discourse in part through structure, in part through anaphora: roughly, they say that the *complement* of the anaphorically-derived argument of "otherwise" serves as a *condition* under which the interpretation of its structural matrix holds.[1] As might be expected, different ways of resolving the anaphoric argument lead to different interpretations, as in (5a) vs. (5b):

(5) If you have brought a dog, you must pay 50p.
   a. Otherwise you will not be allowed to enter.
   b. Otherwise you can come in for free.

which can be paraphrased by resolving the anaphor and making the anaphorically-derived condition explicit:

(6) a. *If you have brought a dog and you do not pay 50p, you will not be allowed to enter.*
   b. *If you have not brought a dog, you can come in for free.*

Here, the antecedent used in (6a) is the preceding main clause, while that for (6b) is the preceding "if"-clause.[2]

[1] (Webber et al. 2001) present as evidence for this, *inter alia*, the fact that the first argument of "otherwise" may not be explicit, but rather have to be derived by inference from the previous discourse, and the fact that it can behave like a 'donkey' pronoun, deriving its first argument from a relative clause — e.g., "Farmers who beat their donkeys would *otherwise* be beating their wives."

[2] As with anaphoric pronouns, an automated procedure for resolving anaphoric "otherwise" must be able to reject contextually inappropriate ways of resolving it as in

(6a′) *If you have not brought a dog, you will not be allowed to enter.*

(6b′) *If you have brought a dog and you do not pay 50p, you can come in for free.*

But we do not consider this aspect of the problem any further in this paper.

That IS can affect what conditions can be derived can be seen by considering "otherwise" in the context of two different single-clause utterances, which differ only in their IS — here (7) vs. (8) in both English and Czech.[3]

(7) You must CARRY a dog. Otherwise you might get HURT.
H* LL% H*LL%

Psa musíte NÉST. Jinak byste mohli přijít k úrazu.
Dog$_{acc}$ must$_{2pl}$ carry. Otherwise be$_{2pl}$ could$_{pl}$ come to injury$_{dat}$.

(8) You must carry a DOG. Otherwise you might get HURT.
H*LL% H*LL%

Musíte nést PSA. Jinak byste mohli přijít k úrazu.
Must$_{2pl}$ carry dog$_{acc}$. Otherwise be$_{2pl}$ could$_{pl}$ come to injury$_{dat}$.

The "otherwise" clause in (7) will be interpreted as warning the hearer (H) that H might get hurt if s/he has a dog but isn't carrying it (e.g., H might get tangled up in the dog's lead). On the other hand, the "otherwise" clause in (8) warns H that s/he might get hurt if not carrying a dog, period (e.g., H might be walking past fanatical members of the Royal Kennel Club).

If the IS of one sentence or clause can affect how another is interpreted, then IS must be incorporated into an account of discourse interpretation and discourse updating. This we do in terms of Rooth's notion of an *alternative set* (Rooth 1985; Rooth 1992) and the alternative-set semantics of information structure worked out in (Steedman 2000a; Steedman 2000b), and refining our earlier presentations in (Kruijff-Korbayová and Webber 2000a; Kruijff-Korbayová and Webber 2000b).

The paper is organized as follows: In Section 2 we present the approach to IS and IS-sensitive context updating we are employing. In Section 3 we describe our IS-sensitive analysis of α *otherwise* β where α is a simple sentence. In Section 4 we describe our IS-sensitive analysis of α *otherwise* β where α is a complex sentence, making more options available. Section 5 concludes the paper and delineates the future directions of this work.

2 Information Structure and Context Updating

The notion of IS we are employing originates in the work of Mathesius (1975), and has been elaborated in subsequent work within the Prague School (Sgall et al. 1986) and by others, e.g., (Firbas 1992, Halliday 1985, Steedman 2000b). Specifically, we adopt the formal account presented in (Steedman 1996; Steedman 2000a; Steedman 2000b) which (1) provides a well worked out compositional semantics of English intonation in IS terms; (2) interprets the elements of IS in terms of alternative sets, and (3) assumes a general IS-sentence notion of discourse context update. Leaving terminological differences aside, Steedman's account is by and

[3]Throughout the paper, SMALL CAPITALS indicate intonation centers (pitch accents), thereby distinguishing Focus$_{is}$ from Background$_{is}$ within both Theme$_{is}$ and Rheme$_{is}$.

large straight-forwardly compatible with the Prague School approach, and thus when analyzing Czech examples, we can combine Steedman's account with Sgall and Hajičová's ideas relating IS and word order (Hajičová and Sgall 1987; Sgall et al. 1986).

