On the Interpretation of Disjunction: Asymmetric, Incremental, and Eager for Inconsistency[*]

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At least two questions concerning the interpretation of disjunctive sentences have caused much debate in the linguistic, logical, and philosophical literature. The first question arises from the fact that disjunctive sentences are sometimes read inclusively, and are sometimes read exclusively. Is the existence of this optionality a matter of semantics (ambiguity) or pragmatics (implicature)? The second question has arisen more recently, and concerns the way meaning strengthening (implicature computation) occurs in disjunctive sentences: are meanings strengthened locally at each disjunct, or globally at the root? No consensus has yet emerged. In this paper I present an observation that, to my knowledge, has heretofore gone unnoticed: under certain conditions, $\ulcorner X$ or $Y \urcorner$ is felicitous while $\ulcorner Y$ or $X \urcorner$ is not. This raises a third question: what is the source of the asymmetry? No existing theory of disjunction/meaning strengthening, as far as I am aware, has an answer to this question.

I will use this article to investigate this asymmetry in some detail. We will see that an answer to this third question will also lead us to answers to the first two questions. Very roughly, I will conclude that what is responsible for the asymmetry is a constraint against informational redundancy that is violated by some disjunctions $\ulcorner Y$ or $X \urcorner$ but not by their permuted variants $\ulcorner X$ or $Y \urcorner$. In trying to specify the form of the constraint, I will begin with a well-known redundancy constraint due to Hurford [20] that rules out disjunctions $\ulcorner X$ or $Y \urcorner$ where one

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disjunct entails the other. I will successively (and as conservatively as possible) modify this constraint under the force of counter-examples, converging in the final analysis on a redundancy constraint that: (i) is checked incrementally in the left-right order of the disjuncts, and (ii) requires each "new" disjunct to the right to be inconsistent with the information conveyed by earlier disjuncts. More specifically, I will conclude that the truth-conditional meaning (basic meaning) of each disjunct should be inconsistent with the strengthened meanings of the disjuncts to its left. I will conclude that the most natural way of accounting for this constraint is by use of a dynamic system of interpretation. I will provide a dynamic lexical entry for disjunction that: (i) computes an inclusive reading as the basic meaning, (ii) strengthens locally at each disjunct, (iii) in the left-right order of the disjuncts, (iv) subject to a constraint against informational redundancy that comes with a timing principle dictating the points at which it is to be checked.

I will be unable to derive the redundancy constraint from deeper principles of communication. Nonetheless, I will end the paper by providing a translation procedure which, given a disjunction asymmetry of the kind discussed in this article, produces the well-known asymmetry in Sobel/Reverse Sobel sequences (Lewis [28], von Fintel [8]), suggesting that the constraint I formulate here is a particular instance of a more general constraint governing the dynamics of communication.

1 The Puzzle

Hurford [20] observes that disjunctions $\ulcorner X$ or $Y \urcorner$ where one disjunct entails the other are infelicitous.[1] Following Simons [41], call such sentences "entailing disjuncts."

1. #John was born in Paris or in France.

2. #John was born in France or in Paris.

Let us call whatever it is that rules out entailing disjuncts "Hurford's constraint" (henceforth HC):

Redundancy Constraint 1 (Hurford's Constraint) $\#\ulcorner X$ *or* $Y\urcorner$ *if X and Y are entailing disjuncts.*[2]

Observe that although the disjunctions in (3) and (4) arguably contain entailing disjuncts, they are nonetheless judged felicitous:

Question: Which of John and Mary came to the party?

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[1]I will just say "entailment," but I do not mean by this 'logical entailment;' rather, the relevant notion here is 'contextual entailment.'

[2]I will use the term "entailing disjuncts" to sometimes denote a relation between sentences and at other times a relation between propositions.

3. (John or Mary) or Both [came to the party].

4. John or (John and Mary) [came to the party].

Hurford uses the felicity of (3) along with HC to argue that English *or* is ambiguous between an inclusive and an exclusive reading. For if the first disjunct is read exclusively there is no longer any entailment between the two disjuncts. As such, HC is avoided and the sentence is judged felicitous.

Hurford's argument fails for at least two reasons. First, there is substantial evidence against the conclusion that *or* has an exclusive reading. For instance, Pelletier [31], Gazdar [14] and Simons [41] observe that *or* is always read inclusively in the scope of negation:

5. I didn't eat beef or pork at the party (= I didn't eat beef and I didn't eat pork).

If *or* had an exclusive reading, it would be possible to judge (5) to be true if I ate both beef and pork at the party. Such a reading is unattested.[3] However, one can imagine various responses to this argument, say by tying the particular reading assigned to *or* to the monotonicity of the environment in which it happens to find itself.

A more convincing argument against the existence of an exclusive reading of *or* is the following. First, let us note that n-ary disjunctions $\ulcorner X_1$ or X_2 or $\ldots$ or $X_n \urcorner$ are normally interpreted as 'only X_1 or only X_2 or $\ldots$ or only X_n.' Let us call this "the only-one reading." Simons [41] shows that an exclusive disjunction actually has no way of generating the only-one reading.[4] For instance, consider the case of $n = 3$. An exclusive *or* predicts that $\ulcorner X_1$ or X_2 or $X_3 \urcorner$ is true iff exactly one of the disjuncts is true or all three are. Whatever meanings this disjunction may generate, *that* is certainly not one of them.

A second challenge to Hurford's argument was presented by Gazdar [14]. He argues that the obviation of HC in (3) and (4) is not a fact specific to disjunction, but rather is indicative of a more general phenomenon extending to all scalar items. More specifically, Gazdar argues that HC can be obviated if a (potential) scalar implicature of one of the disjuncts breaks the entailment relation.[5] For instance, in both (3) and (4), the first disjunct has an implicature which is exactly the negation of the second disjunct. Thus if HC is checked not only with respect to the literal content of each disjunct, but with respect to the content of each disjunct (potentially) strengthened by scalar implicature, the felicity of (3) and (4) will be accounted for. Indeed, Gazdar shows that

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[3]Kai von Fintel points out (p.c.) that one actually gets such a reading with heavy stress on "or." See [16] for relevant discussion.

