Conditionals as Definite Descriptions
(A Referential Analysis)[1]

Philippe Schlenker

Third Draft (last modified: October 5th, 2003)

To appear in *Research on Language and Computation,* Special Issue on 'Choice Functions in Semantics', ed. R. Kempson and K. von Heusinger

Abstract: In *Counterfactuals*, David Lewis noticed that definite descriptions and conditionals display the same kind of non-monotonic behavior. We take his observation literally and suggest that *if*-clauses are, quite simply, definite descriptions of possible worlds (related ideas are developed in Bittner 2001). We depart from Lewis's analysis, however, in claiming that *if*-clauses, like Strawsonian definite descriptions, refer. We develop our analysis by drawing both on Stalnaker's Selection Function theory of conditionals and on von Heusinger's Choice Function theory of definiteness, and by generalizing their analyses to plural Choice/Selection Functions. Finally, we explore some consequences of this referential approach: being definites, *if*-clauses can be topicalized; the word *then* can be analyzed as a pronoun that doubles the referential term; the syntactician's Binding Theory constrains possible anaphoric relations between the *if*-clause and the word then; and general systems of referential classification can be applied to situate the denotation of the descriptive term, yielding a distinction between indicative, subjunctive and 'double subjunctive' conditionals.

0 Introduction

After developing his logic of counterfactuals (Lewis 1973), David Lewis noted -almost in passing- that a weakened form of his system could be applied to definite descriptions, *modulo* a change of domain (possible worlds were replaced with individuals, and *if p, q* was replaced with *[the P] Q*). The crucial observation, which I henceforth call 'Lewis's Generalization', was that the non-monotonic behavior of natural language conditionals is shared by definite descriptions, in a way that is not predicted by standard Strawsonian or Russellian treatments. For many years, Lewis's observation went largely unnoticed. The present paper is an attempt to revive it, and to take it quite literally: we suggest that *if*-clauses are simply definite descriptions of possible worlds. (Similar ideas were developed independently by Maria Bittner, who built upon important work on modality by Matthew Stone (Stone 1997, Bittner 2001); earlier versions of the present theory were presented in Schlenker 1999, 2000, 2001. I do not attempt a systematic comparison in this article).

Following Lewis's intuition, we will suggest that *if* should be seen as the form taken by the word *the* when it is applied to a description of possible worlds. However we depart from Lewis in claiming that both definite descriptions and *if*-clauses refer, something that Lewis's

[1] I wish to thank the following for comments and remarks on various stages of this research: J. Almog, R. Bhatt, P. Dekker, K. von Fintel, B. Geurts, V. Gliozzi, K. von Heusinger, S. Iatridou, H. Kamp, E. Keenan, M. Kracht, R. Kempson, W. Meyer-Viol, R. Pancheva, F. Recanati, B. Schein, D. Sportiche, I. Stojanovic, P. Svenonius, A. Szabolcsi, E. Zimmermann, as well as audiences at the First International Symposium on Linguistics (LICSSOL1) (Lyon, France, October 12-15, 1999), at the Conference on (Preferably) Non-Lexical Semantics (Paris, May 30th, 2000), at the Workshop on Choice Functions and Natural Language Semantics (Helsinki, August 2001), and at the Amsterdam Colloquium (December 2001). Two reviewers for *Research on Language and Computation* have provided extremely detailed and useful comments and criticisms - many thanks to both of them. Special thanks to Valentina Gliozzi and Ede Zimmermann for the remarks that are found in the Appendix.

system was designed to avoid. Following Klaus von Heusinger's recent work (e.g. von Heusinger 1996), we analyze definite descriptions in terms of Choice functions, and show that the latter are a simple variant of Stalnaker's Selection functions, which were originally designed to handle conditionals. In fact, Stalnaker's system can be used to improve on von Heusinger's analysis to ensure that his Choice Functions really do what they are designed to, namely model a notion of 'maximal salience' in discourse (further axioms are needed to achieve this, which can be found in Stalnaker's theory but not in von Heusinger's). By treating *if*-clauses as *plural* definite descriptions (following Schein 2001), we then obtain a generalization of Stalnaker's system, analogous to the 'class selection function' analysis of conditionals discussed in Nute 1980, or to Lewis's Logic *with* the 'Limit Assumption'. We then use this analysis to revisit the syntax and semantics of conditionals: being definites, *if*-clauses can be topicalized (Bittner 2001, Bhatt & Pancheva 2001); the word *then* can be analyzed as a pronoun which doubles the referential term (Iatridou 1994, Izvorski 1996); the syntactician's Binding Theory constrains possible anaphoric relations between the *if*-clause and the word *then*; and general systems of referential classification can be applied to situate the denotation of the descriptive term, yielding a distinction between indicative, subjunctive and 'double subjunctive' conditionals.

1 Lewis's Generalization

1.1 Basic Idea

Lewis's Generalization arose from a critique of traditional analyses of *if*-clauses and definite descriptions, which predicted 'monotonic' patterns of reasoning that turned out to be empirically incorrect. For instance, if a conditional is analyzed as a material or as a strict implication, it is predicted that *If p, q* should entail: *If p & p', q* ('Strengthening of the Antecedent'). But *if*-clauses do *not* obey this pattern. As a result, it is no contradiction to assert (1)a (Lewis 1973 p. 10), which is of the form in (1)b:

(1) a. If Otto had come, it would have been a lively party; but if both Otto and Anna had come it would have been a dreary party; but if Waldo had come as well, it would have been lively; but...
b. If O, L; but if O & A, ¬L; but if O & A & W, L; but ...

By the same token, it appears that the following argument is not valid:

(2) If John came, Mary would be happy. Therefore, if John came and he was drunk, Mary would be happy.

Lewis 1973, 1979 makes an entirely similar observation about definite descriptions. While he starts from a Russellian analysis (which he criticizes), it is somewhat easier to introduce the problem in its Strawsonian guise (the Russellian variant is discussed below). The problem is that the same pattern of strengthening is predicted to hold *whenever all descriptions can be used felicitously*: from *[the P] Q,* one may infer *[the (P & P')] Q* (for if *the P* and *[the (P & P')]* can be uttered felicitously in a given context, they must denote the same individual, hence the entailment). But such patterns fail in natural language, as shown by the following, uttered in a piggery (Lewis 1973):

(3) a. The pig is grunting; but the pig with floppy ears is not grunting; but the spotted pig with floppy ears is grunting; but ...
b. [The P] G; but [the (P& F)] ¬G; but [the (P & F & S)] G; but ...

For the same reason, the following reasoning is invalid:

(4) The pig is grunting, therefore the pig with floppy ears is grunting.

We may also ascertain, for future reference, that the problem arises with plural descriptions as well:

(5) (Uttered in Los Angeles)
a. The students are happy, but the students at the Sorbonne are not *(non-contradictory)*
b. The students are happy, therefore the students at the Sorbonne are happy *(invalid)*

The logical patterns appear to be similar in the case of definite descriptions and conditionals, in the (relatively weak) sense that a monotonic behavior that one might expect systematically fails. Interestingly, the same kind of solution has been offered for both cases, though under different names. In order to handle the non-monotonicity of conditionals, Stalnaker 1968 introduced the device of *selection functions*. Intuitively, the expression *if p* evaluated at a world w was to select among the worlds that satisfy *p* the one that is most similar to w. This presupposed that worlds could always be completely ordered according to their degree of similarity to a given world of reference. A weakened version of the same device, *choice functions,* has been used by von Heusinger to handle the non-monotonic behavior of definite descriptions. It posits that *the P* uttered in a context c selects among the things that satisfy *P* the most salient one. Thus the notion of salience in the domain of individuals plays a role analogous to that of similarity in the domain of possible worlds.

Although Lewis 1973 was the first to state the connection between *if*-clauses and definite descriptions, he did *not* resort to Choice functions or to Selection functions to their non-monotonic behavior. Rather, he designed a more general and more complicated system to address some alleged weaknesses in Stalnaker's original analysis of conditionals. The result was that on Lewis's final analysis definite descriptions and *if*-clauses are taken *not* to refer, nor even to 'denote' in an extended sense, unless one makes an additional assumption (the 'Limit Assumption'). We will see that there is no empirical motivation for the greater generality afforded by Lewis's system, and that a simpler and more intuitive analysis can be preserved, both for *if*-clauses and for definite descriptions. In a nutshell, we will argue that (i) in case no object (or too many objects) satisfy the restrictor P, a referential failure occurs, be if for *if P* or *the P* - as is assumed for the latter by Strawsonian analyses; and (ii) otherwise, *if P* / *the P* picks out the worlds/individuals that satisfy P and are highest on a scale of salience (*the P*) or similarity (*if P).* Thus, by analyzing *if*-clauses as *plural* definite descriptions, we will reduce the analysis of conditionals to the theory of plurals and definiteness. The result is a strengthened version of Lewis's system which is discussed but dismissed in Lewis 1973. It is also the system which is typically used in linguistic semantics for reasons of simplicity (see e.g. Heim 1992 and Fintel 1999).