Building on the findings originating in the Prague School (Firbas 1992; Mathesius 1975; Sgall et al. 1986), Steedman recognizes two dimensions of IS: The first defines a partitioning at the sentence-level into *Theme*$_{is}$ and *Rheme*$_{is}$; the second is a further partitioning of both into *Background*$_{is}$ and *Focus*$_{is}$.[4] The latter partitioning is related to Halliday's *Given-New* dichotomy (Halliday 1970; Halliday 1985) and concerns distinguishing the Theme$_{is}$ and the Rheme$_{is}$ from other alternatives that the context makes available.

In English, Czech and many other languages, IS is established as a result of an interplay of intonation, word order and grammatical structure. Below we give three of the possible IS partitions into Theme$_{is}$-Rheme$_{is}$ that Steedman's approach provides for the string "You should carry the dog".[5] The situation is one in which the first author (IKK) is transporting a dog, a large bag and a trolley by the Underground, and asks the second author (BW) a question, which helps to fix the IS of the reply.

(9) Q: How should I transport the DOG?

A: You should CARRY the DOG.
H* L+H*
Theme *Rheme* *Theme*

i. θ(9): $\lambda Q.\ Q(h, {}^{\star}dog_1)$ ρ(9): $\lambda x.\lambda y.\ {}^{\star}carry(x,y)$

ii. θ-AS(9): $\{\exists Q.\ Q(h, dog_1), \exists Q.\ Q(h, bag_3), \exists Q.\ Q(h, trolley_4)\}$
ρ-AS(9): $\{lead(h, dog_1), carry(h, dog_1), wheel(h, dog_1)\}$

(10) Q: Who should carry the DOG?

A: YOU should carry the DOG.
H* L LH%
Rheme *Theme*

i. θ(10): $\lambda x.\ carry(x, {}^{\star}dog_1)$ ρ(10): $\lambda Q.\ Q({}^{\star}h)$

ii. θ-AS(10): $\{\exists Q.\ Q(dog_1), \exists Q.\ Q(bag_3), \exists Q.\ Q(trolley_4)\}$
ρ-AS(10): $\{carry(h, dog_1), carry(s, dog_1), carry(officer_5, dog_1)\}$

[4] Alternative terms used for similar (but not identical) IS partitions in other works are, e.g., Topic-Focus (Sgall et al. 1986), Background(=Link+Tail)-Focus (Vallduví 1992). We adopt Steedman's terms, but add the subscripts in Theme$_{is}$, Rheme$_{is}$ and Background$_{is}$, Focus$_{is}$ in order to avoid confusion with some other uses of the same terms.

[5] For the time being, we ignore the modality introduced by "should" and any aspects of the speech-act beyond simple assertion.

(11) Q: What should I CARRY?

A: You should CARRY the DOG.
L+H* LH% H*LL%
Theme *Rheme*

i. θ(11): $\lambda x.\ ^{\star}carry(h,x)$ ρ(11): $\lambda Q.\ Q(^{\star}dog_1)$

ii. θ-AS(11): $\{\exists x.\ wheel(h,x),\ \exists x.\ push(h,x),\ \exists x.\ carry(h,x)\}$
ρ-AS(11): $\{carry(h,bag_3), carry(h,dog_1)\}$

For each sentence, (i) provides a simplified *IS-partitioned logical form*, where θ and ρ are operators which 'wrap' Theme$_{is}$ and Rheme$_{is}$, respectively. Within Theme$_{is}$ and Rheme$_{is}$, asterisks on terms (e.g., $\star$*carry*) indicate elements that belong to the respective Focus$_{is}$. These IS-partitioned logical forms represent the linguistic meaning of the sentences, and serve as input for a discourse (context) *update function* described below. (ii) indicates the Theme$_{is}$ alternative set (θ-AS) and Rheme$_{is}$ alternative set (ρ-AS), which are explained below. Because each example contains Focus$_{is}$ within Theme$_{is}$ (indicated by a *-term), which entails contrast with a previous Theme$_{is}$ (and hence alternatives to contrast with), each θ-AS contains more than one element. (Without pitch accents in Theme$_{is}$, and thus without contrast, the θ-AS would be a singleton set.)