[4]Kai von Fintel (p.c.) and Danny Fox (p.c.) point out that this observation was made earlier by Jim McCawley [30] and Hans Reichenbach [34].

[5]Actually, Gazdar makes a stronger claim, namely that the content of one disjunct strengthened by implicature must be inconsistent with the content of the stronger disjunct. We will begin here by using Gazdar's observation to argue for the weaker claim that implicature can break entailment, and will revisit the issue of inconsistency in Section 3.

the obviation of HC by strengthening extends to other scalar items, such as quantifiers:[6]

6. John ate some of the cookies or he ate all of them.

We can summarize the above discussion as follows. Call a sentence X's truth-conditional meaning its "basic meaning," $M(X)$. Call the conjunction of X's basic meaning with its scalar implicatures its "strengthened meaning," $SM(X)$. The facts examined above suggest that HC does indeed rule out entailing disjuncts unless one of the disjuncts has a strengthened meaning under which entailment no longer holds. Let us call this the Gazdar-Hurford Constraint:

Redundancy Constraint 2 (Gazdar-Hurford Constraint) *#⌐X or Y⌐ for disjunctions meeting the following two properties: (i) X, Y violate HC, i.e. M(X) and M(Y) are entailing disjuncts, and (ii) strengthening of the weaker disjunct does not break the entailment, i.e. if X entails Y, then SM(Y) and M(X) are still entailing disjuncts.*[7]

The GHC captures all the facts we've seen until now. Since (presumably) no implicature is available in (1) and (2),[8] the constraint will rule them out. In (3), (4), and (6), strengthening of the first disjunct obviates HC, and the sentences are thereby judged felicitous under the GHC.

The puzzle I set out to tackle in this article is the following: If scalar implicature can save you from HC by strengthening the first disjunct, why can it not save you from HC by strengthening the second disjunct?

7. #(John and Mary) or (John or Mary) [came to the party].

8. #(John and Mary) or John [came to the party].

9. #John ate all of the cookies or he ate some of them.

In other words, (7) - (9) satisfy the GHC just as well as (3), (4), and (6). To what then do they owe their oddness?

2   Symmetric and Asymmetric Disjunction

I take the above facts to indicate that there is an asymmetry in the interpretation of disjunctive sentences that is somehow related to meaning strengthening. Recall that the connection to meaning strengthening is that strengthening of disjuncts should, under the GHC, save you from violating HC. However, the

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[6]Gazdar did not actually generate strengthened meanings in the scope of logical operators. Only potential implicatures were relevant in his modification of HC. I will continue to use the term "strengthened meaning" to include implicatures generated locally, but it should be kept in mind that Gazdar did not actually allow for local strengthening.

[7]And vice-versa if Y entails X.

[8]We will examine this assumption somewhat more carefully in Section 3.

facts above show that this rescue strategy is available only for earlier disjuncts; strengthening of later disjuncts in order to satisfy the GHC seems to be an option that is simply unavailable. At this point we should like to ask: of the major competing theories concerned with the interpretation of disjunctive sentences, and more specifically those concerned with implicature computation, which are, or can be made to be, compatible with the asymmetries noted above? As it stands, no analysis of disjunction currently on offer is able to capture the asymmetry in any obvious way.

In this section I will briefly discuss the major competing proposals, and will attempt to pinpoint what it is about the systems that renders them (at their respective stages of development) incompatible with the asymmetries. However, I will refrain from any extensive analysis or attempt at synthesis. My overall claim will be that with respect to the asymmetries noted above the theories fall into two camps. One class is composed of theories that predict disjunction to be fully symmetric, and so are inherently incapable of capturing the observed asymmetries without the introduction of some kind of asymmetric element to interpretation. The other class of theories, though encoding an asymmetry into the entry for disjunction, make incorrect predictions with respect to attested readings. However, I include the latter only for completeness. I should emphasize that the theories with an asymmetric disjunction were formulated with an eye towards presupposition projection, not meaning strengthening. As such, since they remain silent on the issue of scalar implicature, what I have to say here is not in any way a criticism of those proposals. Rather, it is simply an investigation of currently existing asymmetric disjunctions, attempting to see if we can just buy some such disjunction off the market and get the asymmetry facts for free. The answer I come to here will be negative, and I will not explore how one might amend such a lexical entry in order to capture the asymmetries.

I should also say a few words about what I mean when I say that the theories predicting disjunction to be symmetric are unable to capture the asymmetries I noted in (7)-(9). What do I mean by "asymmetry?" I do not necessarily mean semantic non-commutativity. Rather, I only mean interpretive asymmetry, in that the interpretation of $\ulcorner X$ or $Y\urcorner$, for whatever reason, can differ in felicity from $\ulcorner Y$ or $X\urcorner$. The point is that when we combine all the assumptions the theories make regarding both semantics and pragmatics, none are able to capture the observed asymmetries. They all predict $\ulcorner X$ or $Y\urcorner$ to be felicitous iff $\ulcorner Y$ or $X\urcorner$ is.

2.1   Symmetric Disjunction

There are three broad classes of theories that predict disjunction to be fully symmetric. More specifically, they all predict (3), (4) and (6) to be as (in)felicitous as (7), (8) and (9).

The first class is composed of systems that compute implicatures "globally" (Horn [19], Gazdar [14], Levinson [25], Spector [42], Sauerland [37], van Rooij

and Schulz [35], Schulz and van Rooij [40], Russell [36]).[9] Such systems compute the basic meaning and strengthened meaning of a sentence Z at the root node. As such, in the interpretation of a disjunction $Z = \ulcorner X \text{ or } Y \urcorner$, such systems are completely blind to information concerning the ordering (linear or hierarchical) of X and Y. It is not exactly clear how such systems might be adapted to account for the asymmetry data in (7) - (9). Part of the difficulty in attempting to articulate how to make such systems compatible with asymmetric disjunction is that they are all silent with respect to HC, and its occasional obviation through scalar implicature (GHC). As such, I leave possible amendments to the proponents of such frameworks to work out. Such amendments will have to address two issues. First, they will have to make sense of the GHC. Second, they will have to answer the question of why the capacity to use strengthened meanings to save the interpretive system from crashing under the GHC is sensitive to the linear order of the disjuncts.