1.2 The Non-Monotonic Behavior of Conditionals and Definite Descriptions

1.2.1 If*-clauses*

Let us remind ourselves of the problem faced by monotonic theories of conditionals. Both in traditional modal logic and in theories based on generalized quantification over possible worlds, *if*-clauses are analyzed in terms of universal quantification over possible worlds, as in b. (modal analysis) and in c. (generalized quantification):

(6) a. If I strike this match, it will light
b. □(I-strike-this-match □ it-will-light)
c. [□w: wRw* & I-strike-this-match(w)] (it-will-light(w))

Both representations give rise to the same truth-conditions, and predict patterns of monotonic reasoning that are also shared by material implications. Here are three major properties, which simply derive from the logic of universal quantification, as in: 'every accessible □-world is a □-world':

(7) a. Strengthening of the Antecedent: If *If □, □*, then *If □ & □',□*
b. Contraposition: If *If □, □*, then *If□□, □□*
c. Transitivity: If *If □, □* and *If □, □*, then *If □, □*

But these properties do not hold of natural language conditionals, which appear to be 'non-monotonic'. Consider the following examples, each of which refutes one of the properties mentioned in (7):

(8) a. Failure of Strengthening of the Antecedent:
If this match were struck, it would light, but if this match had been soaked in water overnight and it were struck, it wouldn't light (modified from Stalnaker 1968)
b. Failure of Contraposition
(Even) if Goethe had survived the year 1832, he would be dead by now
≠>If Goethe were not dead by now, he would not have survived the year 1832 (Kratzer)
b. Failure of Transitivity
If Jones wins the election, Smith will retire to private life. If Smith dies tomorrow, Jones will win the election
≠> If Smith dies tomorrow, Smith will retire to private life.

These properties have led to the development of special, 'non-monotonic' logics for conditionals. We now argue that the same properties hold of definite descriptions as well.

1.2.2 Definite descriptions

A Strawsonian account predicts that the patterns in (7) should hold of definite descriptions when *if* is replaced with *the*, at least when all the definite description(s) involved can be used felicitously (i.e. when their presuppositions are satisfied):

(9) a. If *The □, □*, then *The □ & □',□*
b. If *The □, □*, then *The □□, □□*
c. If *The □, □* and *The □, □*, then *The □, □*

Let us first consider (9)a. If *The □* can be used felicitously, there is exactly one □-individual in the domain of discourse. Hence if *The □ & □'* can also be used felicitously, it must denote the same individual, and therefore the entailment should hold. The same reasoning applies to (9)b: if both *The □* and *The □□* can be used felicitously, there is exactly one □-individual and one □□-individual in the domain of discourse. If the former has property □, then it must be distinct from the latter, which thus couldn't have property □ (or else there would be two □-individuals in the domain, contrary to hypothesis). Third, turning to (9)c, if *The □* and *The □* can both be used felicitously, then there is exactly one □-individual and one □-individual in the domain of discourse. Thus if the first one has property □, it must be identical to the second, hence the entailment. Let us note, finally, that the same predictions hold of plural descriptions if these are analyzed in terms of maximality operators. For if *The □* denotes the maximal □-set in the domain of discourse, and it is included in a □-set, then: (i) *a fortiori* the same holds for the maximal □&□'-set, which derives (9)a; (ii) the maximal □□-set cannot contain any □-elements (or else the maximal □-set would contain these elements too, and would thus fail to be included in a □-set); this, in turn, derives (9)b. (9)c is derived in similar fashion: if the maximal □-set s_1 is included in a □-set s_2 and the maximal □-set (which must include s_2) is contained in a □-set s_3, then of course s_1 must be included in s_3.

In natural language, however, all of these patterns fail, just as they do with conditionals. Thus the following inferences are not valid (note that either singular or plural descriptions can be used to make this point):

(10) Invalid inferences
a. The dog is barking, therefore the neighbors' dog is barking.
a'. The pig is grunting, therefore the pig with floppy ears is grunting
a". (Uttered in Los Angeles)
The students are happy, therefore the students at the Sorbonne are happy
b. The professor is not Dean, therefore the Dean is not a professor
c. The students are vocal. The undergraduates in Beijing are students. Therefore the undergraduates in Beijing are vocal.

For the same reason, the following are non-contradictory:

(11) Non-contradictory statements
a. The dog is barking, but the neighbors' dog is not barking.
a'. The pig is grunting, but the pig with floppy ears is not grunting (Lewis 1973)
a". (Uttered in Los Angeles)
The students are happy, but the students at the Sorbonne are not
b. The professor is not Dean, but of course the Dean is a professor.
c. The students are vocal, and of course the undergraduates in Beijing are students, but the undergraduates in Beijing are certainly not vocal at the moment.

Superficially it would seem that Russell fares slightly better than Strawson, since on a Russellian analysis (9)a and (9)b do *not* come out as valid. This is because one of Strawson's definedness conditions could be violated in the consequent, which on Russell's analysis leads to falsity rather than undefinedness. Here are the relevant abstract examples:

(12) a. Refutation of (9)a: Suppose that [[□]]=[[□]]={d}, [[□ & □']]=ø
b. Refutation of (9)b: Suppose that [[□]]=[[□]]={d}, [[□□]]=ø

By contrast, the pattern in (9)c *is* predicted to be valid by Russell, and in this respect he fares no better than Strawson:

(13) Proof of (9)c: From *The □, □*, we obtain: |[[□]]|=1 and [[□]]□ [[□]]. From *The □, □*, we obtain: |[[□]]|=1 and [[□]]□ [[□]]. Taken together, these conditions entail: |[[□]]|=1 and [[□]]□ [[□]]

But even for (10)a' and (10)b', where it would superficially appear to work, Russell's analysis is utterly implausible because it saves the coherence of the sentences only by giving the negation *wide* scope in the clause where it appears, as in (14)b and (15)b. By contrast, giving the negation *narrow* scope would immediately yield falsehoods, as in (14)c and (15)c:

(14) *Situation:* there is one (salient) pig without floppy ears and one (less salient) pig with floppy ears in the domain of discourse.
a. The pig is grunting, but the pig with floppy ears is not grunting (Lewis 1973)
b. [The P] G & □[the (P& F)] G (can be true in this situation)
c. [The P] G & [the (P& F)] □G (cannot be true in this situation)

(15) *Situation:* there is one (salient) professor who isn't a Dean and one (less salient) professor who is Dean in the domain of discourse.
a. The professor is not Dean, but of course the Dean is a professor.
b. □[the P] D & [the D] P (can be true in this situation)
c. [The P] G & [the (P& F)] □G (cannot be true in this situation)

Unfortunately for the Russellian, these sentences may remain intuitively true even when the negation clearly has narrow scope:

(16) a. The pig is grunting, but the pig with floppy ears is doing something other than grunting
b. The professor is something other than Dean, but of course the Dean is a professor

I conclude that the Russellian's advantage is only apparent, and that on closer inspection Lewis's examples are as problematic for Russell as they are for Strawson.

1.3 Possible Analyses

The foregoing observations can be analyzed in at least two ways. One line, which has become standard for conditionals and which we shall extend to definite descriptions, is to posit a non-monotonic semantics, as we do in Section 2 using Choice Functions. The alternative is to deny that the semantics is non-monotonic, and to blame the appearance of a non-monotonic behavior on changing domain restrictions on world and individual quantifiers (Fintel 1999, 2001). By itself, the debate between these two lines of analysis need not affect our general point, as long the same analysis -be it based on a non-monotonic semantics or on changing domain restrictions- is applied uniformly to definite descriptions and conditionals. Thus we argue dialectically, and try to show that, in either case, *if*-clauses can and should be analyzed as definite descriptions. We do discuss, however, one argument (based on Negative Polarity Item licensing) which might suggest that definite descriptions and conditionals do not display the same logical behavior (see Section 1.3.2, where we also provide some counter-arguments).

1.3.1 Non-Monotonic Semantics with Constant Domain Restrictions

Why should *if*-clauses and definite descriptions display a non-monotonic behavior? Stalnaker 1968, who was solely concerned with conditionals, suggested that their semantics contains a superlative component. According to him, *if it rains tomorrow* refers to that world in which it rains tomorrow which is *most similar* to the actual world. Von Heusinger 1996, who was solely concerned with definite descriptions, analyzed *the dog* as referring to that dog in the domain of discourse which is *most salient* for the speaker. There are many variations on these theories. A natural extension is to allows both *if*-clauses and definite descriptions to refer to a plurality of individuals or worlds - a measure that is undoubtedly necessary for the analysis of plural definite descriptions. A less natural extension (advocated by Lewis 1973) is to allow conditionals to have truth conditions even in case there is no world or even group of worlds that counts as 'the closest' to the actual world. These variations are discussed later in the paper, but they all share the main features of the 'superlative' analysis we just sketched.

1.3.2 Monotonic Semantics with Changing Domain Restrictions[2]

Non-monotonic analyses were challenged in the recent literature on conditionals, esp. in Fintel 1999, 2001. The general idea is that bare *if*-clauses should be analyzed as restrictors of covert

[2]This sections owes much to the comments of an anonymous reviewer, who provided extremely useful criticisms of an earlier version.

universal quantifiers over possible worlds. Conditionals *appear* to have a non-monotonic behavior because the implicit domain restriction of the universal quantifier need not remain fixed, even within the confines of a single sentence - according to Fintel 1999, 2001, the domain may be expanded, though not contracted. We discuss three arguments in favor of von Fintel's theory. The first two apply in the same way to *if*-clauses and definite descriptions. Thus if they are correct, they cast doubt on the non-monotonic analysis we develop in Section 2, but not necessarily on our general point that *if*-clauses can and should be analyzed as definite descriptions. The third argument is more complex, and might cast doubt on this assimilation, though we give counter-arguments against this conclusion.