2.1 Alternative Set Semantics for IS

Elaborating on Rooth's alternative semantics (Rooth 1992), Steedman assigns the following semantics to IS (cf. Steedman 2000a):

- Theme$_{is}$ presupposes a *Rheme$_{is}$-alternative set* (ρ-*AS*).
- Focus$_{is}$ within Rheme$_{is}$ restricts the ρ-AS to the singleton set corresponding to the asserted proposition.
- Theme$_{is}$ also presupposes a *Theme-alternative set* (θ-*AS*).
- Focus$_{is}$ within Theme$_{is}$ restricts the θ-AS to the singleton set corresponding to Theme$_{is}$.

ρ-AS corresponds to what Rooth calls the *contextual alternative set* (Rooth 1985; Rooth 1992). θ-AS is a set of alternative themes with respect to the context, corresponding to what Rooth calls the *question alternative set.* The notion of alternative set is also closely related to the notion of *secondary denotation* (Karttunen and Peters 1979).

Following (Steedman 2000a), we take ρ-AS to be a subset of the propositions supported by the context, whose characteristic function is obtained systematically from the IS-partitioned logical form. As noted in (Steedman 2000a, p.10), alternative sets may not be exhaustively known to hearers, and in practice one would want to compute with a more abstract form.

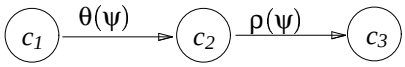

Figure 10.1: IS-sensitive update of context c_1 with ψ: $c_1[\theta(\psi)]c_2[\rho(\psi)]c_3$

2.2 IS-sensitive Context Updating

We follow (Krifka 1993; Kruijff-Korbayová 1998; Steedman 2000a) in defining the updating of an input context c_1 with an IS-partitioned logical form p as comprising two phases, a *Theme$_{is}$ update phase* ($c_1[\theta(\psi)]c_2$) and a *Rheme$_{is}$ update phase* ($c_2[\rho(\psi)]c_3$), where c_2 and c_3 are resulting contexts. (See Figure 2.2).

In the *Theme$_{is}$ update phase*, the input context c_1 is checked as to whether it supports or can accommodate the presuppositions of the theme $\theta(\psi)$ – namely, the Theme$_{is}$-alternative set θ-AS and the Rheme$_{is}$-alternative set ρ-AS. This yields a restricted context c_2 where $\theta(\psi)$ holds. In the *Rheme$_{is}$ update phase*, one alternative according to the ρ-AS is selected, which yields the final context c_3. Updating fails if either update phase does.

3 IS and "otherwise": single-clause antecedents

As noted earlier, Webber et al. (1999) have argued that "otherwise" has one argument established anaphorically, and one provided structurally. It is the anaphoric argument that provides the condition that "otherwise" appeals to and whose IS, we are arguing, the interpretation of "otherwise" must be sensitive to. This does not mean, however, that the antecedent of "otherwise" is limited to IS-partitioned utterances: just that IS-partitioning provides relevant possibilities.

Because example (5), given earlier, contains two different clauses (main and subordinate) that can serve as antecedents for "otherwise", there are at least the two possible conditions — shown in (6a) and (6b) — that *otherwise* β can derive and apply to the interpretation of β. Examples such as this are discussed in Section 4. Here we focus on cases where the condition that "otherwise" appeals to derives from a single clause antecedent.

Even here, the analysis in (Webber et al. 1999) must be refined in two ways to take account of IS:

1. The antecedent (A) of "otherwise" should not be treated as an atomic unit: rather, "otherwise" can appeal to a condition "C" deriving from either A's Theme$_{is}$ or its Rheme$_{is}$.

2. The context that β is asserted with respect to is not strictly worlds consistent with the real world or the current discourse context other than those "C" worlds: rather, it may or may not be consistent with the Theme$_{is}$ of its antecedent A as well.

(In the following examples, "Otherwise β" itself has an IS-partitioning. However, we do not explicitly indicate it, because it is not relevant to the points we are advancing. We will make a point about the IS-status of "otherwise" itself at the end of this section.)

The examples below address the first point, showing that the condition that "otherwise" appeals to may derive either from the Theme$_{is}$ of its antecedent — we call this the *full Theme$_{is}$-complement condition*– as in (12i), or from its Rheme$_{is}$ — we call this the *full Rheme$_{is}$-complement condition*– as in (12ii). (The corresponding paraphrases of the "otherwise β" are shown in italics.)