The second class of theories predicting a symmetric disjunction are systems that compute implicatures "locally" (Chierchia [5], Fox [10]). It is noteworthy that much of the argument for local implicatures comes from HC and its obviation through what seems to be the computation of local implicatures (Fox [11], Chierchia, Fox, and Spector [12]).[10] Implicatures arise in such systems with the use of a null operator in the syntax which has a meaning somewhat like that of *only*. This operator is introduced into the syntactic parse in order to generate strengthened meanings. We keep discussion to Fox's system here, though our conclusions follow for Chierchia's system as well.

Fox's operator is an exhaustive operator, a null morpheme *exh*, which can be appended to a sentence X in any position, root or embedded, giving rise to strengthened meaning $SM(X)$. Thus, there are two parses available for (6):[11]

10. [[John ate some of the cookies] or [he ate all of them]]

11. [[*exh*[John ate some of the cookies]] or [he ate all of them]]

Note that only the second of the two parses satisfies HC. It is clear how such systems behave with respect to the GHC. If a parse of $\ulcorner X \text{ or } Y \urcorner$ is generated violating HC, try inserting *exh*. In (6), the parse [[*exh*[*some*]] or [*all*]] will save you from HC, as the GHC predicts it should. The question of course is why *exh* insertion does not save you from infelicity in (9): The parse [[*all*] or [*some*]] will be ruled out by HC, but what rules out the parse [[*all*] or [*exh*[*some*]]]?

[9]Katzir [23] offers a theory of scalar alternatives that is compatible with both global systems and local ones. Since the alternatives of $\ulcorner X \text{ or } Y \urcorner$ are the same as the alternatives of $\ulcorner Y \text{ or } X \urcorner$, unless further assumptions are made regarding how these alternatives are used, his system predicts interpretive symmetry as well. In what follows, any conclusions I draw concerning "global systems" should not be construed as making any claims concerning Katzir's theory of alternatives, since it is not tied to globalism in any way.

[10]Again, none of the globalist responses have addressed this issue. Nor does Geurts [16], who provides an otherwise comprehensive survey of the kinds of examples that have been cited in the literature as cases of local implicatures,

[11]*exh* actually takes two arguments: the prejacent and a set of alternatives. I suppress the latter to reduce eye clutter.

According to the GHC, this parse should not only be preferred, it should be forced in order to save the sentence from infelicity.

There might, of course, be alternative accounts of the infelicity of (9). However, a theory wishing to maintain HC as the source of infelicity in such examples while maintaining *exh* insertion as the mechanism for generating strengthened meanings will require the introduction of further constraints on *exh* insertion. Such constraints will have to rule out a parse like [[*all*] or [*exh*[*some*]]] but allow a parse like [[*exh*[*some*]] or [*all*]]. But what kind of constraint might that be? There seems to be no obvious static requirement on the syntax or semantics (proposition computed at the root) that might plausibly prevent the insertion of *exh* into the second disjunct. Since we have evidence that *exh* cannot be inserted into this disjunct, it seems that whatever additional constraint is postulated, it will have to involve some asymmetric component to it. For thoughts on what such a constraint might be, designed to account for the asymmetries noted above, see Fox, Spector and Chierchia [12].

The third class of systems predicting a fully symmetric disjunction are what I will call "list systems" approaches (Simons [41], Zimmerman [45], Geurts [15]). Although the systems differ with respect to implementation details and predictions, we may extract a relevant core that they all share, at least regarding meaning strengthening. According to such systems, a disjunction $\ulcorner X$ or $Y \urcorner$ is interpreted as a list of possibilities $\mathcal{L} = \{SM(X), SM(Y)\}$. Second, there will be a constraint on the well-formedness of lists, stipulated or derived, that ensures that the propositions in the list share no worlds in common. Note that this constraint on list well-formedness can be used to capture the exclusive reading of disjunctions.[12] However, since lists are understood in these systems as simply unordered sets, $\ulcorner X$ or $Y \urcorner$ and $\ulcorner Y$ or $X \urcorner$ will always give rise to the same list, viz. $\mathcal{L} = \{SM(X), SM(Y)\}$.[13] As such, however one may wish to reformulate either list systems and/or the GHC to make the co-exist, there will be no room for asymmetries as currently formulated.

In my own analysis, I will actually adopt a modified version of the list systems approach. I will argue that two important innovations are required. First, the actual left-right construction of the list is important. Second, constraints on list well-formedness are to be checked at particular points in the construction of the list. The relevant well-formedness constraint in list systems approaches is a check for inconsistency between list members. Our working generalization (the GHC) currently posits non-entailment as the relevant constraint. Which of the two well-formedness constraints should be used will be the topic of Section 3. Either way, the overall architecture I adopt will be very much like the list systems discussed here. Again, the major modifications I offer will be: (i)

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[12]More generally, the only-one reading.

[13]Geurts [15] has some wiggle room for asymmetries in the interpretation of disjuncts where each disjunct is overtly modalized. If the (contextually determined) domain of one modal depends on the content of the prejacent of the other, then there may be asymmetric effects. However, such considerations are irrelevant to the examples at hand, where no such asymmetries can be generated. I will leave aside the interpretation of overtly modalized sentences in this paper.

the introduction of dynamic factors, such as phases in the construction of the list, and (ii) timing principles dictating the points at which well-formedness constraints are to be checked.