(i) The argument from changing domain restrictions

Suppose that the implicit domain restriction on world or individual quantifiers were allowed to change in sentences such as (8)a or (14)a. If conditionals were analyzed as structures of universal quantification over possible worlds, (8)a would then have a logical form such as *[□w:C(w)&□]□ but [□w:C'(w)&□'&□]□□*, where C and C' are implicit restrictions on the quantifier domains. Similarly (14)a would be of the form *[□x:C(w)&□]□ but [□x:C'(x)&□'&□]□□*. As long as the extension of C' is not a subset of the extension of C, there is no reason the resulting logical forms should be contradictory, which would obviate the need for a non-monotonic analysis. In his discussion of conditionals, Lewis 1973 explicitly considers this possibility, and rejects it[3]. Commenting on examples such as (8)a, he writes that 'our problem is not a conflict between counterfactuals in different contexts, but rather between counterfactuals in a single context. It is for this reason that I put my examples in the form of a single run-on sentence, with the counterfactuals of different stages conjoined by semicolons and 'but'' '(Lewis 1973 p. 13). Unfortunately Lewis assumes a premise which is false, namely that quantifiers that are uttered in the same context share the same domain restriction. This is clearly incorrect, as is shown by the following example, which was pointed out to me by A. Szabolcsi (it is originally due to D. Westerstahl):

(17) [*Situation:* A committee must select some applicants. Some of the applicants are Italian, and there are also Italians on the committee, though of course they are not the same.]
Every Italian voted for every Italian

The intended reading is that every Italian *on the committee* voted for every Italian *among the applicants*. This means that the domain restriction is not the same for the first and the last noun phrase, although both occur in the same sentence. Lewis's premise is thus incorrect.

Of course this does not mean that his conclusion is, only that a stronger argument is needed to establish it. Peter Svenonius (p.c.) suggests that Lewis's conclusion can be established on the basis of the following contrasts:

(18) [There are ten girls and ten boys in the class. Three girls raise their hands. Talking to the speaker, I say:]
a. Wait, the girls have a question!
b. Wait, the three girls have a question!
c. <?> Wait, the girls each have a question!
d. #Wait, every girl has a question!

---

[3] His (short) discussion centered around the hypothesis that conditionals are strict implications with a *vague* accessibility relation and a context-sensitive mechanism of resolution. But his argument carries over to the hypothesis that the quantifier restriction rather than the accessibility relation is context sensitive.

e. #Wait, all girls have a question!
f. #Wait, all the girls have a question!
g. #Wait, each of the girls has a question!

On von Heusinger's salience-based theory, the contrast between (18)a and (18)d is entirely expected. The extension of the predicate *girl* is presumably the set of the ten girls in the class. The description *the girls* picks out the most salient group among those; a good candidate is the group of the three girls that have raised their hands, thus increasing their their salience. By contrast, *every girl* and *all girls,* not being definite descriptions, must quantify over all the girls in the domain of discourse, i.e. over the ten girls in the class. Now one could *try* to argue that *the girls* denotes the three girls rather than all ten because of an implicit domain description. But if such a domain restriction is available for the definite description, why is not also available for other quantifiers such as *every* and *all*? It would seem that von Heusinger's theory is at a clear advantage to explain these data. I also note for completeness that *all the girls* or *each of the girls* do *not* behave in the way that one might expect given (18)a, since they do not just quantify over the three most salient girls but rather over all the girls in the domain of discourse. This is presumably a problem for every compositional analysis, since *all the girls* or *each of the girl* do not have the meaning that would be obtained by applying the meaning of *all* or *each* to the meaning of *the girls*. We could stipulate that in such contexts the salience hierarchy becomes trivial, so that all girls in the domain are equally salient, and hence that the group of the most salient girls is the maximum set of girls in the domain. But obviously this only describes the problem, which I have to leave open in this article. Be that as it may, it is interesting to note that the same problem seems to arise with conditionals. *Necessarily, if p, q* appears to display a monotonic behavior, while *if p, q* does not, as is suggested by the following contrast:

(19) a. <#>Necessarily, if the United States threw its weapons into the sea, there would be war. However (, necessarily,) if the United States and all other nuclear powers threw their weapons into the sea, there should be war.
b. If the United States threw its weapons into the sea, there would be war. However, if the United States and all other nuclear powers threw their weapons into the sea, there should be war.

To my ear, the first sentence sounds contradictory, but the second clearly does not. A compositional solution is far from obvious, but the problem seems to be structurally analogous to the one we observed with respect to (18)a vs. (18)d.

While the argument we just discussed concerned the denotation of definite descriptions and universal quantifiers uttered in the same context, the following (tentative) contrasts concern patterns of entailment:

(20) a. (Uttered in Los Angeles) Every student is happy, therefore the students at the Sorbonne are happy.
b. (Uttered in Los Angeles) #The students are happy, therefore the students at the Sorbonne are happy.

(21) a. Necessarily, if the United States threw its weapons into the sea, there would be war. Therefore, necessarily, if the United States and all other nuclear powers threw their weapons into the sea, there should be war.
b. #If the United States threw its weapons into the sea, there would be war. Therefore, if the United States and all other nuclear powers threw their weapons into the sea, there should be war.

Suppose that changing domain restrictions were responsible for the non-monotonic behavior of *if*-clauses and definite descriptions. Still, a charitable interpreter of the sentences in (20) and (21) should try to keep the domain restrictions fixed so as to make the arguments valid. But if the judgments shown above are correct, this is quite a bit harder with *the* than with *every* and with *if* than with *necessarily if*. These facts are unexpected on the monotonic analysis. By contrast, they are explained by the non-monotonic analysis, which predicts that the arguments in b. should not be valid *even* when the domain restrictions are fixed. Unfortunately, it must be granted that the data are not entirely clear, and this argument should be considered as speculative at this point[4].

(ii) The argument from the order of presentation

Another argument (attributed variously to I. Heim [in Fintel 2001] or to Frank 1997) has been brought up against the non-monotonic analysis of conditionals. In the version discussed by Fintel 2001, the observation is that the non-monotonic behavior of conditionals is highly sensitive to the order in which the test sentences are presented, in a way which is not predicted by Stalnaker's or Lewis's analyses:

(22) a. If the USA threw its weapons into the sea tomorrow, there would be war; but if the USA and the other nuclear powers all threw their weapons into the sea tomorrow, there would be peace.

---

[4] One could try other procedures to ensure that a domain restriction remains constant, for instance by resorting to the elision of a restrictor, as in the following French examples:

(i) a. Chaque Italien en a critiqué un autre.
Each Italien EN has criticizied another
a'. Chaque Italien a critiqué un autre Italien.
Each Italien has criticizied another Italian
b. Un Italien en a critiqué un autre.
An Italien EN has criticizied another Italian
b'. Un Italien a critiqué un autre Italien.
An Italien has criticizied another Italian
c. Chaque professeur en a critiqué un autre.
Each professor EN has criticized another
c'. Chaque professeur a critiqué un autre professeur.
Each professor has criticized another professor
d. Un professeur en a critiqué un autre.
A professor EN has criticized another
d'. Un professeur a critiqué un autre professeur
A professor has criticized another professor
e. Le professeur en a critiqué un autre.
The professor EN has criticized another
e'. Le professeur a critiqué un autre professeur
The professor has criticized another professor
(cf. McCawley 1979: 'The dog got into a fight with another dog')

The reading obtained in (17)a appears to be harder to get in (ia) than in (ia'), in the sense that in (ia) one understands that each Italian among a group P criticized some Italian *in the same group P*. If this judgment is robust (which is not clear at all), one could hypothesize that ellipsis forces the elided restrictor to have the same semantic value (and in particular the same domain restriction) as its antecedent. This paradigm could then provide an *experimentum crucis* to decide between the monotonic and the non-monotonic approaches. On the monotonic line, (ie) should come out as a presupposition failure, because *the professor* presupposes that there is a single professor in the domain of discourse, while *un autre* presupposes or asserts that there are at least two. On the non-monotonic analysis, by contrast, there should be no such effect. I must grant that I am uncertain about the facts, which are rather subtle.

b. ??If all nuclear powers threw their weapons into the sea tomorrow, there would be peace; but if the USA threw its weapons into the sea tomorrow, there would be war (Fintel 1999, attributed to Heim)

I hasten to say that *exactly the same facts hold of definite descriptions,* as shown by the following:

(23) a. The dog is barking, but fortunately the neighbor's dog isn't.
b. ??The neighbor's dog is barking, but fortunately the dog isn't.

Thus although this argument might cast doubt on the non-monotonic analysis, it does not by itself argue against the treatment of *if*-clauses as definite descriptions.

It is clear that these facts are not explained by the non-monotonic analysis. As Fintel 1999 writes,

> in [(22)a], the two counterfactuals claimed to be consistent by Lewis are reversed in their order and the sequence does not work as before. The reason seems intuitively clear: once we consider as contextually relevant worlds where all nuclear powers abandon their weapons, we can't ignore them when considering what would happen if the USA disarmed itself. We seem to be in need of an account that keeps track of what possibilities have been considered and doesn't allow succeeding counterfactuals to ignore those possibilities. An account according to which the context remains constant throughout these examples would not expect a contrast between these two orders.