(12) Q. What should I do at a RED LIGHT?

i. At a red light, STOP. Otherwise you can go straight on.
H*LL%
Theme *Rheme*
Na červenou zastavte. Jinak můžete jet rovně.
At red$_{acc}$ stop$_{imp2pl}$ Otherwise can$_{2pl}$ go$_{inf}$ straight.
If the light is not red, you can go straight on.

ii. At a red light, STOP. Otherwise you will get a ticket.
H*LL%
Theme *Rheme*
Na červenou zastavte. Jinak dostanete pokutu.
At red$_{acc}$ stop$_{imp2pl}$ Otherwise get$_{2pl}$ fine$_{acc}$
If (the light is red and) you do not stop, you will get a ticket.

The full Theme$_{is}$-complement condition in (12i) corresponds to "not being at a red light" (or, "the light not being red"). The full Rheme$_{is}$-complement condition in (12ii) corresponds to "not stopping".

As to our second point, the context in which β is asserted, at issue is the Theme$_{is}$ of the antecedent of "otherwise". When "otherwise" appeals to the full Theme$_{is}$-complement condition, there is only one context with respect to which β can be asserted, namely the initial context before asserting α. The context updated with α's Theme$_{is}$ is irrelevant, because it is incompatible with the full Theme$_{is}$-complement condition: example (12i) cannot be interpreted as *If the light is red and if the light is not red, you can go straight on*.

On the other hand, when "otherwise" appeals to the full Rheme$_{is}$-complement condition, it appears that the IS-partitioning makes two contexts available with respect to which β can be asserted: the initial context before asserting α's Theme$_{is}$ (as in (13i)), and the context updated with α's Theme$_{is}$ (as in (13ii)).

(13) Q. When should I STOP?

i. Stop at a red LIGHT. Otherwise you can go straight on.
H* LL%
Theme *Rheme*

Zastavte na červenou. Jinak můžete jet rovně.
Stop$_{imp2pl}$ at red$_{acc}$. Otherwise can$_{2pl}$ go$_{inf}$ straight.
If the light is not red (i.e., in other conditions than being at a red light), you can go straight on.

ii. Stop at a red LIGHT. Otherwise you might get rear-ended.
H* LL%
Theme *Rheme*
Zastavte na červenou. Jinak by do vás
Stop$_{imp2pl}$ at red$_{acc}$. Otherwise be-aux$_{3sg}$ into you$_{gen}$
někdo mohl narazit.
somebody$_{nom}$ might$_{sg}$ bump$_{inf}$
If you stop and the light is not red, you might get rear-ended.

The sense that (13ii) conveys both in English and in Czech that one should *only* stop at a red light, comes from this interpretation of "otherwise" in terms of stopping under all conditions other than the light being red.

There is one further point to make before presenting our analysis of this phenomenon and review of these examples in more detail. That is that "otherwise" itself is a contrastive (part of the) Theme$_{is}$, and what we have seen here are different ways in which it relates to the input context: in example (12i), "otherwise" contrasts with the preceding Theme$_{is}$ (and therefore picks up the full Theme$_{is}$-complement condition), while in examples (12ii), (13i) and (13ii), it contrasts with the preceding Rheme$_{is}$ (and therefore picks up the full Rheme$_{is}$-complement condition). Example (12i$'$) below illustrates this Theme$_{is}$ contrast even more vividly, in that the pitch accents on "red" as Focus$_{is}$ within the Theme$_{is}$ of the first sentence indicates the speaker's awareness of alternatives that the "otherwise" sentence then explicates.

(12i$'$) At a RED light, STOP. Otherwise you can continue.
L+H* LH% H*LL%
Theme *Rheme*

3.1 Analysis

We propose the following IS-sensitive refinement of the analysis of "otherwise" in (Webber et al. 1999): Let us assume that α is the antecedent of *otherwise* β, and c_0 is the context prior to updating with α (rather than the real world). The IS-sensitive update enables us to distinguish between the following subsets of c_0:

- the subset where α's Theme$_{is}$ and alternatives to α's Rheme$_{is}$ hold (i.e., excluding α itself);
- the subset where alternatives to α's Theme$_{is}$ hold;
- the subset where alternatives to α's Rheme$_{is}$ hold (irrespective of Theme$_{is}$).