2.2   Asymmetric Disjunction

There exists in the literature an asymmetric entry for disjunction framed within a dynamic system of interpretation. The entry is the following: a sentence $\ulcorner X$ or $Y \urcorner$ is interpreted as 'X or $(Y$ and $\neg X)$.' This entry is due to Karttunen [22]. The basic idea is that the interpretation of $\ulcorner X$ or $Y \urcorner$ is essentially 'X, or else Y.' Unfortunately, this entry doesn't quite work for meaning strengthening. For consider the question *which of John, Mary, and Sue came to the party?*, and consider its answer *(j and m) or s*. The above entry predicts that the sentence should be interpreted as '(j and m) or (s and (¬j or ¬m)).' As such, the sentence should be judged true in a context where John and Sue, but not Mary, came to the party. But the sentence doesn't have any such reading. Indeed, the only available reading is that either only John and Mary came to the party (but not Sue), or only Sue came to the party (and neither of John or Mary did). Thus, it seems we will not be able to simply purchase wholesale this already existing asymmetric entry from the dynamic semantics literature. Something more will need to be said to allow this entry to generate the correct strengthened meanings, such as (eg.) the only-one reading. I will not attempt such a modification here, nor will I attempt to say anything concerning how such an entry might be expected to interact with redundancy constraints such as the GHC. Instead, I will turn now to my own proposal concerning the puzzle outlined in Section 1.[14]

3   The Generalization

Recall that we are interested in the constrast between (3), (4), and (6), on the one hand, and (7), (8), and (9) on the other. We repeat them here:

3. (John or Mary) or Both [came to the party].

4. John or (John and Mary) [came to the party].

6. John ate some of the cookies or he ate all of them.

7. #(John and Mary) or (John or Mary) [came to the party].

8. #(John and Mary) or John [came to the party].

9. #John ate all of the cookies or he ate some of them.

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[14] For in depth discussion of this lexical entry in the context of the theory of presupposition, see Beaver [2] and Schlenker [38, 39].

As we've seen, our current constraint (the GHC) is unable to capture the desired contrast. In this section I will try to make conservative enrichments to the GHC in an attempt to find the right generalization. I will ultimately conclude that an asymmetric version of Gazdar's own contraint (cf. Footnote 5 on p.3) is correct, requiring $M(Y)$ to be inconsistent with $SM(X)$ in $\ulcorner X$ or $Y \urcorner$. This constraint thus has two important ways in which it deviates from the GHC: (i) there is an asymmetry in that the strengthened meaning of only the first disjunct is relevant (as opposed to the GHC, which allows for strengthening of the weaker disjunct no matter what its relative position), and (ii) the relation that must hold between $SM(X)$ and $M(Y)$ *inconsistency* (as opposed to the GHC, which is a check for non-entailment). This is, of course, a quite radical amendment to the GHC with very little intuitive support behind it, so we should accept it only if forced to. I will spend this section trying to show that we are indeed forced to accept this constraint as operative in linguistic communication.

3.1   Part I: Introducing Asymmetries

One problem with the GHC is that it makes no room for asymmetries between X and Y. Let us begin by making the GHC sensitive to the order (hierarchical or linear) between X and Y:

Redundancy Constraint 3 (Asymmetric GHC) *#$\ulcorner X$ or $Y \urcorner$ if: (i) M(X), M(Y) are entailing disjuncts, and (ii) SM(X), M(Y) are also entailing disjuncts.*

For instance, consider the contrast between *j or (j and m)* and *(j and m) or j)*. $SM(j) = [Oj]$, M(j and m) $= [jm]$.[15] Since there is no entailment between the two, the sentence *j or (j and m)* is judged felicitous. In the reverse order, SM(j and m) $= [jm]$, $M(j) = [Oj] \cup [jm]$. In this case, the former proposition is a subset of the latter, so we have entailment, and the sentence is judged infelicitous. Similar calculations show that the constraint captures the desired contrast between (3), (4), (6) and (7)-(9).

3.2   Eliminating Entailment Conditions

Upon closer inspection, we see that we can tighten the statement of the constraint even further. As stated, there are two conditions a disjunction $\ulcorner X$ or $Y \urcorner$ must meet in order for it to be ruled out under the AGHC. Both conditions are stated in terms of entailment. We will see that both conditions will have to be given up.

Consider condition (i) first, which requires $M(X), M(Y)$ to be entailing disjuncts. Is this necessary? The following example would suggest not, if it does indeed instantiate the same kind of infelicity we have been investigating throughout this paper:

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[15]Let $[Oj] = \{$w: John came to the party in w but Mary didn't$\}$, $[jm] = \{$w: John and Mary both came to the party in w$\}$.

12. #John ate some or not all of the cookies

The sentence is extremely odd, and one would like for its oddness to be derived from whatever it is that rules out sentences like *John ate all of the cookies or he ate some of them.* However, note that in this example, as opposed to the others examined so far, the basic meanings of the disjuncts are not entailing disjuncts. However, the strengthened meaning of the first disjunct, 'John ate some but not all of the cookies,' does indeed entail the basic meaning of the second disjunct. This suggests that (i) is not necessary, and only (ii) is operative. We may then strengthen our constraint by eliminating (i), and keeping only (ii):

Redundancy Constraint 4 (Strengthened AGHC) $\#\ulcorner X$ *or* $Y\urcorner$ *if* $SM(X)$, $M(Y)$ *are entailing disjuncts.*

Further support for the move to eliminate (i) from the AGHC comes from the following example:

Question: *Which of John, Mary, and Sue came to the party?*

13. #(j or m) or (j or s)

Note that, as with (12), the basic meanings do not constitute an instance of entailing disjuncts. However, observe that the Strengthened AGHC (SAGHC) is also incapable of capturing the oddness of this example, since the strengthened meaning of the first disjunct and the basic meaning of the second disjunct do not stand in an entailment relation: $SM(j \text{ or } m) = [j, \neg m, \neg s] \cup [\neg j, m, \neg s]$, $M(j \text{ or } s) = [j, m, s] \cup [j, m, \neg s] \cup [j, \neg m, s] \cup [j, \neg m, \neg s] \cup [\neg j, m, s] \cup [\neg j, \neg m, s]$. It is clear that there is no subset relation in either direction. For instance, $M(j \text{ or } s)$ contains worlds not in $SM(j \text{ or } m)$, eg. $[j, m, s]$, and so can't be a subset of it. On the other hand, $SM(j \text{ or } m)$ contains worlds that are not in $M(j \text{ or } s)$, viz. $[\neg j, m, \neg s]$. As such, the SAGHC does not predict the infelicity of this example. Of course, examples (12) and (13) may be odd for reasons that have nothing to do with our successive modifications of Hurford's Constraint. But to the extent that we wish to, and are able to, give a unifying account of these facts, what might be the relevant factor connecting them all?