The same point could obviously be made about (23) as well[5]. Be that as it may, the monotonic analysis needs a stipulation to account for these facts, to the effect that domain restrictions can be expanded but not contracted. The non-monotonic analysis could presumably make do with a stipulation too. Consider salience first. The deviance of (23)b could be explained by postulating that an object that has been mentioned has thereby become salient, and thus that the neighbor's dog becomes the most salient dog in the domain of discourse as soon as the first conjunct of (23)b is uttered. As a result, the expression *the dog* in the second conjunct must denote the most salient dog, i.e. the neighbor's dog, and the sentence ends up being contradictory. In order to apply the same reasoning to (22)b, we need to assume that the similarity measure between worlds is affected by the salience of worlds mentioned in the previous discourse. It must be granted, of course, that there is currently no independent motivation for this assumption.

---

[5] In the case of conditionals, Fintel 1999 further notes that the following rejoinders are quite natural as uttered by the addressee of (22)a:

(i) a. But that means that if the USA threw its weapons into the sea tomorrow, there wouldn't NECESSARILY be war. (Fintel 1999)
b. But that means that if the USA threw its weapons into the sea tomorrow, there might NOT be war. (Fintel 1999)

Fintel 1999 writes that the possibility of such replies 'is unexpected under the standard static approach. If we go back to the simpler antecedent, the domain of quantification should shrink back to the closest worlds where just the USA disarms, ignoring the far-fetched worlds where all nuclear powers become meek. But that doesn't seem to happen.'

I am not sure this argument is convincing. Note that unlike the inference from *if p, q* to *if p and p', q*, the inference from *Necessarily, if p, q* to *Necessarily, if p and p', q* does not suffer obvious exceptions in natural language. Thus proponents of the non-monotonic analysis are still forced to posit a monotonic analysis for sentences involving adverbs of quantification. If so the naturalness of the rejoinders in (i) comes as no surprise at all: the initial assertion in (22)a made the point that the closest world in which the US throws its weapons into the sea is one in which there is war, but that the closest world in which the US and all other nuclear powers throw their weapons into the sea is one in which there is peace. The addressee correctly infers from this that not *all* worlds (in the domain of quantification) in which the US throws its weapons into the sea are worlds in which there is war - which is unobjectionable.

(iii) The argument from NPI licensing

Finally, Fintel 1999 argues is further supported by the behavior of Negative Polarity Items (NPIs) in conditionals:

(24) a. If John subscribes to any newspaper, he is probably well informed.
b. If he has ever told a lie, he must go to confession.
c. If you had left any later, you would have missed the plane.

NPIs are apparently licensed in the antecedent of condtionals. This follows on the assumption that (a) conditionals are structures of universal quantification over possible worlds, whose restrictor is provided by the *if*-clause, and that (b) NPIs are licensed in downward-entailing environments ('Ladusaw-Fauconnier Generalization'). By contrast, non-monotonic analyses lack an explanation of these facts, since they are presigned designed to ensure that an *if*-clause does *not* create a downward-entailing environment.

How serious is the problem? It all depends on one's assessment of the Ladusaw-Fauconnier generalization. As it happens, it faces important problems with other examples, such as the following, discussed in Heim 1984:

(25) a. #Most mountaineers with any experience (still) need a guide for this tour.
b. Most men with any brains eat rutabagas

(25)a is entirely expected, since the restrictor position *N'* of *Most N' IP* does not provide a downward-entailing environment. On the other hand, (25)b is unexpected on any standard analysis. Heim suggests that the relevant generalization has to do with a limited form of downward-entailingness *in the presence of certain background assumptions*. Thus the contexts in which (25)b is felicitous are ones in which it is assumed that, *a fortiori*, most men with *a lot of brains* also eat rutabagas (by contrast, one does not normally assume that most mountaineers with a lot of experience need a guide, which accounts for the deviance of (25)a). Heim applies the same strategy to conditionals in general, and to the following contrast in particular:

(26) a. If you read any newspaper at all, you are well informed.
b. #If you read any newspaper at all, you remain quite ignorant.

Heim observes that *despite* the non-monotonicity of conditionals, one typically has background assumptions that ensure that *If you read (at least) n newspapers, you are well informed* entails for n'>n that *If you read (at least) n' newspapers, you are well informed* - the background assumption might be something like: 'the more newspapers you read, the better informed you are'. In other words, background assumptions ensure a limited form of downward-entailingness for the antecedent of (26)a. By contrast, no plausible background assumptions entail that 'the more newspapers you read, the more ignorant you remain', and as a result the antecedent of (26)b does not even display a limited form of downward-entailingness, which explains that the NPI *any* is not licensed. The facts in (25) and (26) can thus be naturally accounted for by appealing to a refined notion of downward-entailingness. Once this move is made, the non-monotonic analysis of conditionals can in principle be made compatible with this modified version of the Ladusaw-Fauconnier Generalization (although of course the precise definite definition of the 'refined notion' of downward-entailingness should be made much more precise).

Does this analysis extend to definite descriptions? At first glance, the facts might appear to be different from those we observed in conditionals, since definite descriptions often *fail* to license NPIs, e.g. in <#> *The students who knew anyone had a good time at the party*.

However contrasts noted by Heim for conditionals can to some extent be replicated with definite descriptions:

(27) a. <> The Ling 1 students who understood anything at all got an A.
b. <#> The Ling 1 students who understood anything at all still got bored.

(28) a. <> The students who read any newspapers at all are well-informed.
b. <#>The students who read any newspapers at all remain quite ignorant

I conclude that the facts of NPI licensing do not necessarily show that there is a real difference between definite descriptions and conditionals[6].

(iv) A monotonic analysis of *if*-clauses as definite descriptions

Let us now suppose for a minute that the monotonic analysis of conditionals is in fact correct, contrary to what we will assume from Section 2 on. The monotonic analysis could still be implemented in two ways:
(i) By postulating (following much of the literature, e.g. Fintel 1999, 2001) that the *if*-clause restricts a universal quantifier.
(ii) By analyzing the *if*-clause as a *standard* (monotonic) definite description, i.e. one that picks out the maximal set that satisfies its restrictor.

Within a monotonic framework, Schein 2001 has offered an independent argument for (ii) and against (i), one that crucially relied on *plural* descriptions (plurality is incorporated to our non-monotonic analysis in Section 2.2). In simple cases, introducing a plural definite description as the restrictor of a generalized quantifier would seem to be harmless, as shown in the following:

(29) a. Each student is happy
a'. [□x: student(x)] (happy(x))
b. Each of the students is happy
b'. [□x: [□X: STUDENT(X)] Xx)] (happy(x))

The analysis in (29)a' is standard. The analysis in (29)b'. is more indirect, since the restrictor of 'every' is obtained by first singling out a plural object (capital letters are used for higher-order predicates and variables). In this example the final truth-conditions are the same in both cases. In more complicated examples, however, an important difference does arise. With an eye to what is to come, I illustrate it with preposed definite descriptions in French, which will be seen to be similar to preposed *if*-clauses:

---

[6] Note also that if there is a significant difference between definite descriptions and conditionals, it is not clear how the monotonic analysis of Fintel 1999, 2001 can account for it. Fintel's main analytical tool is that of *Strawson-entailment,* defined as follows:
(i) Strawson Downward Entailingness (Fintel 1999)
A function f of type <s, t> is Strawson-DE
iff for all x, y of type s such that x□ y and f(x) is defined : f(y) □ f(x) [where □ applies in the usual way to all types that 'end in t'].
Suppose we analyze definite descriptions in terms of maximality operators. On Fintel's theory *The Ns had a good time* is a Strawson DE environment, since for each N_1 and N_2 such that (a) N_1□ N_2 and (b) the presupposition of *The N_1s had a good time* is met, i.e. N_1 has at least two individuals in its extension, it is the case that *The N_2s had a good time* □ *The N_1s had a good time* (example: *The students who knew many people had a good time* □ *The students who knew some people had a good time*). Thus the expectation is that plural definite descriptions should in fact license Negative Polarity Items. (Presumably Fintel could adopt a non-monotonic analysis of definite descriptions, while still preserving a monotonic analysis of conditionals.)

(30) a. Les Français, ceux que je connais sont pour la plupart sympathiques.
The French, those that I know are for the most part nice
'As for the French, those I know are mostly nice'
b. [ιX': FRENCH(X')] [ιX: X⊆X' & I-KNOW(X)] [Most x: Xx] (nice(x))
c. [Most x: French(x) & I-know(x)] (nice(x))
'Most Frenchmen I know are nice'

Here two definite descriptions have been stacked at the beginning of the sentence. The truth-conditions should come out as in c., which only involves first-order quantification. But the syntax of c. is implausible because 'mostly' had to be moved to the beginning of the sentence, while the two restrictors had to be conjoined. In this case the solution is to give a plural analysis as in b., which derives the correct truth-conditions[7].

However, when the problem is transposed to quantification over possible worlds, the solution becomes less obvious because English does not have overt markers of plurality for worlds. The problem is Barker's puzzle about iterated *if*-clauses (Barker 1997), and the solution is Schein's (Schein 2001), who resorts to plural quantification over events rather than possible worlds, as is done in the present paper. Here is a simplified version of the crucial examples:

(31) a. If John comes, if Mary comes as well, the party will probably be a disaster.
b. [ιW': JOHN-COMES(W')] [ιW: W⊆W' & Mary-comes(W)] [Most w:Ww] (disaster(w))
c. [Most w: John-comes(w) & Mary-comes(w)](disaster(w))

As in the preceding case, the final truth-conditions should be those of c. (at least as a first approximation). But the logical form in c. is implausible because it involves a drastic re-arrangement of various parts of the sentence. By contrast, the analysis in b., which crucially relies on plural definite descriptions of worlds, is syntactically natural. Thus even if the monotonic analysis of conditionals is correct, *if*-clauses should be analyzed as (monotonic) plural descriptions rather than as structures of universal quantification[8].