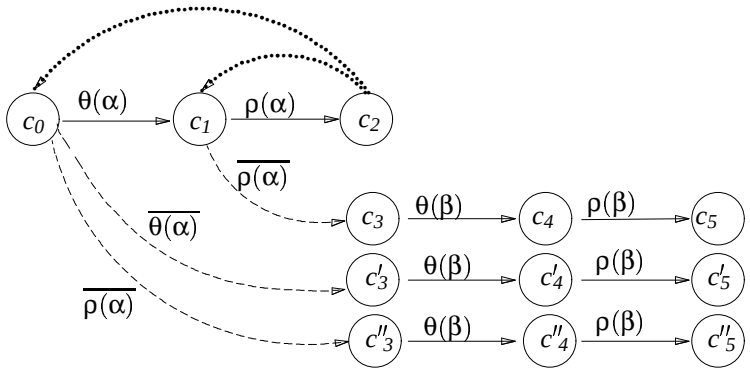

Figure 10.2: IS-sensitive updating with "α. Otherwise β".

The dotted arcs indicate the two possible ways of resolving "otherwise" with respect to the simplest IS-partitioning of the antecedent, and the dashed arcs indicate the transitions to the corresponding contexts.

In (Webber et al. 1999), β is asserted solely with respect to $c_0 - c_\alpha$, the subset of c_0 where alternatives to α hold. Here we refine this with respect to the above three subsets, defining how an input context is updated with the sequence "α. Otherwise β" for a single clause α:

1. c_0 is updated with α as described in Section 2.2: $c_0[\theta(\alpha)]c_1[\rho(\alpha)]c_2$.
2. Updating with "otherwise β" involves either:
   - c_1 being updated with "otherwise β", which involves constructing context c_3 as the Rheme$_{is}$-complement of c_2 with respect to c_1 and then updating this context with β: $c_1[\overline{\rho(\alpha)}]c_3[\theta(\beta)]c_4[\rho(\beta)]c_5$
   - c_0 being updated with "otherwise β" in one of two ways:
     - Context c_3' is constructed as the Theme$_{is}$-complement of c_1 with respect to c_0 and then c_3' is updated with β: $c_0[\overline{\theta(\alpha)}]c_3'[\theta(\beta)]c_4'[\rho(\beta)]c_5'$
     - Context c_3'' is constructed as the Rheme$_{is}$-complement of c_1 with respect to c_0 and then c_3'' is updated with β: $c_0[\overline{\rho(\alpha)}]c_3''[\theta(\beta)]c_4''[\rho(\beta)]c_5''$

These context-updating possibilities are shown schematically in Figure 10.2.

3.2 Examples

We now demonstrate this detailed IS-sensitive updating analysis for examples from the introduction to this section. Example (12i) repreated in (14) shows how the analysis applies to the case where a full Theme$_{is}$-complement condition is derived from the Theme$_{is}$ of the antecedent of "otherwise" and β is asserted with respect to the initial context, c_0. (Recall that this is the *only* context-updating possibility.)

(14) At a red light, STOP. Otherwise you can go straight on.
H*LL%
Theme *Rheme*

$c_0[\lambda P.at(h, red\_light) \wedge P]c_1[stop(h)]c_2$

$c_0[\overline{at(h, red\_light)}]c'_3[\lambda Q.Q(h)]c'_4[go\_straight(h)]c'_5$

If you are not at a red light, you can go straight on.

Example (13i) repeated in (15) shows how the analysis applies to the case where a full Rheme$_{is}$-complement condition is derived from the Rheme$_{is}$ of the antecedent. As shown above, there are two possible contexts against which β can be asserted. In (15), β is asserted with respect to the initial context, i.e. c_0.

(15) Stop at a red LIGHT. Otherwise you can go straight on.
H* LL%
Theme *Rheme*

$c_0[\lambda P.P \wedge stop(h)]c_1[at(h, red\_light)]c_2$

$c_0[\overline{at(h, red\_light)}]c_3[\lambda Q.Q(h)]c_4[go\_straight(h)]c_5$

If the light is not red (in other conditions than being at a red light), you can go straight on.

In contrast with (13i) is example (13ii), repeated in (16). While it appeals to the full Rheme$_{is}$-complement condition, β is asserted with respect to the context updated with α's Theme$_{is}$, i.e. context c_1.

(16) Stop at a red LIGHT. Otherwise you might get rear-ended.
H* LL%
Theme *Rheme*

$c_0[\lambda P.P \wedge stop(h)]c_1[at(h, red\_light)]c_2$

$c_1[\overline{at(h, red\_light)}]c_3[\lambda Q.Q(h)]c_4[get\_rear\_ended(h)]c_5$

If you stop and the light is not red, you might get rear-ended.