Our answer can be found in Gazdar's own modification of HC.[16] Gazdar reformulated HC to say that the strengthened meaning of the weaker disjunct must be *inconsistent* with the basic meaning of the stronger disjunct. For Gazdar, you begin with an entailing disjunct, and the way you rescue yourself is by taking the weaker disjunct and running an implicature on it so that its strengthened meaning will be inconsistent with the basic meaning of the stronger disjunct.[17] Note however that inconsistency is not required for successful obviation of entailment. For instance, in the following sentence $\ulcorner X$ or $Y\urcorner$ uttered in a context where there are five cookies in the domain, the basic meanings of X and Y are

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[16]cf. Footnote 5 on p.3, and the discussion of list systems approaches at the end of Section 2.1.

[17]With the caveat expressed in Footnote 6 on p.3.

entailing disjuncts. Note however that strengthening of X breaks the entailment but not the consistency:

14. #John ate some of the cookies or he ate at least three of them

Further evidence that consistency between disjuncts, not entailment, seems to be the source of infelicity comes from the following example due to Noam Chomsky (p.c.):

15. #John was born in Russia or in Asia

(12) and (13) teach us that $M(X), M(Y)$ need not be entailing disjuncts for $\ulcorner X$ or $Y \urcorner$ to be ruled out. (13)-(15) teach us that $SM(X), M(Y)$ also need not be entailing disjuncts for $\ulcorner X$ or $Y \urcorner$ to be judged infelicitous. My suggestion here, following Gazdar's own modification of HC, is that we strengthen the SAGHC by turning "entailment" into "consistency".[18] Indeed, we trust that the reader can verify that in all of the examples we have seen until now, the disjunction is felicitous iff $SM(X) \cap M(Y) = \emptyset$. Thus, the correct generalization seems to be encoded in the following constraint:[19]

Redundancy Constraint 5 (Constraint Enforcing Inconsistency) *#$\ulcorner X$ or $Y \urcorner$ if $SM(X), M(Y)$ are consistent with one another, i.e. have non-empty intersection.*

Note that satisfaction of this constraint does not determine the interpretation of a disjunction. Take *j or m* for example. $SM(j) = [Oj], M(m) = [jm] \cup [Om]$. Since $SM(j) \cap M(m) = \emptyset$, the CEI is satisfied. However, this still leaves open the question: do we strengthen the second disjunct or not? That decision will depend on other factors that are irrelevant to the CEI, which is just a formal constraint limiting the arrangments of sentences.

Note further that since we check the CEI at the truth-conditions of the second disjunct, and not its strengthened meaning, we predict that in some violations of the CEI, adding an overt *only* to the second disjunct should improve the sentence. This is indeed what we find:

16. John ate all of the cookies or only some of them

17. John and Mary came to the party or only John did

3.3   A Worry About Inconsistency

I should like in this section to discuss a potential difficulty with the CEI, but before doing so, let me briefly retrace the steps we took in arriving at this

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[18]Gazdar gave no evidence that such a radical revision of HC was necessary. The above examples suggest that Gazdar's conclusion was correct, though the argument that led to it was not sound.

[19]This is the final version of our redundancy constraint. It will not undergo any further modification, because it seems to be correct.

constraint. We began with HC, a constraint ruling out entailing disjuncts. We took seriously Gazdar's conclusion that meaning strengthening can obviate HC. We then formulated the GHC in an attempt to capture this intuition. However, we saw that the GHC was unable to deal with the asymmetries in disjunction, and so went on to formulate the AGHC, a constraint that checks whether or not a subset relation holds between the strengthened meaning of the first disjunct and the basic meaning of the second disjunct. All throughout, it was assumed that a requirement on infelicity was that the basic meanings of the disjuncts be entailing disjuncts. But we then observed that this requirement is not necessary, an observation that led us to the SAGHC. Finally, we noted that what seems to be operative in the SAGHC is not a check for entailment between $SM(X)$ and $M(Y)$, but rather a check for consistency. This successive modification of redundancy constraints finally led us to the CEI:

- HC: $\#^{\ulcorner}X$ or $Y^{\urcorner}$ if $M(X), M(Y)$ entailing disjuncts

- GHC: $\#^{\ulcorner}X$ or $Y^{\urcorner}$ if (i) $M(X), M(Y)$ are entailing disjuncts, and (ii) strengthening does not break the entailment

- AGHC: $\#^{\ulcorner}X$ or $Y^{\urcorner}$ if: (i) $M(X), M(Y)$ are entailing disjuncts, and (ii) $SM(X), M(Y)$ are also entailing disjuncts

- SAGHC: $\#^{\ulcorner}X$ or $Y^{\urcorner}$ if $SM(X), M(Y)$ are entailing disjuncts

- CEI: $\#^{\ulcorner}X$ or $Y^{\urcorner}$ if $SM(X) \cap M(Y) \neq \emptyset$

The CEI encodes an intuition that Gazdar shared with the list systems approaches to disjunction, viz. that the information conveyed by each disjunct must be inconsistent with the information in the other disjuncts, containing no redundancy whatsoever.[20] This is a rather strong requirement, and it is not entirely clear why it should play a role in linguistic communication. Note further that the CEI adds a rather unnatural sort of complication to the Gazdar/List Systems intuition, in that the relevant units of information that need to meet the inconsistency requirement are the *strengthened* meaning of the first disjunct but the *basic* meaning of the second.[21] But why should that be the constraint? Why not check to ensure that the totality of the information conveyed by the second disjunct, including meaning strengthening, is inconsistent with what has come before it? Since strengthening is an option, and since the disjunct's strengthened meaning will often enough be what is actually conveyed, why check for inconsistency at its basic meaning? Unfortunately, I have no answers to these questions, but before even attempting to address them, perhaps we should ask: have we jumped the gun? What pushed us to conclude that (in)consistency, rather than (non-)entailment, was the relevant factor?

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[20] Again, with the caveat noted in Footnote 6 on p.3.

[21] And the basic meaning of the third disjunct must be inconsistent with the strengthened meanings of the first two disjuncts, etc.