2 A Choice Function Analysis

In the rest of this article we tentatively assume that the non-monotonic analysis of conditionals and definite descriptions is on the right track, and we seek to implement it and explore some of its consequences.

2.1 Choice Functions across domains (the singular case)

Stalnaker 1968, who assumed that there *was* something to explain about non-monotonicity above and beyond domain-restriction, introduced the device of *Selection functions* to handle the problem. Intuitively, *if φ* is taken to 'select' the world most similar to the actual world which satisfies φ (if there is no such world we will assume that a presupposition failure occurs,

---

[7] To make this analysis complete we would have to explain how the formula X ⊆X' can appear in the restrictor of the second quantifier. This is presumably an effect of domain restriction, but I leave this issue for future research.

[8] As Ede Zimmermann points out, however, this leaves one question open - do we ever obtain cases of collective prediction with *if*-clauses, analyzed as plural descriptions? I do not know of any such cases; if none can be found this will count as an argument against the present theory, and in favor the the analysis based on universal quantification.

although this isn't Stalnaker's analysis; see below). *If* □, □ is then taken to be true just in case the world selected by *if* □ satisfies □ (this is simply a case of predication). And as was mentioned above, von Heusinger's Choice functions are simply a weakened version of Selection functions. By taking literally the suggestion that *if* is *the* applied to worlds, we obtain either Stalnaker's analysis (singular definite descriptions) or a strengthened version of Lewis's system (plural definite descriptions). We start our discussion with Stalnaker's Selection Function analysis, which we apply to *if*-clauses and definite descriptions alike. We then extend this system by introducing functions that select a plurality of objects.

2.1.1 General Format

We write *the* and *if* as □ When □ is followed by an individual variable, it represents *the*; when it is followed by a world variable, it represents *if*. □ always selects the element that is closest to a given element under some pre-established linear ordering. What is this 'given element'? If we didn't have to worry about embeddings, we could simply assume that, both for definite descriptions and for conditionals, it is the context of utterance. But this won't do in the general case for conditionals, which can be recursively embedded:

(32) If John were here, if Mary were here as well, the party would be a lot of fun.

Clearly the context of utterance is the same throughout the discourse. However the second *if*-clause should not be evaluated from the standpoint of the actual world w*, but rather from the world selected by f(w*, [[John is here]]). In the general case, then, Stalnaker's Selection functions must take two arguments: a world of evaluation and a set of worlds[9].

Turning now to definite descriptions, it would seem that there is no reason to provide the Choice function with two arguments (an individual and a predicate extension) rather than just one (a predicate extension). This is because on a superficial analysis *the P* might be taken to denote an element which is salient *in the context of discourse*. However when more complex examples are taken into account, this treatment can be seen to be too crude:

(33) a. The dog got into a fight with another dog (McCawley 1979)
b. John said that the dog had gotten into a fight with another dog.
c. <>At some point or other, each of my dog-owning friends came home to realize that the dog had gotten into a fight with another dog.

In (33)a *the dog* may be taken to denote the most salient dog relative to the speaker. In (33)b, by contrast, it is plausible that *the dog* denotes the most salient dog *relative to John* rather than relative to the speaker. (33)c makes the same point more forcefully, since for various dog-owners the most salient dog is of course not the same[10]. The data are correctly handled by binding the additional argument of the □-operator to a quantifier, as in the following simplified representation, where I have also included a contextual restriction C that depends on the variable x:

(34) [□ x: friend(x)] ... [□y: dog(y) & C(x)] ...

Thus there appears to be independent motivation for providing Choice Functions that are used to model salience with an additional individual argument[11].

---

[9] The second argument could just as well be taken to be a sentence rather than a set of worlds (=a proposition).

[10] Note that in each of these cases at least two dogs are relevant to each of my friends (his own and the one it got into a fight with), which shows that domain restriction alone cannot account for the data (there must be some way to select the 'salient' dog within each of these domains).

[11] In a De Se analysis of attitude reports (as in Chierchia 1989), (ia) would be analyzed along the lines of (ib), where the point of reference x of the □-operator is bound by a □-operator introduced by the *that*-clause:

2.1.2 Stalnaker's first three conditions

Let us now consider Stalnaker's Selection Functions and see whether and how they may be used to model the behavior of definite descriptions as well. Stalnaker 1968 imposed four conditions on his selection functions, which we discuss in turn.

Condition 1 (=Stalnaker's Condition (1)): For each element d and each non-empty set E of elements of a given sortal domain, f(d, E)∈E. This is of course the condition that makes Stalnaker's Selection Functions a variety of Choice Functions. For definite descriptions, this means that the individual denoted by *the φ* must satisfy the predicate φ. For conditionals, this means that the world denoted by *if φ* must satisfy the sentence φ. Both conditions are uncontroversial.

Condition 2 (equivalent to Stalnaker's Condition (4) when Condition 1 holds): For each element d and any sets E and E', if E'⊆E and f(d, E)∈E', then f(d, E')=f(d, E). When applied to individuals under a measure of salience, this can be paraphrased as: if some element is the most salient among all the members of E, then it is also the most salient among some subset of E that includes it. Although this condition has not (to my knowledge) been discussed in the Choice Function literature, it is necessary to ensure that the Choice Function indeed models a notion of *maximal* salience. More generally, this condition must apply whenever a function is supposed to select from a set the element(s) with the greatest degree of a property P. (On Stalnaker's analysis, P is the degree of similarity to the world of evaluation.)

The foregoing discussion was a slight distortion of the history, however. Stalnaker 1968 discusses in fact a different version of the condition, but it turns out to be equivalent to the present version given Condition 1. Stalnaker's original condition is:

Condition 2' (=Stalnaker's Condition (4)): For each element d and any sets E and E', if f(d, E')∈E and f(d, E)∈E', then f(d, E)=f(d, E').
Claim: Condition 2 and Condition 2' are equivalent given Condition 1.
Proof: (i) Condition 2 ⇒ Condition 2'. Suppose f(d, E')∈E and f(d, E)∈E'. By Condition 1, f(d, E')∈E' and hence f(d, E')∈E∩E'; and similarly f(d, E)∈E and hence f(d, E)∈E∩E'. By Condition 2, f(d, E)=f(d, E∩E')=f(d, E').
(ii) Condition 2' ⇒ Condition 2. Suppose E'⊆E and f(d, E)∈E'. By Condition 1, f(d, E')∈E', and hence f(d, E')∈E since E'⊆E. Thus f(d, E)∈E' and f(d, E')∈E. By Condition 2', f(d, E)=f(d, E').

Condition 3 (=Stalnaker's Condition (2)): For each element and each set E of elements, f(d, E)=# iff E=Ø.
Here I will interpret # as symbolizing referential failure, as is natural for definite descriptions on a Strawsonian view. Stalnaker, who was solely interested in conditionals, did not allow for referential failure. Rather, he interpreted # (which he wrote as *λ) as* 'the *absurd world* - the world in which contradictions and all their consequences are true'.[12] In Stalnaker's system any

---

(i) a. John said that the dog had gotten into a fight with another dog.
b. John said that λx λw [ιy: dog(y, w)] got into a fight with another dog

[12] Stalnaker further stipulates that λ 'is an isolated element under [the accessibility relation] R; that is, no other world is possible with respect to it, and it is not possible with respect to any other world'.

proposition is true of the absurd world. As a result, a conditional with an impossible antecedent is deemed true no matter what the consequent is (this is because in that case *if* ϕ, ψ is true just in case the world selected by *if* ϕ, i.e. λ, satisfies ψ; but λ satisfies every proposition). By contrast, on the present view a conditional with a *clearly* impossible antecedent is deemed infelicitous. Thus *if* ϕ fails to refer just in case there is no world whatsoever, even a particular distant one, which satisfies ϕ. This condition does not appear to be too far-fetched given the infelicity of sentences such as: *#If John were and weren't here, Mary would be happy*[13].

2.1.3 Stalnaker's last condition: Centering

Stalnaker's Selection Functions were defined by a fourth condition, which does not appear to be plausible for definite descriptions:

<u>Condition 4</u> (=Stalnaker's Condition (3)): For each element d and each set E, if $d \in E$, then f(d, E)=d.

Applied to possible worlds, this condition states that *if* ϕ always selects the world of evaluation in case ϕ is true in that world. For instance, in an unembedded environment, this means that the *if*-clause must always select the actual world if it happens to satisfy the antecedent. This condition is entirely natural when the ordering of two elements is defined by their similarity to the actual world, as is the case for *if*-clauses. The condition seems less plausible for definite descriptions, where elements are ordered by their relative salience from the standpoint of a particular individual. If Condition 4 were applied in this domain, it would require that an unembedded definite description should always pick out the speaker if she happens to satisfy the restrictor of the description. Clearly, this is an overly egocentric view of communication. I may certainly use the description *the guy in the white shirt* to refer to John even if I myself happen to be wearing a white shirt. But if Condition 4 held of descriptions of individuals, 'the guy in the white shirt' would, of necessity, denote *me*.