The examples in this section demonstrate a range of possible antecedents for "otherwise" that are not available without taking IS into account.

4 IS and "otherwise": complex-clause antecedents

We now turn to examples of the form considered in (Webber et al. 1999), where the condition used for interpreting "otherwise" comes from a complex sentence of the form *If* ϕ*, then* ψ. Here we show that the same analysis holds as before, with one addition:

- When both the subordinate clause and some element(s) from the main clause are included in the Theme$_{is}$, a third possibility for deriving the condition to which "otherwise" appeals is made available: the condition can be derived from a part of the Theme$_{is}$ of the antecedent.

There are somewhat more examples to review, because in both English and Czech, the main clause can belong entirely to the Theme$_{is}$ or to the Rheme$_{is}$ (i.e., the boundary between Theme$_{is}$ and Rheme$_{is}$ can coincide with the clause boundary between ϕ and ψ), or the main clause can be divided over the Theme$_{is}$ and the Rheme$_{is}$ (i.e., the boundary between Theme$_{is}$ and Rheme$_{is}$ splits ψ). The first of these possibilities is discussed in Section 4.1, the second in Section 4.2.

4.1 IS-boundary coinciding with clause boundary

When the IS-boundary between Theme$_{is}$ and Rheme$_{is}$ coincides with the clause boundary between ϕ and ψ, the Theme$_{is}$ (Rheme$_{is}$) consists of ϕ, and the Rheme$_{is}$ (Theme$_{is}$) of ψ. The examples below show that, as with simple clause antecedents, the condition that "otherwise" appeals to may derive either from the Theme$_{is}$ of its antecedent (the *full Theme$_{is}$-complement condition,* as in (17i)), or from its Rheme$_{is}$ (the *full Rheme$_{is}$-complement condition,* as in (17ii)).

(17) Q. What should I do if the light is RED?

A. If the light is RED, stop at the CORNER.
L+H*LH% H*LL%
Theme *Rheme*

A′. Stop at the CORNER if the light is RED.
H*LL% L+H*LH%
Rheme *Theme*

i. Otherwise you can go straight on.
If the light is not red, go straight on.

ii. Otherwise you will get a ticket.
If the light is red and you do not stop at the corner, you will get a ticket.

The full Theme$_{is}$-complement condition in (17i) corresponds to "the light not being red", and the full Rheme$_{is}$-complement condition in (17ii) corresponds to "not stopping" (as with the simple antecedent examples in (12i) and (12ii)).

When "otherwise" appeals to the full Theme$_{is}$-complement condition, there is only one context with respect to which β can be asserted, namely the initial context before asserting α. The context updated with α's Theme$_{is}$ is irrelevant, because it is incompatible with the full Theme$_{is}$-complement condition: example (17i) cannot be interpreted as *If the light is red and if the light is not red, you can go straight on.*

On the other hand, when "otherwise" appeals to the full Rheme$_{is}$-complement condition, it appears that the IS-partitioning makes two contexts available with

respect to which β can be asserted: the initial context before asserting α's Theme$_{is}$ (as in (18i)), and the context updated with α's Theme$_{is}$ (as in (18ii)).

(18) Q. When (i.e., under what conditions) should I stop at the CORNER?

A. Stop at the CORNER (L+H*LH%) — *Theme* if the light is RED. (H*LL%) — *Rheme*

A′. If the light is RED (H*LL%) — *Rheme* stop at the CORNER. (L+H*LH%) — *Theme*

i. Otherwise you can go straight on.
If the light is not red, (you needn't stop) and you can go straight

ii. Otherwise you might get rear-ended.
If you stop at the corner and the light is not red, you might get rear-ended.

Again, the sense that (18ii) conveys that one should *only* stop at a red light, comes from this interpretation of "otherwise" in terms of stopping under all conditions other than the light being red. It appears very difficult to get the variant of (18) with the preposed rhematic "if"-clause. We think that this is because this IS-partitioning requires a marked intonation pattern that may be difficult in English.

4.2 IS-boundary splitting the main clause

When the IS-boundary between Theme$_{is}$ and Rheme$_{is}$ "splits" ψ, the Theme$_{is}$ (Rheme$_{is}$) consists of ϕ and a part of ψ, while the rest of ψ belongs to the Rheme$_{is}$ (Theme$_{is}$). As before, "otherwise" can appeal to the *full Theme$_{is}$-complement condition* and the *full Rheme$_{is}$-complement condition,* but another possibility is that the condition derives from just that part of the Theme$_{is}$ in the matrix clause, as illustrated below. This we call the *partial Theme$_{is}$-complement condition.*

(19) Q. Where do you buy wine if it's SUNDAY?