Recall that a check for entailment would not have ruled out (13)-(15), whereas a check for consistency does rule them out. Indeed, a check for consistency captures all the data examined so far. But that might be due to having not examined a broad enough data set. The following sample, for instance, is composed of disjuncts that are consistent with one another, yet display no obvious oddness of any kind:

18. The point is on Line A or on Line B (where Line A and Line B intersect)[22]

19. John is either tall or fat[23]

20. John is either rich or famous[24]

If these are indeed counterexamples to the CEI, then perhaps the best strategy would be to simply stick to the SAGHC and list (13)-(15) as exceptions, and search for some alternative explanation of why they are odd. Note that, intuitively, being on Line A does not rule out being on Line B, nor is John's being tall inconsistent with his being fat, nor is his being rich inconsistent with his being famous.

Recall, however, that the CEI is not interested in the basic meanings of the first and second disjuncts, which are indeed consistent as noted above. Rather, it is interested in the following question: in disjunction $\ulcorner X$ or $Y \urcorner$, is $SM(X)$ consistent with $M(Y)$? To be able to determine whether this is so in these examples, we need to say something about what $SM(X)$ might be for each X in (18)-(20). We have so far remained as neutral as possible about the mechanism generating strengthened meanings. We will try to remain so here as well, but we will not be able to avoid theoretical commitments entirely.

In order to proceed, I will need to assume that when $\ulcorner X$ or $Y \urcorner$ is uttered, in computing $SM(X)$, we have available the alternative $\ulcorner X$ and $Y \urcorner$, and do not have available the alternative $\ulcorner X$ and $\neg Y \urcorner$.[25] In our cases then, SM(The point is on Line A) $= LineA \wedge \neg LineB$, SM(John is tall) $= tall \wedge \neg fat$, SM(John is rich) $= rich \wedge \neg famous$. As such, $SM(X)$ will indeed be inconsistent with $M(Y)$ in each case, and so the felicity of these examples will be derived.

However, as pointed out to me by Roni Katzir (p.c.), we are now in danger of losing the basic Hurford cases that we started out with. For example, consider

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[22]Danny Fox, p.c.

[23]Roni Katzir, p.c.

[24]Vann McGee, p.c.

[25]There are many possible implementations of this idea. For example, when there is an explicit question, such as *where does the point lie?*, we will have the following alternatives: {The point is on Line A, The point is on Line B, The point is on Line A and Line B}. We also have in place context-independent theories of the alternatives of disjunction (Sauerland [37], Katzir [23]). In these theories, the alternatives of any disjunction $Z = \ulcorner X \vee Y \urcorner$ are $ALT(Z) = \{X \vee Y, X, Y, X \wedge Y\}$. We will assume that in the absence of any explicit or implicit question, these formal alternatives are always available to be used locally. Finally, we assume that $SM(X)$ is computed with respect to a set of alternatives by "innocent exclusion" (Fox [10]). For our purposes, it is enough to say that innocent exclusion will negate stronger alternatives, though this doesn't quite precisely capture the formal operation presented in [10].

again *John was born in France or in Paris*. If we have the alternative $f \wedge p \equiv p$, then $SM(f) = f \wedge \neg p$, i.e. the strengthened meaning of the first disjunct should convey the information that John was born in France but not in Paris. As such, $SM(f)$ and $M(p)$ should be inconsistent, and the sentence should thus be judged felicitous. But of course the sentence is not judged to be felicitous, so it would seem that there must be a crack in the system.

I respond to this objection by denying that the strengthened meaning of *John was born in France* can ever be anything other than its basic meaning. To make the argument, I need to make use of an observation due to Danny Fox (Fox [10]). Fox's observation is that there is a very general way to paraphrase the strengthened meaning of any sentence:

Paraphrasing Strengthened Meanings The strengthened meaning of a sentence S can always be paraphrased by asserting *only S'*, where S' is like S but with focus on the relevant items.

Now, let us make the conjunctive alternative to $\ulcorner X \text{ or } Y \urcorner$ relevant by explicitly asking whether or not it is true:

21. Is the point at the intersection of Line A and Line B?
    No! It's only on LINE A.

22. Is John both tall and fat?
    No! He's only TALL.

23. Is John both rich and famous?
    No! He's only RICH.

I use these examples to illustrate that the strengthened meanings I claimed X has in each case are indeed the ones it has, given the felicitous paraphrases. For instance, given the felicitous dialogue in (21) we can conclude that $SM(LineA) = LineA \wedge \neg LineB$. However, observe that it is simply impossible to carry out such a dialogue in our Paris/France example:

24. Is John from Paris?
    # No! He's only from FRANCE.

I do not know why (24) should be infelicitous. However, given that it is, it suggests that there is no way to strengthen *John is from France* to mean something like John is from France but not from Paris, even when John's being from Paris is relevant and, moreover, is a possibility that has already been rejected. Whatever else this fact may tell us about meaning strengthening, about the semantics of *only* and about the meaning of *France*, it teaches us that $SM(f) \neq f \wedge \neg p$. Thus, assuming the Sauerland alternatives for disjunction, along with the local strengthening procedure outlined in Footnote 24 on p.13, the felicity of (18)-(20) can be derived without predicting that sentences like

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John was born in France or in Paris should be felicitous.[26] The reader can verify that all the other examples covered so far are captured by the CEI. Thus, we conclude that the CEI is correct as it stands.

4   Making Sense of the Generalization: Taking Dynamics Seriously

HC seems to be in little need of justification. If you have entailing disjuncts, one of the disjuncts is wholly vacuous, so what is it doing there in the first place? However, we've seen that the constraint that needs no justification does not adequately capture the facts. In its stead, we have proposed that the CEI is operative in linguistic communication. But what justification can there be for such a constraint? Why should inconsistency between disjuncts be required? And if inconsistency between disjuncts is required, why should we find asymmetries the way we do, i.e. why should each disjunct to the right be required to be inconsistent with the information to its left? And given some sort of left-right asymmetry, why should the constraint be checked at the basic meaning of later disjuncts rather than at their strengthened meanings, i.e. why check for inconsistency between $M(Y)$ and $SM(X)$ instead of checking for inconsistency between $SM(Y)$ and $SM(X)$? I am afraid that the reader looking for answers to these questions will not find them here. Although I am unable to derive the CEI from deeper principles of communication, or rationalize it in any insightful way, I do believe the generalization has consequences for the architecure of interpretation. I would like to take this section to comment briefly on what I take the significance of the generalization to be.