This, however, is a problem only so long as it is assumed that the speaker necessarily serves as the default point of evaluation for the Choice/Selection Function used to model salience. But this might well be too strong. In fact, when I utter a sentence I typically take for granted some perceptual situation which I might not be a part of (this should be clear if the perceptual situation is my own visual field, since I don't typically see myself, at least not entirely). Obviously no such perceptual condition holds in the domain of worlds (because these can't be perceived). As a result, the world of evaluation in a standard speech situation c is the one which is most relevant to c, i.e. the world of c. If this analysis is correct, the reason 'the man in the white shirt' may fail to refer to me even if I happen to be wearing a white shirt is *not* that the centering condition fails; rather, it is that the point of reference in that situation isn't the speaker himself but whatever is at the center of the speaker's perceptual field.

One final point is in order. Although in standard cases the world of utterance provides a default value for the world argument of an unembedded *if*-clause, this needn't always be the case. Consider the following example of modal subordination:

(35) Suppose I didn't exist. If you were the same person that you actually are, you would be much happier[14]

---

[13] What about other cases? 'If round squares existed, you might get the job' - no infelicity here, except for the applicant. I would suggest that the speaker who utters this presents himself as assuming that there *is* a possible world in which round squares exist, although this is a very remote one.

[14] See for instance Roberts 1989 for an analysis of modal subordination.

It is clear in this case that the actual world w* satisfies the antecedent of the conditional. Yet the *if*-clause certainly does not select the actual world, for if this were the case the sentence would be trivially false (it couldn't be that you are happier in w* than you are in w*). The natural interpretation is not that Condition 4 is suspended; rather, it is that the point of evaluation is not w* but one of the worlds in which the initial assumption ('Suppose I didn't exist') is met. This is of course parallel to the reasoning we just made for definite descriptions.

To conclude this part of the discussion, let us see how the system works in the example of 'Strengthening of the Antecedent'. The logical forms are now as follows (I use a cross-sortal ι and overt variables for each sort; w* represents the world of evaluation -typically the world of the context, and x* represents the individual of evaluation, which will often be different from the speaker. For simplicity, I omit time/world variables in a'. and time/individual variables in b'.):

(36) a. The pig is grunting, but the pig with floppy ears isn't grunting.
a'. grunting([ι_{x*}x: pig(x)]) but ¬grunting([ι_{x*}x: pig(x) & floppy-ears(x)])
b. If this match were struck, it would light, but if this match had been soaked in water overnight and it were struck, it wouldn't light
b'. light([ι_{w*}w: strike(w)]) but ¬light([ι_{w*}w: strike(x) & soak(w)])

Since the most salient *pig with floppy ears* need not be the most salient *pig*, a'. is not contradiction. For the same reason the closest (most similar) world in which the match is soaked in water and struck might not be the closest world in which it is struck, and thus b'. is also predicted to be consistent.

2.2 Adding Plurality

Stalnaker's analysis has a major defect: it does not allow for quantification over possible worlds. This is problematic in view of examples such as 'Necessarily, if John comes, Mary will be happy' or 'Probably, if John comes, Mary will be happy'. A major insight in the recent history of conditionals was that in these examples *if*-clauses restrict generalized world or event quantifiers (Lewis 1975). But if *if*-clauses are construed as *singular* descriptions, there is no way this can be done. Part of the solution is to treat *if*-clauses as *plural* definite descriptions, and to analyze generalized world quantification by analogy with partitives[15] (this is only *part* of the solution because, as was discussed in Section 1.3.2, one still needs to explain why *necessarily, if p, q* appears to display a monotonic behavior even though *if p, q* does not). As was mentioned above, Schein 2001 gives independent evidence for such an analysis, based on the recursion of *if*-clauses (see also Stone 1997 for a different use of plurality in the analysis of mood and conditionals). On the assumption that *if*-clauses are plural descriptions, we can analyze (37)a-b by analogy with (37)a'-b':

(37) a. Probably, if Mary comes, John will be happy.
b. If Mary comes, John will probably be happy.
a'. Most of the students are happy.
b'. As for the students, most of them are happy.

The resulting theory is analogous to a strengthened version of Lewis's Logic, one which is discussed at some length by Lewis himself in *Counterfactuals* (see also Nute 1980).

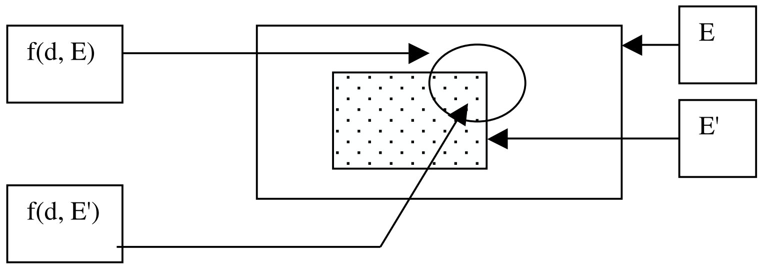
[15] As an anonymous reviewer points out, Matthewson 2001 suggests that quite generally quantifiers contain a hidden referential element which selects a subset of the objects that satisfy the restrictor.

2.2.1 Modifying Stalnaker's Conditions

What happens, then, when plurality is incorporated to the theory? Plural Choice functions are just another name for what Nute 1980 calls 'Class selection functions'. The literature on conditionals is rife with constraints that can be imposed on these to yield various logics. I will not attempt to do justice to these suggestions, but only to point out (i) that the same constraints might in principle be imposed on salience-based theories of plural definite descriptions, and (ii) that it might be heuristically interesting to explore the possibility (which is our working assumption) that exactly the same constraints are at work for all plural Choice functions, whether they apply to *if*-clauses or to plural definite descriptions. If we wish to preserve as much as possible of Stalnaker's original intuitions in this weaker framework, we may impose (tentatively) the following conditions:

<u>Condition 1*</u>: For each element d and each non-empty set E of elements, $f(d, E) \neq \#$ and $f(d, E) \subseteq E$.

<u>Condition 2*</u>: For each element d, each set E and each set E', if $E' \subseteq E$ and $f(d, E) \cap E' \neq \emptyset$, then $f(d, E') = f(d, E) \cap E'$.
This modification of Condition 2 is natural given that our Choice functions are supposed to select the *most salient* individuals and the *most similar* worlds in a given context. Consider the following, which represents a situation in which $f(d, E) \cap E' \neq \emptyset$:



-Clearly, if some elements of E' are the most highly ranked (with respect to salience or similarity) in the superset E, they should count as the most highly ranked among the elements of E'. This yields the inclusion: $f(d, E) \cap E' \subseteq f(d, E')$.
-Conversely, the elements of f(d, E) are more highly ranked than any other element of E, hence also more highly ranked than any other element of the subset E'. Since $f(d, E) \cap E' \neq \emptyset$, any element of E'-f(d, E) must be less highly ranked than the elements of $E' \cap f(d, E)$, and hence couldn't belong to f(d, E'). This yields the inclusion: $f(d, E') \subseteq E' \cap f(d, E)$
As Ede Zimmermann (p.c.) points out, Condition 2* together with Condition 1* and a reinterpretation of Condition 3* turns out to be equivalent to the choice being based on a universal, centered ordering. Zimmermann's argument is laid out in Appendix II. In fact, as he suggests, the entire story could just as well be stated directly in terms of orderings, though this would obscure the historical connection with Stalnaker's Selection Function analysis and von Heusinger's Choice Function analysis of definite descriptions.

For convenience, I repeat Condition 3, which may be retained without change, and I adapt Condition 4, which will be useful for conditionals:

<u>Condition 3*</u> (=Condition 3): For each context c and each set E of elements of a given sortal domain, $f(c, E) = \#$ iff $E = \emptyset$.

(We could decide to interpret # as Ø, i.e. to assume that a plural description whose restrictor is empty denotes the empty set. This is the assumption we make for technical reasons in Appendix II, though for linguistic purposes it is probably better to analyze # as a presupposition failure).

<u>Condition 4*</u>: For each element d and each subset E of the domain, if d□E, then d□f(d, E).

2.2.2 Comparisons

The comparison with Stalnaker's system is straightforward: the extension to plural Choice Functions allows us to leave out the requirement that similarity or salience should always be so fine-grained as to yield a single 'most salient' individual or a single 'most similar' world. We also weaken the resulting logic. In Stalnaker's initial system, *because if □* denotes a single possible world, for any proposition you care to mention either that world is in that proposition or it isn't. As a result, *[if □□] [if □□□]* comes out as a logical truth ('Conditional Excluded Middle'). This principle fails when plural choice functions are used. If some of the worlds denoted by *if □* satisfy □ while others don't, it will neither be the case that *[if □□]* nor that *[if □□□]*[16].