A. If it's SUNDAY , we buy wine (L+H*LH%) — *Theme* over the STATE LINE. (H*LL%) — *Rheme*

Otherwise we just buy beer.

a. *If we don't buy wine, we buy beer.*

b. *If it is Sunday and we don't buy wine, we buy beer.*

The partial Theme$_{is}$-complement condition in (19) corresponds to "we do not buy wine". The reason we give two possible paraphrases of "otherwise we just buy beer" (*otherwise* β) is that the initial contex c_0 can be updated with this partial Theme$_{is}$-complement (γ) in either of two ways (shown schematically in Figure 10.3):

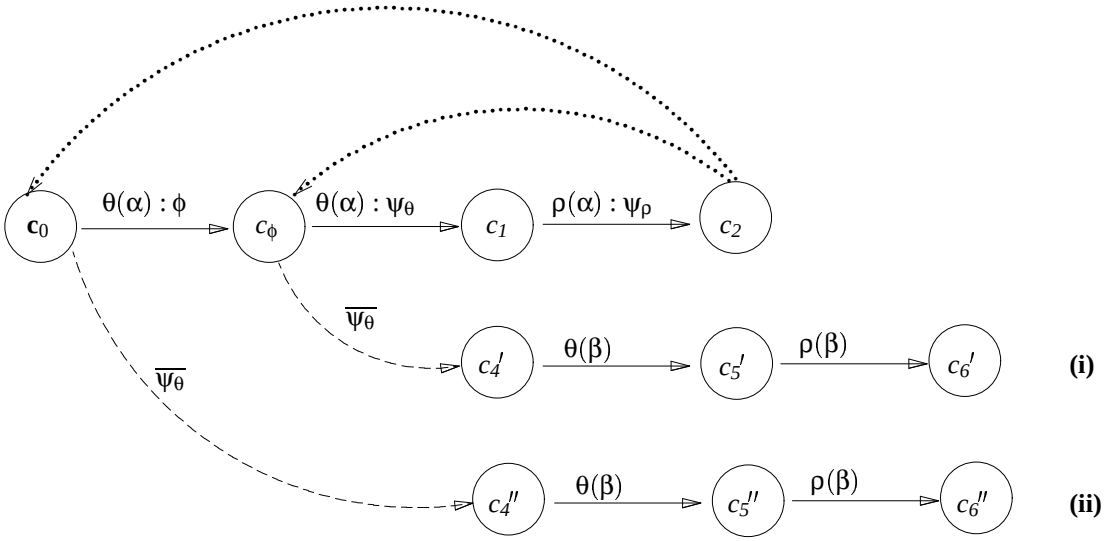

Figure 10.3: IS-sensitive updating with "α. Otherwise β" involving a partial Theme$_{is}$-complement condition.

- It can be updated just with γ, asserting β with respect to the result, as in (19a);
- It can be just updated with that part of α's Theme$_{is}$ in the "if-clause" and then γ, asserting β with respect to the result, as in (19b).

c_0 cannot be updated with respect to the entire Theme$_{is}$ and then γ because the two are incompatible.

Finally, we consider the case where the "if-clause" belongs to the Rheme$_{is}$ of α, as in example (20a). Of concern is the possibility that "otherwise" appeals to a condition derived from that part of the Rheme$_{is}$ in the matrix clause, what we call the *partial Rheme$_{is}$-complement condition.*

(20) Q. What should I do AFTER 5PM?

A. After 5pm take a BREAK, if you are TIRED.
LH% H* H*LL%
Theme *Rheme*

a. Otherwise, you'll start making mistakes.
If it is after 5pm, and if you are tired, and you do not take a break, you'll start making mistakes.

b. Otherwise, carry on until the job is done.
If it is after 5pm, and if you are not tired (and you do not take a break), carry on until the job is done.

