Conditional Reading of Logical Connectives

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Abstract

Logical connectives such as *and* and *or* can give rise to conditional readings, as in *Be on time and you'll get a seat.* Previous literature has focused on the implications of this fact on the meaning of imperatives, despite the fact that conditional readings arise even in their absence. In this paper, I propose a parsimonious theory of *how* and *when* conditional readings come about. It is shown that an extension of dynamic semantics, i.e. Mandelkern's (2019) "bounded modality", makes correct predictions without further stipulations. The theory has significant bearings on how contexts are updated and evaluated upon, which broadens our understanding of how we exchange information with language.

1 Introduction

Logical connectives in natural language such as *and* and *or* can sometimes be interpreted as a conditional, as shown in (1) and (2).

(1) a. Be on time and you'll get a seat.
b. If you are on time, you will get a seat.

(2) a. Be on time or you'll miss the first slot.
b. If you are not on time, you will miss the first slot.

(Kaufmann, 2011)

These constructions are given several different names in the literature: **IaDs/IoDs** (imperative-and/or-declarative) (Kaufmann, 2011; Scontras & Gibson, 2011; Starr, 2018; von Fintel & Iatridou, 2017), **Conditional Conjunctions/Disjunctions** (Kaufmann & Whitman, 2022), and **Pseudo-Imperatives** (Franke, 2008; Jayez & Dargnat, 2008; van Rooij & Franke, 2012). This reflects the fact that consensus is yet to made on the exact characterization of these sentences. We will call them *conditional reading of logical connectives* (CROLC) throughout this paper, to begin with the most theory-neutral position possible.

Among the extant terminologies, IaDs/IoDs and pseudo-imperatives give the wrong impression that conditional reading is confined to imperatives. That is not the case. Conditional reading of English conjunctions is most extensively studied by Culicover and Jackendoff (1997), who call them **left subordinating and** ($_{\text{LS}}$*and*). They are also found in the conjunction of two declaratives (3a), the conjunction of (*one more*) NP and a declarative (3b), and the conjunction of a sufficiency modal construction (Von Fintel & Iatridou, 2007) with a declarative (3c).

(3) a. You enter a Starbucks and you run into Ede.
b. One more coffee and I'm not going to sleep for the entire night.
c. Cécile only has to take a look at me and she knows what I'm thinking.
(Kaufmann, 2011)

Conditional reading of disjunctions is also found various contexts: the disjunction of two declaratives (4a), the disjunction of a bare NP with a declarative (4b), and the disjunction of two modalized declaratives (4c).

(4) a. You hand in your paper now or you get kicked out of the program.
b. Coffee or I'll fall asleep.
c. You must hand in this paper immediately or you'll get kicked out of the program.
(Kaufmann, 2011)

Nonetheless, most of the previous literature has studied CROLC in association with the meaning of imperatives. This is because CROLCs work as a good testing ground for whether the meaning of imperatives is strong or weak.[1] To illustrate, consider the following sentence:

(5) Ignore your homework and you will fail this class.
(von Fintel & Iatridou, 2017)

When *and* is taken as a logical conjunction ($\wedge$), the entire conjunction entails each of the conjuncts. However, it seems that (5) does not entail the left conjunct 'Ignore your homework.' (and neither does it entail the right conjunct). Instead, the speaker is taken to oppose the idea of ignoring homework and warn the addressee to put in some actual effort. This empirical observation turns out to be problematic for the strong theory of imperatives, because there seems to be no obligation issued, e.g., to ignore one's homework, in this case.

[1]Strong in the sense that something like obligation is built into the denotation of imperatives, and weak in the sense that imperatives denote a non-modal property (von Fintel & Iatridou, 2017). A more detailed discussion is laid out in section 2.

This paper has three central aims. First, it aims to provide a broader, integrated view of the CROLC which is independent from the meaning of imperatives. Second, it aims to understand *how* CROLCs come about without stipulating a separate lexical entry for logical connectives, *pace* $_{\text{LS}}$*and*. Our analysis can be seen as an extension of the bounded theory of modal operators (Mandelkern, 2019), in which modal operators are expected to sensitive to local contexts. Lastly, it aims to develop a predictive theory of (local and global) context updates; we show that whenever a linguistic expression E is consumed under local context, it is barred from contributing to the global context.

