

Quantification over times in subjunctive conditionals

The problem. Stalnaker (1968) proposed that a conditional *if* \square , *then* \square is an assertion that the consequent is true not necessarily in the world as it is, but in the world as it would be if the antecedent were true. More formally, a conditional *if* \square , *then* \square is true just in case \square is true in $f(\square, w)$, where the value of $f(\square, w)$ is the most similar \square -world. Stalnaker (1975) suggested that the difference between indicative and subjunctive conditionals lies in the pragmatic constraint imposed on the selection function f : in indicative conditionals, f is required to reach inside the context set, i.e. the set of possible worlds where all that is presupposed to be true in the actual world is true. What this means is that the hypothetical \square -world that f selects is a world where all that the speaker's presuppositions are true. In subjunctive conditional no such requirement is imposed on f and, consequently, the world that is selected may not be a member of the context set. This neatly accounts for the felicity contrast between (1) and (2) uttered in a context in which it is known that Jack already died.

However, this is not enough to capture the infelicity of (3) when uttered in a context where it is known that Jack quit smoking already a year ago. If the selection function in subjunctive conditional can reach outside the context set, thus selecting a counterfactual world where Jack is alive in (2), then it is a mystery why it cannot reach a counterfactual world where *Jack will smoke* and quit next summer in (3). Heim (1992) discusses this puzzle and concludes that it must be stipulated that the presuppositions of the antecedent of a subjunctive conditional (if any) must be entailed by the context set. This problem arises in Lewis (1973) and Kratzer (1991)'s theories of counterfactuals as well. Furthermore, even if it were stipulated that the presuppositions of the antecedent must be true in the actual world, we would run into the further problem of explaining why this constraint does not hold of the subjunctive conditional in (4).

The solution: quantification over times. The two properties of subjunctive conditionals that need to be accounted for are: (a) the set of worlds that the modal operator quantifies over must include some \square -worlds, even though \square -worlds may be counterfactual; (b) the presuppositions of the antecedent (if any) must hold not only in the hypothetical \square -worlds, but also in the actual world. The objective of this paper is to argue that modality has a temporal structure: once we unveil this temporal structure, the presupposition puzzle outlined in the preceding section will be shown to be just an instance of the presupposition projection phenomenon in quantified structures.

I argue that the structure of a subjunctive conditional involve universal quantification over subintervals of an interval introduced by a perfect operator, morphologically realized by the past morphology that marks subjunctive conditionals in English, as well as in many other languages. As a consequence, the set of worlds over which the modal operator quantifies will be the set of worlds w such that there is a subinterval t at which w is metaphysically accessible from the actual world (i.e. worlds that have the same history as the actual world up to t). For lack of space, I can only give the truth-conditions of the sentence in (3). *RB* stands for *right boundary of the perfect interval*, which in counterfactuals with one layer of past like (3) is the time of the context by default (cf. McCoard 1978, von Stechow and Iatridou 2002, among many others).

I argue that the properties of subjunctive conditionals given in (a) and (b) above follow from the quantification over times that I am proposing. Let us begin with (a), i.e. the set of worlds that the modal operator quantifies over must include some \square -worlds,

even though \Box -worlds may be counterfactual. This follows from the fact that, in order to be felicitous, quantified sentences require that the restriction of the quantifier not be empty: e.g., (6) requires that there be boys in the domain of quantification (cf. von Stechow 1994 and Beaver 1995, 2001, among others). Similarly for (2): the constraint on the necessity operator is that there must be some (maximally similar, accessible) \Box -worlds. However, this presupposition must not be bound by the universal quantifier over times, because if it were, it would follow that there must be worlds accessible at all subintervals, including the *utterance time* (t_c), and we would incorrectly predict that the antecedent must be metaphysically possible at the utterance time (cf. the felicity of (2) in a context where it is known that Jack is dead). This is precisely what we find in inverse-linking sentences like (7). What this sentence presupposes is not that every boy has some friend (as it would, if the presupposition of the LF-lower quantifier *every friend* were bound by the LF-higher quantifier *every boy*), but only that *some boys have friends*. Similarly, in (5), the presupposition will be that at some subinterval t_2 there are (maximally similar, accessible) \Box -worlds. Let us now consider point (b), i.e. the presuppositions of the antecedent (if any) must hold not only in the hypothetical \Box -worlds, but also in the actual world. Again, the parallel with other quantified sentences holds. If there is a presupposition in the nuclear scope of the universal quantifier, the presupposition must be satisfied by every member in the domain: (8) is felicitous only if every nation in the domain has a king. Again, the same holds for the subjunctive conditional whose truth-conditions are given in (5): the presupposition in the nuclear scope of the universal quantifiers over times will have to be satisfied by every subinterval. Now, the presuppositions in the nuclear scope of the \Box over times (if any) will be the presuppositions of the embedded conditionals (i.e. \Box 's presuppositions and \Box 's presuppositions that are not entailed by \Box). Therefore, every subinterval t_2 quantified over by the universal quantifier over times must be such that the antecedent's presuppositions (if any) and the consequent's presuppositions (not entailed by the antecedent) must hold at t_2 . I will also show how this proposal accounts for the contrast between (3) and (4).

To sum up, I have argued that the puzzle of subjunctive conditionals is reducible to the phenomenon of presupposition projection in non-modal quantified sentences, once we unveil the quantification over times hidden in non-indicative modal sentences.

Examples

- (1) #If Jack is alive we are doomed.
- (2) If Jack were alive, we would be doomed.
- (3) #If Jack quit smoking next summer, he would lose the marathon.
- (4) If Jack had quit smoking next summer, he would have lost the marathon.
- (5) **[[If Jack quit smoking next summer, he would lose the marathon]]^c = 1** iff $\Box t_3$: RB(t_c, t_3) & $\Box t_2 \Box t_3$ [$\Box w$ [w is metaphysically accessible from w_c at t_2 and Jack will quit smoking next summer is true at t_2 in w and w resembles w_c no less than any other world where Jack will quit smoking next summer \Box he will lose the marathon is true at t_2 in w]
- (6) Every boy passed the test.
- (7) Every friend of every boy passed the test.
- (8) Every nation_i cherishes its_i king. (Heim 1983)

Partial references

Lewis 1973 / Kratzer 1991 / Heim 1992 / Ogihara 2000/ Stalnaker 1975.