In example (20a), the partial Rheme$_{is}$-complement condition corresponds to "you do not take a break". Here, the only context in which it makes sense to assert

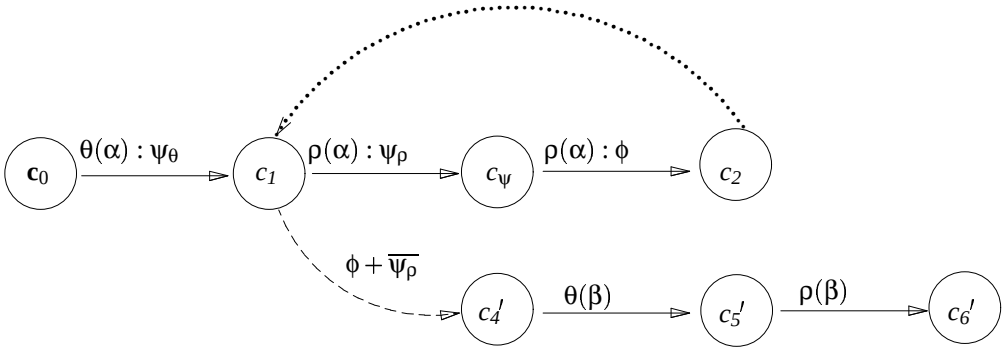

Figure 10.4: IS-sensitive updating with "α. Otherwise β" involving a partial Rheme$_{is}$-complement condition.

"Otherwise β" (with "otherwise" appealing to this condition) is the context resulting from updating the initial context c_0 with α's Theme$_{is}$ and with that part of α's Rheme$_{is}$ constituted by the "if-clause". This is shown schematically in Figure 10.4.

We note example (20b) because we are uncertain whether "otherwise" appeals to just the complement of the "if-clause" (i.e., part of α's Rheme$_{is}$) or the complement of the entire Rheme$_{is}$ of α. Here we feel that more research is needed concerning the status of (postposed) subordinated clauses with respect to the IS-partitioning, in particular, whether they should be treated within the matrix clause, or as separate utterances (with their own IS-partitioning) (cf. (Günthner 1996) for a discussion based on spoken data; cf. also Komagata's paper at this workshop).

5 Conclusions and Further Research

While we must still complete our discussion of "otherwise" with complex antecedents, we hope that we have convinced the reader that that IS is crucial to any account of the semantics of "otherwise". We recognize that several problems remain unaddressed:

- As already noted, we have not identified the range of things that can serve as antecedents (i.e., provide conditions) for "otherwise" nor identified from where in the discourse they can come, other then the previous clause or an embedded relative clause. More importantly, we have not said *why* they provide conditions for "otherwise": That is, we haven't addressed the basic problem of what (alternative) conditions a speaker may have in mind and what features of language give evidence for them.

  Here we have claimed that the *alternative sets* of Information Structure give such evidence. But they are clearly not the only evidence (e.g., multi-clause

antecedents seem possible for "otherwise", as do accommodated antecedents, both of which would be outside the realm of IS). And a more parsimonious analysis of the data we have presented may not involve IS at all: For example, Matthew Stone (personal communication) has pointed out that all our examples involve generics, which can be analysed as involving a set of *cases under discussion.* We must understand whether and if so, how, these two concepts are related.

- There are cases of postposed "if"-clauses that are best analysed as having their own IS – as in:

(21) Q. When should I stop?

A1. Stop at a red light — that is, if it's a weekend.
H*LL% H*LL%
Theme *Rheme* *Theme* *Rheme*

A2. Stop at a red light
H*LL%
Theme *Rheme*

— that is, if you don't want to get a ticket.
H*LL%
Theme *Theme* *Rheme*

In the case of (21:A2), the "if" clause is playing a role similar to an "otherwise" clause, so that adding an "otherwise" clause appears redundant. In the case of (21:A1), it may be that "otherwise" can either combine the rhemes into a single condition or consider the later one as a condition of its own.

- The role that the "otherwise" clause plays with respect to the preceding discourse is clearly tied, at least partially, with the condition it is taken to be otherwise to: In the complex "if"-clause antecedents we have discussed, being otherwise to the Rheme_{is} (in main or subordinate clause) provides an *explanation,* while being otherwise to the Theme_{is} provides a *elaboration* of what holds in other circumstances. While this may call into question the notion in Rhetorical Structure Theory (Mann and Thompson 1987) that there is an "otherwise" rhetorical relation signalled by the use of "otherwise", it still goes only a small way towards characterizing what is happening.

- Finally, we alluded earlier to ways in which the themes of subsequent utterances may be related and how "otherwise" was a prime example of a contrastive relation between themes or between theme and previous rheme. Discovering and enumerating these possibilities would do much to clarify the relationships between discourse structure and Information Structure.

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