2 The meaning of imperatives

Although not a primary focus of this paper, let us briefly discuss how CROLCS bear on the meaning of imperatives. The typical use of imperatives is, of course, to convey a command or an order. However, there is an ongoing debate on whether this effect should be encoded in the semantic denotation of imperatives or be derived from higher level pragmatics. Proposals in favor of a minimal semantics of imperatives put forth three core empirical arguments: *acquiescence* uses, *indifference* uses, and IaDs/IoDs.[2]

(6) A: It's getting warm. Can I open the window?
B: Sure. Go ahead. Open it! *acquiescence*

(7) Go left! Go right! I don't care. *indifference*

It seems that the imperatives in (6) and (7) by themselves do not impose obligations on the addressee. If we take imperatives to denote obligations, (7) should be understood as issuing two inconsistent commands at the same time. That is not what (7) means. Kaufmann (2011) proposes that imperatives denote modal propositions in the sense that *read this book!* means something similar to *you must read this book.* However, modals cannot be used to express acquiescence or indifference in the same way imperatives do:

(8) A: It's getting warm. Can I open the window?
B: Sure. Go ahead. #You must open it.

(9) #You must go left. You must go right! I don't care.

These empirical facts suggest the denotational semantics of imperatives be kept minimal while the building of directive force is done at the pragmatic level. Port-

[2]Examples (6)-(10) are from von Fintel and Iatridou (2017), some of which are in turn brought from other references therein. (11a) and (11b) are brought from Kaufmann (2011) and Franke (2005), respectively.

ner (2007) argues that imperatives denote addressee-restricted properties. According to Portner's account, dynamic pragmatics determines which component of the context is to be updated with a given utterance: imperatives update the addressee's *to-do list* (TDL) in the same way declaratives update the common ground. The weakening of imperatives, as seen in acquiescence and indifference uses, is derived by pragmatics in consideration of other contextual factors.

(10) a. Study hard and you will pass the class.
b. Ignore your homework and you will fail this class.
c. Open the paper and you will find 5 mistakes on every page.

(11) a. Be on time or you'll miss the first slot.
b. Speak at least six different languages or you are not a cosmopolitan.

IaDs and IoDs pose a more serious threat to the strong theory of imperatives.[3] They are composed of an imperative followed by a promise or a threat that is likely to happen when the content of the imperative is made true. The right conjunct/disjunct, which is equivalent to the consequent of a conditional, is understood as a promise if it is taken to be something desirable for the addressee. This is shown in (10a). On the other hand, it is understood as a threat if undesirable, as in (10b) and (11a), or simply a result/conclusion if neutral, as in (10c) and (11b).[4]

[3]One could argue that the left conjunct/disjunct of IaDs/IoDs are not genuine imperatives but bare VPs that denote actions in some hypothetical sense. This is countered by a cross-linguistic survey of IaDs/IoDs, in which they were very easily found in a wide variety of languages, including those with rich morphology (von Fintel & Iatridou, 2017).

(i) a. Fae ena apo afta ke tha pethanis mesa se 24 ores
Eat.IMP one from these and FUT die within 24 hours
'Eat one of these and you will die within 24 hours' (Greek)
b. Ilmis-ha w b-tindam tool 'omr-ak
touchIMP-it and b-regret.2sgm all life-your
'Touch it and you will regret it the rest of you life' (Palestinian Arabic)

[4] Franke (2008) points out an interesting gap in the pattern of IaDs/IoDs: it is impossible to make a disjunction of an imperative and a promise.

(ii) #Ignore your homework or you will pass the class.

van Rooij and Franke (2012) proposes that this is because disjunctive promises are strategically suboptimal in two ways. First, mentioning a possibility raises its salience among the alternative set. Disjunctive promises are suboptimal in that they mention an action *Ignore your homework* when the speaker actually has a dispreference for it. (This also applies to 10b.) Second, a threat is cheaper in expectation than a promise in that a threat does not issue an obligation on the side of the speaker.

This condition — positive, neutral, or negative consequent — seems to systematically determine speaker endorsement. In neutral cases such as (10c) and (11b), there seems to be no speaker endorsement involved.[5] When the consequent is negative in IaDs, as in (10b), it seems that the speaker is dictating that the addressee must *not* ignore their homework. This is the exact opposite of what the strong theory of imperatives predicts. In addition, modal expressions and desideratives cannot replace the imperative, as shown in (12). All in all, the empirical facts work in favor of a minimal denotational semantics for imperatives.