Lewis 1973 considered a system related to the analysis based on plural Choice Functions. But he dismissed it as too strong. In our terms, the problem is that the analysis predicts referential failure whenever it is not possible to select a set of worlds that are 'the closest' among those that satisfy the antecedent. How could this situation ever arise? Consider the following example:

> Suppose we entertain the counterfactual supposition that at this point ________ there appears a line more than an inch long. (Actually it is just under an inch.) there are worlds with a line 2" long; worlds presumably closer to ours with a line 11/2" long; worlds presumably still closer to ours with a line 11/4" long; worlds presumably still closer .... But how long is the line in the *closest* worlds with a line more than an inch long? If it is 1+x" for any x however small, why are there no other worlds still closer to ours in which it is 1+1/2x", a length still closer to its actual length? (...) Just as there is no shortest possible length above 1", so there is no closests world to ours among the worlds with lines more than an inch long (...)". (Lewis 1973 p. 20)

It isn't clear that Lewis's example is cogent; nor does his solution to the problem seem satisfactory. As pointed out by Stalnaker and others (see Harper 1981, Nute 1980), if such a fine-grained measure of similarity were *ever* available it would according to Lewis make the following sentence true for any value of □ (e.g. □=0.1", 0.01", 0.001", etc.): 'If this line were

---

[16] Stalnaker (p.c.) has pointed out that a treatment of *if*-clauses as plural definite descriptions might allow us to have our cake and eat it too when it comes to the Conditional Excluded Middle, a suggestion already made in Fintel 1997. Within a semantics in which an *if*-clause denotes a plurality of worlds, *(if p, q or if p, not q)* should *not* come out as valid, since it might well happen that some of the p-worlds selected by the *if*-clause are q-worlds, while others are not. However Fintel 1997 and Löbner 1985, 1987 have argued that definite plural noun phrases have a 'homogeneity presupposition' (Fintel 1997) or satisfy the 'logical property of completeness': *If the predicate P is false for the NP, its negation not-P is true for the NP*. Fintel and Löbner observe that in a situation where all of ten children are playing, among them three boys and seven girls, (ia) and (ib) have a clear truth value, but (ic) does not, as is expected if a presupposition of homogeneity holds of definite plurals:

(i) a. TRUE: The children are playing.
b. FALSE: The children are not playing.
c. ?: The children are boys." (Fintel 1997, citing Löbner 1987).

If the same presupposition holds of *if*-clauses, as is suggested by Fintel 1997, the Conditional Excluded Middle will appear to hold of all sentences that can be uttered felicitously.

longer than 1" long, it would be smaller than (1+□)" long□.[17] This is clearly an undesirable result, since for small enough □s these sentences are certainly not judged to be true.

In order to address this objection, Lewis has apparently suggested that the *coarseness* of the similarity measure may vary, so that in the example at hand all worlds in which, say, the length is between 1" and 5" count as equally similar to one another (Nute 1980 cites conversations with Lewis on a different but structurally similar example). But if so the same device can be used to save the plural Choice function analysis (i.e. the class function analysis) from Lewis's purported counterexample: we may simply stipulate that the similarity measure is never as fine-grained as the difference between the length of the line at w and at w*. Coarseness may save Lewis from trouble, but it also saves the plural Choice Function analysis from Lewis.

In addition, it is highly unclear how Lewis's system can be extended to cases of generalized quantification, which require that some value be given to the *if*-clause so it can restrict the generalized world quantifier (e.g. 'probably', 'there are 30% chances', etc.). The beginning of a solution can be found if we use the plural Choice Function analysis, since a plural definite description of worlds may restrict a generalized world quantifier, just as 'the students' may restrict 'most' in 'Most of the students came'. As was mentioned above, the only remaining problem is to insure that somehow the measure of salience becomes trivial when a quantifier (e.g. *necessarily)* is applied to *if*-clause. I leave this as an open problem.

3 Consequences of the referential analysis (I): topic, focus and 'then'.

3.1 Topicalization of the *if*-clause, focalization of 'then'

The referential analysis of *if*-clauses can now be used to derive a number of interesting syntactic and semantic facts. First, it has been observed that *if*-clauses can appear in the position of sentence topics, in a left-dislocated position. This should now come as no surprise, since referential elements can quite generally be dislocated in this fashion. By contrast, quantifiers or simple restrictors may not be:

(38) a. *Every man, he is happy
b. *Man, every is happy

Bittner 2001, who develops similar ideas, gives a further argument from Warlpiri. Following Hale 1976, she observes that the following sentence is ambiguous:

(39) Maliki-rli *kaji*-ngki yarlki-rni nyuntu
[dog-ERG *ST*-3SG.2SG bite-NPST you]
ngula-ju kapi-rna luwa-rni ngajulu-rlu.
DEM-TOP FUT-1SG.3SG shoot-NPST me-ERG

[17] Here is why. In Lewis's sphere-based system, the truth-conditions a conditional If □, □ are as follows:
If □, □ is true at world i (according to the system of spheres $) if and only if either
(1) No □-world belongs to any sphere S in $$_i$, or
(2) Some sphere S in $$_i$ does contain at least one □-world, and □□ □ holds at every world in S
Take □=□this line is longer than 1"□, □□=□this line is longer than (1+□)"□(note that □is a parameter, to be replaced by its value, not quoted; hence the use of Quine's quasi-quotation marks).
Let $□ be the sphere than contains all the worlds in which the size of the line is smaller than (1+□)" (by assumption such a sphere exists since the similarity measure in the context of speech orders worlds by the value of □at those worlds). Clearly there are □-world in $□if □>0. In these worlds □□ □ is true. Hence the conditional should be true.

a. Reading A. ‘As for *the* dog that bites you, I’ll shoot *it*.’ (individual-centered)
b. Reading B. ‘*If* a dog bites you, *then* I’ll shoot it.’ (possibility-centered)

Bittner writes:

The dependent clause of [(39)] — with the complementizer *kaji*, glossed ‘ST’ for ‘same topic’ — introduces a topical referent of some type. On reading (A) the topic is a contextually prominent individual, and on reading (B), a prominent possibility. In either case, the topical referent is picked up in the matrix comment by a topic-oriented anaphoric demonstrative *ngula-ju*, which is likewise type-neutral. So depending on the context, the topic of [(39)] may be either the most prominent dog which bites the addressee or the closest possibility that a dog may bite. The fact that one and the same sentence can have both of these readings suggests that they have essentially the same semantic representation, up to logical type.

Bhatt & Pancheva 2001 further observe that there is a strong syntactic similarity between conditionals and correlative constructions, which 'involve a free relative clause adjoined to the matrix clause and coindexed with a proform inside it'. In fact, in many languages *if*-clauses are overtly correlative structures themselves. Bhatt and Pancheva suggest that, quite generally, *if*-clauses are free relatives, i.e., definite descriptions of possible worlds, and that the word *then* is a world pronoun (in some languages, for instance Marathi, *then* appears to be morphologically related to other pro forms). The analysis of *then* as a world pronoun has also been proposed by van Benthem, Cresswell 1990, Iatridou 1994 and Izvorski 1996. In particular, Iatridou 1994 that this could derive the semantic/pragmatic restrictions on the distribution of *then*:

(40) a. If Peter runs for President, the Republicans will lose.
b. If Pete runs for President, then the Republicans will lose.

(41) a. If John is dead or seriously ill, Mary will collect the money.
b. If John is dead or seriously ill, then Mary will collect the money.
a'. If John is dead or alive, Bill will find him.
b'. #If John is dead or alive, then Bill will find him.

Although superficially there is no difference between a sentence with and without *then* (e.g.(40)a-b), on closer inspection some subtle contrasts do arise, as illustrated by the deviance of (41)b’. Iatridou’s suggestion is that the presence of *then* triggers a presupposition or an implicature which she analyzes as follows, where O is a generalized quantifier over worlds (e.g. ‘necessarily’, ‘possibly’, etc.), ‘[p]’ is its restrictor, and ‘q’ its nuclear scope:

(42) Iatridou’s analysis of *O, if p, then q*
a. Assertion: O[p] q
b. Presupposition/Implicature: □O[□p] q

A bare *if*-clause is analyzed as restricting a covert universal quantifier. The presupposition/implicature in (41)b’ is thus that there is a possible world in which John is neither dead nor alive and in which we find him. But there are certainly no such worlds (John is either dead or alive but not both), which accounts for the deviance of this example.

Iatridou further attempts to relate this effect to the presupposition/implicature found in constructions that involve left-dislocation and doubling in German. The following typically implicates that someone other than Hans failed to understand:

(43) $Hans_i$, der_i hat es verstanden. (German; Iatridou 1994)
Hans, he has it understood
a. Assertion: P(i)
b. Presupposition/Implicature: [□j: j≠i] □P(j)

Iatridou suggests that the doubled pronoun plays the same role as *then* in the preceding examples. Although these suggestions are illuminating, Iatridou doesn't really explain how *if*-clauses and dislocated noun phrases may be treated in a unified framework. Part of the problem is that on her analysis an *if*-clause is a restrictor rather than a referential element. This makes the comparison with left dislocated referential noun phrases harder to make. On the present approach, the difficulty disappears since *if*-clauses are analyzed as being referential.

Iatridou further observes, however, that the analogy between *then* and *der* in German breaks down in the following example, due to I. Heim:

(44) Alle haben die Vorlesung verstanden. Hans hat sie verstanden. Maria hat sie verstanden. Und unser Freund Peter, der hat sie auch verstanden. (German)
'Everybody understood the lecture. John understood it. Mary understood it. And our friend Bill, he understood it too.'