First, the left-right asymmetry cries for a dynamic analysis of interpretation. There seems to be no obvious structural difference between earlier and later disjuncts that might plausibly be held responsible for the observed asymmetries. Interpretive asymmetries have often been thought to provide evidence for dynamic systems of interpretation (Stalnaker [43], Karttunen [22], Heim [18], van Benthem [4], von Fintel [8], inter alia). The asymmetry discussed here seems to share a family resemblance with these other examples, all pushing us away from static Semantic Systems to dynamic ones. What do I mean by "Semantic Systems?" I follow Fox [9] and use this term to denote those interpretive systems responsible for using syntactic structures in thought and communication. More broadly, Syntax will generate syntactic structures, and these will be used by interpretive systems on both the PF side of the grammar and the LF side of the grammar.[27] A guiding intuition is that on both sides, the expressions

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[26]Kai von Fintel and Irene Heim (p.c.) point out that there are variants of these sentences that make them better, eg. *John was born in Paris, or at least in France.* I read these not as actual disjunctions, but as retractions, whereby the speaker weakens her initial assertion. Of course, it is probably not accidental that one performs this weakening by use of *or*. More will need to be said about these cases. See Jackson [21] for relevant discussion.

[27]Again, the terminology and the architectural considerations come directly from Fox [9]. See also Marantz [29] for related discussion.

generated by Syntax serve as instructions for action (Chomsky [6]). On the PF side, these can be thought of as instructions to the articulators. On the LF side, these can be thought of as "instructions specifying certain operations of context change" (Heim [18]). For the instruction denoted by n-ary disjunctions $Z = \ulcorner X_1 \text{ or } X_2 \text{ or } \ldots \text{ or } X_n \urcorner$, please see the interpretive procedure outlined at the end of this section, as well as the Appendix.[28]

Second, in attempting to capture the essence of the asymmetry, we proposed the idea that we accummulate information as we process a disjunction from left-right. As we build this informational base, we continually check each new disjunct to ensure that it is wholly informative, in that it can only but add information on top of what we've accumulated so far. No redundancies allowed. This inconsistency requirement thus seems to vindicate the list systems approaches to disjunction, which required that list items share nothing in common.

Third, since earlier disjuncts sometimes need to be strengthened in order to allow for inconsistency to be met, local strengthening seems to be necessary. Indeed, HC and its occasional obviation are some of the strongest arguments in favour of local strengthening,[29] and it is therefore no surprise that globalist corners have been silent on the matter.

Finally, there are crucial timing principles involved. As we build up our information, we check that new disjuncts are informationally disjoint from what we have accumulated so far. Since local strengthening is an option, this raises a choice point in the design of the interpretive system. For instance, it makes perfectly good sense to think of a system that would look at the strengthened meanings of the disjuncts and check for inconsistency between strengthened meanings. Such a system would be fine, for example, with *(j and m) or j*, since $SM(j \text{ and } m) \cap SM(j) = \emptyset$. Such a system wouldn't be fine with something like *John was born in France or Paris*, since, as observed earlier, strengthening can't help you here. However, natural language has opted to check for inconsistency essentially "as soon as possible," viz. at the basic meaning of the disjunct. Thus, our interpretive system seems to be "eager for inconsistency," and we seem forced to go dynamic due to the presence of timing principles such as the following:

Timing Principle Check for inconsistency at the truth-conditional output of the disjunct currently being interpreted.

Note that this timing principle suggests a two-step procedure in interpretation, where basic meanings are computed "first," with strengthening taking place on top of basic meanings. Thus, strengthening is computationally costly, in that it requires further action on the part of the interpretive system after

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[28]The instruction as stated in these places is not quite complete, for such instructions generally have definedness conditions, which we haven't discussed here. A fuller analysis would spell out the definedness conditions as well as accommodation instructions in case those definedness conditions are not met.

[29]See especially Fox [11] and Chierchia, Fox, and Spector [12].

having already computed the basic meaning. We have tried to remain as non-committal as possible as to the source of the strengthening. Our discussion so far is consistent with a wide variety of approaches: exhaustive operators in the syntax (Fox [10], Chierchia [5]), local pragmatics (Landman [24], Levinson [26], Recanati [33], alternatives used locally (Katzir [23] is compatible with such an approach)), dynamic minimization on ordered information states (van Benthem [3]), and many others besides. The only approaches to implicature this paper seems entirely incompatible with are global pragmatic systems. Indeed, consider the fact that the asymmetry manifests itself not just at the level of speech acts of disjunctive assertions, but rather anywhere a disjunction may be embedded:

25. Every student who reads *Syntactic Structures* or (*Syntactic Structures* and *Aspects*) becomes a syntactician.

26. #Every student who reads (*Syntactic Structures* and *Aspects*) or *Syntactic Structures* becomes a syntactician.

Indeed, such a fact lends further support to a dynamic analysis of interpretation, given the following plausible LFs for (25) and (26) in a dynamic framework (eg. Heim [17, 18]):

27. Every x_i, x_i a student, x_i reads SS or (SS and A), x_i becomes a syntactician.

28. Every x_i, x_i a student, x_i reads (SS and A) or SS, x_i becomes a syntactician.

Interpretation of an LF such as (27) in a dynamic system is compatible with a wide range of meanings, basically all possible choices of an inclusive/exclusive reading for each individual in the domain. This variety of available readings seems to be correct. An LF such as (28) will be uninterpretable because it violates the CEI.