(12) a. #You must ignore your homework and you will fail this class.
b. #I want you to ignore your homework and you will fail this class.

The fact that some IaDs involve speaker endorsement but some do not has led researchers to conclude that they are of two different kinds[6] (Kaufmann, 2011; von Fintel & Iatridou, 2017). According to this view, endorsing IaDs such as (10a) and (11a) are instances of true speech-act conjunction. Non-endorsing IaDs, on the other hand, are instances of conditional conjunction, something along the lines of Culicover and Jackendoff's $_{\text{LS}}$*and*. Obviously, something about this explanation feels *ad hoc*; it crucially depends on whether what we expect to be the meaning of imperatives is there or not.[7]

3 Local contexts, bounded modality, and conditional readings

As we have discussed so far, previous analyses of CROLC are far from complete. A considerable amount is restricted to the discussion of imperatives despite the fact that CROLC is a more general phenomenon. Culicover and Jackendoff's account

[5] See, however, Kaufmann's (2011) claim that (11b) is not entirely neutral. Clearly, (11b) does not issue an obligation the same way (11a) does. Yet, Kaufmann argues that speaking six different languages and being a cosmopolitan is still judged as something positive. An interesting observation in this regard is the following contrast:

(i) a. #You must open the paper and you will find 5 mistakes on every page.
b. You must speak at least six different languages or you are not a cosmopolitan.

[6] Literature on imperatives and their meanings has mostly centered around IaDs but not IoDs. This is because IoDs predominantly involve speaker endorsement; they are in most cases consistent even if we assume a strong meaning of imperatives (see footnotes 4 and 5).

[7] In fact, von Fintel and Iatridou (2017) also suggests that a unified analysis is in order. Turkish has imperatives, but not conditional conjunction or IaDs. If conditional conjunction was necessary only for non-endorsing IaDs, we would expect Turkish to lack non-endorsing IaDs but to have endorsing IaDs, contrary to fact.

stipulates a separate lexical entry for conditional conjunction, which, if they are correct, necessitates one for disjunction too. It is worth noting, however, that the question of *how* conditional readings arise in the first place, is not paid enough attention in the literature.

There is one more aspect to CROLC that goes often neglected but deserves more attention. In conditional readings, *or*, but not *and*, reverses the polarity of the antecedent. This is demonstrated in (1) and (2), repeated below as (13) and (14).

(13) a. Be on time and you'll get a seat.
b. If you are on time, you will get a seat.

(14) a. Be on time or you'll miss the first slot.
b. If you are *not* on time, you will miss the first slot.

This reminds us of the following logical equivalence:

(15) $p \vee q \equiv \neg p \rightarrow q$

We take this to mean that there is a good reason to assume that conditional readings arise in part from the simple denotation of logical connectives: $\vee$ for *or* and $\wedge$ for *and*. We show that conditional readings are derived from modal subordination which is sensitive to local contexts. Logical connectives contribute to the shaping of local contexts, which explains the contrast in polarity switch properties.

3.1 Local contexts

Let us first briefly walk through what we mean by *local contexts*. Presupposition satisfaction is one of the major empirical motivations for a dynamic semantics, in which local contexts are computed incrementally. Take the following example:

(16) John is incompetent and he knows that he is.

(Schlenker, 2009)

Let us call the initial context, the context in which (16) is uttered, κ. The presuppositions of the right conjunct is not evaluated with respect to κ, but with respect to the local context: κ + *John is incompetent*. It is in this sense that local contexts are computed incrementally; linguistic expressions add onto the initial context to create local contexts to subsequent expressions.[8]

[8]In its simplest formalization, this supposes that the composition of local contexts goes in a left-to-right fashion. Schlenker (2009) and Barker (2022) both present examples that are problematic to this idea, suggesting that local contexts can, in some cases, be computed symmetri-

Schlenker (2009) takes the local context of an expression E in a sentence S to be the *smallest domain that one may restrict attention to when assessing* E without jeopardizing the truth conditions of S. Barker (2022) offers a technical refinement of this idea: local contexts are derived by excluding from the previous context (i) the worlds that do not satisfy the least upper bound and (ii) the worlds that satisfy the greatest lower bound. The difference is largely of theoretical implementation, which is why we rely on verbal descriptions in the rest of this subsection — although they may look impressionistic. The core idea is complemented by a chart at the end, which is provided in Barker (2022).

