Updates & discourse anaphora: a dynamic approach to otherwise
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The puzzle. The interpretation of the English adverb otherwise depends on preceding discourse, giving rise to different possible readings, as in (Ia–b) from Webber et al. (2001:7):

(1) a. If the light is red, stop. Otherwise go straight on.
   ≈ If the light is not red...

   b. If the light is red, stop. Otherwise you’ll get a ticket.
   ≈ If the light is red and you don’t stop...

Proposal. We propose that otherwise refers to a set of worlds that have been eliminated from consideration in a previous discourse update. We formalize this in a dynamic semantics framework, borrowing insights from work on complement anaphora and modal subordination. Dynamic approaches to semantics have been fruitful in accounting for anaphora resolution (e.g. Kamp 1981, Heim 1982, Roberts 1987, Nouwen 2003). These approaches view meaning as the context-change potential of a given utterance (Nouwen et al. 2016), accounting for the role of inter-sentential dependencies for interpretation.

Following Kratzer (1981, 1986); Roberts (1989), a.o., we assume that if-clauses induce a temporary update of the common ground with the antecedent proposition, thereby restricting the context set. The consequent then further restricts this same set of worlds in the common ground. In other words, “if p then q” eliminates all the p ∧ ¬q worlds from the context set (see also Meyer 2013).

We propose that otherwise represents an instruction to the addressee to consider the complement of a set of worlds that has been established elsewhere in the discourse context. The prejacent of otherwise is interpreted as predicating of worlds in this complement set.

These relations can be instructively formalised with reference to the notion of “discourse subordination” as formulated in Roberts (1989:718), where ‘accommodation of material from prior utterances serves the role of antecedent for the subordinated clause.’

The analysis of examples (Ia–b) is illustrated below, where different prior discourse updates can be chosen to serve as the antecedent to the otherwise statement — that is, to be negated by otherwise. We introduce the notation ◦ to signify this negation of a prior discourse update.

In (Ia), the antecedent of ‘otherwise’ is the antecedent of the conditional. That is, otherwise targets the set of worlds in which the light is not red, and asserts that in those worlds, you should go straight. In (Ib), the antecedent of ‘otherwise’ is the consequent of the conditional. That is, otherwise targets the set of worlds where the light is red but you do not stop, and asserts that in those worlds, you get a ticket.

Notice that both DRSs are subordinate to the first if-clause.
Our analysis furthermore allows for cases of e-type anaphora as in (2) below from Webber et al. (2001:7), by making discourse referents salient for quantification across dynamic updates. Here, otherwise selects the set of worlds where every (relevant) person is not selling “The Big Issue”, and asserts that in those worlds, they might be begging.

(2) Every person selling “The Big Issue” might otherwise be asking for spare change.

**Predictions.** It follows from our proposal that otherwise is not well-defined when no worlds have been eliminated from consideration by prior updates. We thus correctly predict that root possibility modals are incompatible with otherwise, because they fail to reduce the context set.

(3) a. I have to go to school, otherwise I’ll get in trouble.
   b. ?? I can go to school, otherwise I’ll get in trouble.

Moreover, if a sentence with a possibility modal is strengthened, otherwise becomes felicitous again. E.g., examples (4a–b) receive a similar interpretation, with universal rather than existential force. Specifically, the interpretation of the epistemic might in (4b) receives a (weak) necessity interpretation (e.g. von Fintel & Iatridou 2008), roughly: “there are no worlds I am considering where she isn’t here and isn’t sick (but I do not claim to have access to all relevant worlds).”

(4) a. She must be sick, otherwise she’d be here.
   b. She might be sick, otherwise she’d be here.

Likewise, in examples with “may not,” which is ambiguous between ¬ > ◇_deontic and ◇_epistemic > ¬ readings, only ¬ > ◇_deontic eliminates worlds and supports otherwise.

(5) **Context:** Ashley got horrible grades in college and is very clumsy.
   a. She may not be a doctor.
      ¬ > ◇_deontic
   b. Otherwise, she might kill someone.
      ≈ If she does become a doctor...

(6) **Context:** Ashley works at a hospital and wears a white coat, but I don’t know what she actually does.
   a. She may not be a doctor.
      ◇_epistemic > ¬
   b. # Otherwise, she might be a surgeon.
      Intended: ≈ If she’s not not a doctor...

**Implications.** We further relate our analysis of otherwise to the dynamic analysis of complement anaphora in Nouwen (2003), (7): otherwise picks out a complement set of worlds; complement anaphora picks out a complement set of individuals. We show in the talk a parallel between otherwise and complement anaphora: both become degraded if there is intervening material between the (complement) antecedent and its referent (data omitted here).

   (Evans 1980)
   a. They are (all) very junior.
      reference set A ∩ B
   b. They think he’s incompetent.
      complement set A \ B

From a broader perspective, we argue that properly accounting for the semantics of otherwise requires appeal to a level of discourse representation that intermediates between LF and interpretation. This provides further evidence of the desirability of dynamic approaches to semantics.