In summary, we are led to a view of the interpretation of disjunctive sentences that shows it to be dynamic and strongly resistant to redundancy. Non-redundancy is enforced through the use of a formal constraint that kicks in under the dictation of timing principles. We capture this interpretation in the following procedure:[30]

Procedure for the interpretation of disjunctive sentences Let $Z = \ulcorner X_1$ or ... or $X_n \urcorner$ be a disjunctive sentence. Begin with an empty proposition $\mathcal{L}$ (i.e. a set with no worlds). Take each disjunct in the left-right order in which it appears, and check that its basic meaning has no overlap with $\mathcal{L}$, i.e. check that $\mathcal{L} \cap M(X_i) = \emptyset$. If there is intersection, halt and output '#'. If there is no intersection, compute $SM(X_i)$ and add it to $\mathcal{L}$, so that

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[30]Strengthening is always optional, though the statement here does not indicate this optionality. For a more explicit statement incorporating the optionality of strengthening, see the Appendix.

the new $\mathcal{L}$ is the old $\mathcal{L}$ plus the worlds in $SM(X_i)$. Move to the next disjunct and repeat the above steps. Output $\mathcal{L}$ if all disjuncts satisfy the CEI.

5　Concluding Remarks

One can read the literature on HC and its modifications in one of two ways. First, one can begin from the observation that entailing disjuncts are generally infelicitous and work one's way to the observation that entailment can be obviated by scalar implicature. Alternatively, one can begin with the idea that disjuncts must be informationally disjoint. The infelicity of disjuncts that entail one another even after strengthening will then fall out as a special case of a violation of consistency. If the basic meanings happen to be entailing disjuncts, the required inconsistency can sometimes be met if local strengthening is available for earlier disjuncts. Gazdar thought that meaning strengthening was saving you from entailment, but what it seems to have really been doing was ensuring inconsistency.

I have been unable to derive the CEI from any deeper semantic or pragmatic principles. I also refrain from speculating here as to what might be responsible for both the CEI and its associated timing principle. One has the intuition that such dynamic effects are related to other dynamic effects that have been investigated in the literature, such as Sobel and Reverse Sobel sequences (Lewis [27], von Fintel [8]), shrinking and growing permission, reference, and modal possibilities (Lewis [28]), and other well-formedness constraints on disjunction (Stalnaker [44], Jackson [21]).[31] How, if at all, these domains relate is a question I leave for future investigation.

However, one parallel is particularly striking, and I would like to dwell somewhat on this parallel here. I do so because it seems to suggest that a unified theory of discourse dynamics may be lurking about somewhere in this neighbourhood. We have been concerned in this paper with the occasional asymmetry between $\ulcorner X$ or $Y \urcorner$ and $\ulcorner Y$ or $X \urcorner$. Suppose we have a case of disjunctions where $\ulcorner Y$ or $X \urcorner$ violates the CEI but $\ulcorner X$ or $Y \urcorner$ doesn't. Now, run the following procedure. For some suitable W, V, form the sentences $Z_1 = \ulcorner$if it were the case that X, then it would be the case that $W \urcorner$, and $Z_2 = \ulcorner$if it were the case that Y, then it would be the case that $V \urcorner$. One finds that the sequence of couterfactuals $\ulcorner Z_1$; but $Z_2 \urcorner$ is felicitous while the sequence $\ulcorner Z_2$; but $Z_1 \urcorner$ is infelicitous. In other words, we have a (nearly) formal procedure for translating our disjunction asymmetry into the asymmetry between Sobel Sequences and Reverse Sobel Sequences:[32]

29. John or (John and Mary) [came to the party]

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[31] Especially when combined with lazy evaluation procedures (Abelson and Sussman [1]).

[32] "Nearly" because we still need to select suitable W and V. The procedure can be made explicit by selecting any W, V that are mutually disjoint and exhaust the space of possibilities. But this would only capture a subset of the cases.

30. If John had come to the party, it would have been lively; but if John and Mary had come it would have been drearyitem

31. # (John and Mary) or John [came to the party]

32. # If John and Mary had come to the party, it would have been dreary; but if John had come, it would have been lively

33. # Either John came to the party or only John did [come to the party]

34. # If John had come to the party, it would have been dreary; but if only John had come, it would have been lively[33]

35. John ate some of the cookies or he ate all of them

36. If John had eaten some of the cookies, he would have been happy; but if he had eaten all of them he would have been miserable

37. # John ate all of the cookies or he ate some of them

38. # If John had eaten all of the cookies, he would have been miserable; but if he had eaten some of them he would have been happy

39. John ate all of the cookies or he ate only some of them

40. If John had eaten all of the cookies, he would have been miserable; but if he had eaten only some of them he would have been happy

41. # John ate some or not all of the cookies

42. #If John had eaten some of the cookies, he'd have been happy; but if he hadn't eaten all of them he'd have been miserable

43. # John was born in Paris or in France

44. # If John had been born in Paris, he'd have been a poet; but if he had been born in France, he'd have been a philosopher

45. # John was born in France or in Paris

46. # If John had been born in France, he'd have been a philosopher; but if he had been born in Paris, he'd have been a poet

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[33]Note that, under standard treatments of counterfactual sequences (Lewis [27], von Fintel [8]), the contrast between (30) and (34) means that worlds in $[jm]$ cannot be construed as being closer to the evaluation world than the worlds in $[Oj]$. I don't know what this would follow from.

The above evidence seems suggestive, but suggestive of what I cannot say. For now, I make the following conclusions concerning the interpretation of disjunctive sentences: (i) The basic meaning (that comes 'for free') is inclusive, (ii) exclusive and only-one readings occur by strengthening, (iii) strengthening occurs locally, (iv) in the left-right order in which disjuncts appear, (v) after the disjunct has been verified as being inconsistent with what's been seen before it. If (v) is not met, the disjunction will be rejected as infelicitous.

6 Appendix

Let $M(X)$ be the basic meaning of sentence X, $SM(X)$ its strenghtened meaning. Let $I(X) \in \{M(X), SM(X)\}$. Let $Z = \ulcorner X_1$ or X_2 or $\ldots$ or $X_n \urcorner$ be a disjunction uttered in context c. Interpretation of Z proceeds according to the following algorithm:

```
      Initialize:  L ⟵ ∅

for  i = 1, . . . , n
    if  L ∩ M(Xᵢ) = ∅
        then L ⟵ (L ∪ I(Xᵢ))
        else Output ''#'' and Halt
    end if
end for
Output L, and perform the following operation:  c ∩ L ⟵ c
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The disjunction is infelicitous if every way of interpreting it outputs $\#$.

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