Let us first focus on linguistic expressions of the form p *and* q. Upon hearing p *and* ..., the listener restricts their attention to only consider those worlds in which the truth condition of the entire sentence can be examined relatively to the truth condition of the imminent linguistic expression, i.e. q. Such worlds are p-worlds. If p is false, p *and* q is definitely false; the truth condition of q does not make a difference. However, if p is true, the truth condition of q will determine the truth condition of the entire sentence. Therefore, the listener restricts their attention to p-worlds only. In other words, the local context for the right conjunct is p.

Let us now move on to linguistic expressions of the form p *or* q. Upon hearing p *or* ..., the listener restricts their attention to only consider those worlds in which the truth condition of the entire sentence can be examined relatively to the truth condition of the imminent linguistic expression, i.e. q. Such worlds are $\neg p$-worlds. If p is true, p *or* q is definitely true; the truth condition of q does not make a difference. However, if p is false, the truth condition of q will determine the truth condition of the entire sentence. Therefore, the listener restricts their attention to $\neg p$-worlds only. In other words, the local context for the right disjunct is $\neg p$.

(17) Local contexts in conjunction and disjunction (Barker, 2022)[9]

f	$\lceil f \rceil$	$\lfloor f \rfloor$	Local context
p *and* ...	p	$\bot$	p
p *or* ...	$\top$	p	$\neg p$

cally. Chung (2023) (and references cited therein) suggests that the building of local contexts is partially sensitive to syntactic structure. Without further theoretical discussion, we assume that the composition of local contexts is sensitive to linear order.

[9]Take $\lceil f \rceil$ to be the most informative (smallest) proposition that is entailed by each way of saturating the arguments of f. Dually, $\lfloor f \rfloor$ can be understood as the least informative (largest) proposition that entails each way of saturating the arguments of f. Local context is defined as $\lceil f \rceil \wedge \neg \lfloor f \rfloor$.

3.2 Bounded modality

It has been noticed in the literature that there is something wrong with asserting *not p* and *might p* in the same breath:

(18) #It's not raining but it might be raining.

(Wittgenstein, 1953)

This is a surprising observation, given that *might p* can be true even when *p* happens to be false. Dynamic semantics offers a nice solution to this problem: *might*, just like presupposition triggers, is sensitive to local context. Mandelkern (2019) proposes that epistemic modals are quantifiers over accessible worlds, as the standard theory has it, but that their domain of quantification is limited by local context. The semantic entry of *might*, according to Mandelkern (2019), is given in (19).[10]

(19) $[\![\text{might}_i\ p]\!]^{g,\kappa,w}$

a. defined only if $\forall w' : g(i)(w') \subseteq \kappa$;

b. if defined, true iff $\exists w' \in g(i)(w') : [\![p]\!]^{g,\kappa,w'} = 1$

We are interested in the *locality constraint* given in (19a). The constraint limits admissible accessibility relations to those which quantify over a subset of the local context: that is, to those under which only local context worlds are accessible (Mandelkern, 2019). This explains why (18) is commonly taken as a contradiction. The local context for the right conjunct, assuming that *but* also denotes conjunction, is κ + *It's not raining*. Given the locality constraint, the domain of quantification for the epistemic modal is now restricted by the local context, i.e. to *non-raining*-worlds only.

3.3 Proposal: how conditional readings arise

There is an essential core to Mandelkern's proposal of bounded modality that immediately recalls us of one of the central aims of this paper. That is, it accounts for *how* is it that conditional readings arise from logical connectives. The description turns out to be a bit misleading now. Conditionals are, in fact, derived from modal expressions and how they interact with local contexts. The role of logical connectives is marginal: it determines how local contexts should look like, or to be more precise, their polarity. But this must be understood almost as a side effect of how local contexts are computed; the meaning of *and*/*or* are just

[10]This follows Von Fintel's (1994) implementation, in which a contextual variable assignment g takes a variable i to return a function from worlds to sets of worlds (*accessibility relation*). It also simplifies Kratzer's theory by ignoring ordering sources.

simple conjunction/disjunction, as classical logic has it.

Unsurprisingly, a great majority of examples of CROLC we have seen so far have *will* in its right conjunct/disjunct. Even in cases where there is no overt modal expression, there seems to be a taste of modality to it. We assume that conditional readings arise from modal subordination of *will* (or its covert counterpart WILL), whose domain of quantification is limited by local context. The semantic entry for *will* (and equivalently for WILL) is given in (20). The only difference between (19) and (20) is that the existential is replaced by a universal in truth-conditional meaning (20b).

(20) $[\![\text{will}_i\ p]\!]^{g,\kappa,w}$

a. defined only if $\forall w' : g(i)(w') \subseteq \kappa$;

b. if defined, true iff $\forall w' \in g(i)(w') : [\![p]\!]^{g,\kappa,w'} = 1$

Does this mean that all epistemic modals are sensitive to local context? We don't have a decisive answer to this question yet, but there is evidence suggesting that we might be on the right track. It is easy to construct an example of CROLC using *might*:

(21) a. Be on time and you might get a seat.

b. Be on time or you might miss the first slot.

However, there is something wrong with using *must* to derive CROLC:

(22) a. #Be on time and you must get a seat.

b. #Be on time or you must miss the first slot.

CROLCs with *must* may be difficult to find, but are certainly possible. One naturally occurring example is found in a Tripadvisor review for a restaurant the seemingly serves huge portions:[11]

(23) One portion is enough for two, or you must be really hungry.

CROLCs cannot be counterfactual:

(24) a. #Be on time and you would have gotten a seat.

b. #Be on time or you would have missed the first slot.

Our proposal naturally predicts this, as the local context to which the epistemic modal is evaluated always entails the global context. Since the global context consists of the common ground, the shared state of affairs, and the facts about

[11] `https://www.tripadvisor.com/ShowUserReviews-g189909-d10496719-r653168837-Eepin_Grilli-Mikkeli_Southern_Savonia.html`

the world we take for granted, it is impossible make a counterfactual statement with CROLCs.

4 Towards a dynamic theory of context updates

One key characteristic of CROLC is that everything except the conditional reading goes *unasserted*. This is best shown in the case of conjunction.

(25) Ignore your homework and you will fail this class.

When the speaker utters (25), they are committing to neither of the conjuncts. No obligation to ignore one's homework is issued, nor does the speaker commit to the belief of the statement *you will fail this class*.

Following Portner (2007), let us assume a minimal semantics for each clause-type: declaratives denote propositions, interrogatives denote sets of propositions, and imperatives denote addressee-restricted properties. It is crucial that we assume a uniform pragmatics for the argument to be developed henceforth. Clause-types determine the appropriate component of the context to be updated: declaratives are used to add a proposition to the common ground, interroagtives are used to add a question to the stack of questions under discussion (QUD), and imperatives are used to add a property to the addressee's TDL.

Under this divorced view of denotational semantics and context update functions, a systematic pattern emerges in CROLCs. That is, a linguistic expression that has been used as a restrictor to the domain of quantification of an epistemic modal does not contribute to a global context update. We call this the "extinguishment of context update potentials".

(26) Extinguishment of context update potentials:
The denotation of a linguistic expression E is consumed either locally or globally; if it is subordinated by an epistemic modal, its context update potential is extinguished.

If such a theoretical proposal is correct, it brings us new insights on the dynamics of information in natural language. Namely, if we take a bundle of information that makes up a context to be kept in some computational space, local context can be understood as a "temporal copy" of such computational space, as it begins with κ, the context prior to the utterance. Context update potentials can, in fact, be exerted innocently. This is because, as soon as an utterance finishes, global context will be updated and local contexts will be discarded.

Of course, this is just a sketch of a premature concept of what dynamic pragmatics could look like. Nevertheless, we hope to get at a better understanding of

how local and global contexts are updated in tandem. We believe that investigating (i) how linguistic expressions shape local contexts and (ii) what linguistic expressions are sensitive to local contexts will provide the answer.

5 Conclusion

In this paper, we proposed a unified analysis of the conditional reading of logical connectives (CROLC). Our analysis has several advantages over others: (i) it explains *how* the conditional reading arises in the first place, (ii) it encompasses all of the corners of CROLCs that were often overlooked — CROLCs in non-imperatives, conditional disjunction, etc., and (iii) it does not stipulate anything for the meaning of *and* and *or*. The analysis is parsimonious — it is simply an extension of extant proposals on local context and bounded modality — yet generalizable. In short, conditional readings arise from a local-context sensitive property of epistemic modals. The paper concludes with a brief discussion on how local and global contexts are to be updated in a dynamic pragmatics.

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