Iatridou's prediction is that (44) should be infelicitous because the implicature contradicts the assertion. But this is not the case. Iatridou leaves the problem open. The difficulty can be solved by suggesting that *then* isn't just any pronoun, but rather a *strong* pronoun. In languages that distinguish between weak and strong pronouns, Heim's facts can be replicated with the former but not with the latter. Strong pronouns thus pattern in the way predicted by Iatridou's analysis, as is illustrated by the following contrasts in French:

(45) Everybody understood. The professors understood, the staff understood, and...
a. #[Les étudiants]$_i$, eux$_i$ ont compris aussi
[The students]$_i$, them$_i$-strong$_F$ have understood too
b. [Les étudiants]$_i$, ils$_i$ ont compris aussi
[The students]$_i$, they$_i$-weak$_F$ have understood too

Thus the behavior of the strong pronoun *eux* appears to be similar to that of the world pronoun *then*. With *eux*, the implicature is that some non-students didn't understand, hence the infelicity of the above example (since everybody understood). In the case of *then* in *if p, then q*, the implicature is that some non-*p* worlds are non-*q* worlds, which accounts for (41)b'

Izvorski 1996 explores a different line of analysis to overcome this problem. She suggests that the reason (44) is grammatical is that the focus-particle *too* has been added. Adding the same particle to Iatridou's 'then' examples makes them felicitous under the same conditions:

(46) We will definitely play soccer. If the sun shines we will. If it is cloudy and cold we will. And if it rains (#then) we will / And <also> if it rains *then* too we will.

As it happens, this observation meshes well with the suggestion that *then* is a *strong* world pronoun. For in Izvorski's example *too* is added right after the word *then*. If *aussi* ('also') is placed right after *eux* in (45)a, the example improves. And if *too* is placed lower down in the structure in Izvorski's example, it becomes worse:

(47) Everybody understood. The professors understood, the staff understood, and...
a. [Les étudiants]$_i$, eux$_i$ aussi ont compris
[The students]$_i$, them$_i$-strong$_F$ too have understood
b. We will definitely play soccer. If the sun shines we will. If it is cloudy and cold we will. #And if it rains *then* we will too.

Let us now see whether Iatridou's and Izvorski's observations can be derived (both for individual and for world pronouns) from an independently motivated mechanism. In order to achieve this, I simplify the problem and consider only the case of a focused pronoun, disregarding the left-dislocated element. Given the referential analysis of *if*-clauses, the semantic value of *then* should be precisely that of its antecedent, which makes the simplification relatively harmless.

Let us first consider a standard example. Rooth 1996 briefly discusses the following sentence:

(48) Situation: Steve, Paul and I took a calculus quiz (which was graded on the spot). George asked me how it went.
a. Well, I_F passed. (Rooth 1996, (11)b)
b. Implicature: Steve and Paul didn't pass

Briefly, Rooth's suggestion is that a focused element introduces a set of alternatives, so that if the subject is focused in 'I_F passed', a set of alternatives is evoked, of the form: {'I passed', 'Steve passed', 'Paul passed', 'Steve and I passed', 'Paul and I passed', 'Steve, Paul and I passed', etc.}. This, in turn, triggers an implicature that the sentence that was in fact asserted was the most informative true sentence among the set of alternatives. Note that the alternatives may involve plural subjects, which is crucial to derive the correct result. Rooth analyzes the alternatives as a set of propositions (i.e. as a set of sets of possible worlds). In order to simplify the treatment of focused world pronouns, I use sets of sentences instead. Rooth's analysis may then be reconstructed as follows, where 'w' is a variable that denotes the actual world ('⌜' and '⌝' are Quine's quasi-quotation marks):

(49) Situation: Steve, Paul and I took a calculus quiz (which was graded on the spot). George asked me how it went.
a. Well, I_F passed. (Rooth 1996, (11)b)
b. Ordinary value: passed(w, I)
[Ordinary value: 'I passed']
c. Focus value: F={S: for some contextually given denoting (possibly plural) expression E, S=⌜passed(w,E)⌝}
[Focus value: {'I passed', 'Steve passed', 'Paul passed', 'Steve and I passed', 'Paul and I passed', 'Steve, Paul and I passed', etc.}]
d. Implicature: no sentence in F both (i) entails (a) and (ii) is true.
[Implicature: Among the relevant alternatives, no one but me passed]

Since the alternatives to 'I' in Rooth's example involve plural subjects, if someone other than me, X, had passed, I could have uttered: 'X and I passed' (or: 'we passed'), which would have been both true and more informative than what I in fact uttered. Since I did not utter this more informative sentence, I implicated that only I passed.

This analysis can be extended without difficulty to a case involving focalization of a plural pronoun (I use a French example because the morphological distinction between weak and strong pronouns indicates that in the following the pronoun *must* be focused):

(50) a. ([Les étudiants]$_i$,) [eux$_i$]$_F$ ont compris [French; 'eux' is the strong pronoun]
([The students]$_i$,)[them$_i$-strong]$_F$ have understood
b. Ordinary value: understood(w, they$_i$)
[Ordinary value: 'they$_i$ understood']
c. Focus value: F={S: for some contextually given denoting (possibly plural) expression E, S=⌜understood(w,E)⌝}
[Focus value: {'they$_i$ understood', 'I and they$_i$ understood', 'Paul, Steven and they$_i$ understood', etc}]

d. Implicature: no sentence in F both (i) entails (a) and (ii) is true.
[Implicature: Among the relevant alternatives, no one except them$_i$ understood]

The implicature is that none of the contextual alternatives to the plural individual denoted by 'the students' did in fact understand, for otherwise a more informative sentence could have been asserted (namely: 'The students *and X* understood'). There are now two ways in which the implicature could lead to infelicity:
-If there are other (salient) people and they also understood, the implicature will simply be false.
-If there is no one else in the domain of discourse, the focus value will only contain sentences that are entailed by the sentence that was in fact asserted. This makes the implicature idle, in a way that appears to lead to deviance. Thus if there were only students in the audience of a particularly complicated thriller, it won't do to say: 'Les étudiants, eux ils ont compris' (*the students, them-strong they understood*). For this would imply that other members of the audience, non-students, didn't understand. But there are no non-students in the audience. This observation motivates the following condition:

(51) Non triviality: some element of the Focus value should not be entailed by the asserted sentence.

Applied to conditionals, this appears to account for the deviance of (41)b', repeated as (52) and analyzed as in (53) (W is a variable over pluralities of worlds):

(52) #If John is dead or alive, then$_F$ Bill will find him.

(53) a. ([If p]$_i$,) [then$_i$]$_F$ q
b. Ordinary value: q(then$_i$)
[Ordinary value: q holds in the worlds denoted by 'then$_i$']
c. Focus value: F={S: for some contextually given denoting expression E, S=will-find-him(E)}
[Focus value: {'if John is dead, Bill will find him', 'if John is alive, Bill will find him', etc}]
d. Implicature: no sentence in F both (i) entails (a) and (ii) is true.

Because the antecedent is a tautology, the condition of non-triviality is violated, hence the deviance of the example. (Note that on this analysis this sentence is not exactly parallel to the 'Hans' example given above, as was suggested by Iatridou; rather, the correct point of comparison is the thriller example we just discussed).

3.2 Condition C effects

The referential analysis allowed us to explain why *if*-clauses can be dislocated and doubled by the word *then*, construed as a world pronoun. But if this theory is on the right track, we would expect world pronouns and world descriptions to share other formal properties of pronominal and referential expressions. In the domain of reference to individuals, there are well-known constraints on the syntactic distribution of such elements, summarized in Chomsky's 'Binding Theory'. We now attempt to show that one of these conditions, the strong form of 'Condition C', applies to world expressions as well. This can be seen as an extension of an analysis made by Percus 2000, who suggested that some world variables must satisfy other syntactic constraints (Percus suggested that some world variables must be bound locally).

Condition C of the Binding Theory states that a referential expression ('R-expression') may not be bound. Typically violations of the constraint are relatively mild (and cross-linguistically unstable) when an R-expression is co-indexed with another c-commanding R-expression. By contrast, the violations are very strong (and cross-linguistically stable) when an R-expression is c-commanded by a co-referring pronoun. The latter case is illustrated by the examples in (54), whose structures are given in (56):

(54) a. $John_i$ likes [people who admire him_i]
b. *He_i likes [people who admire $John_i$]
c. [His_i mother] likes [people who admire $John_i$]

(55) a. [$R\text{-}expression_i$ [$_{VP}$ [$_{NP}$ ... $pronoun_i$ ...]]]
b. * [$pronoun_i$ [$_{VP}$ [$_{NP}$ ... $R\text{-}expression_i$ ...]]]
c. [[... $pronoun_i$ ...] [$_{VP}$ [$_{NP}$ ... $R\text{-}expression_i$ ...]]]

As is shown in (54)-(55)c, a pronoun may in some cases be coindexed with a referential expression that follows it ('backwards anaphora'). However this is impossible if the referential expression is in the scope of ('c-commanded by') the pronoun, as in (54)b. Exactly the same pattern can be replicated with *if*-clauses, construed as referential terms, and the word *then*, analyzed as a world pronoun:

(56) a. [if it were sunny right now]$_i$ I would see [people who would $then_i$ be getting sunburned].
b. *I would $then_i$ see [people who would be getting sunburned [if it were sunny right now]$_i$].
c. Because I would $then_i$ hear lots of people playing on the beach, I would be unhappy [if it were sunny right now]$_i$

All the examples make reference only to the time of utterance, which ensures that *then* is interpreted modally, not temporally (this is because the word *now* rather than *then* must be used to refer to the time of utterance). It is plausible that *then* and an *if*-clause are adjoined somewhere below IP and above VP. This yields exactly the same schematic structures as in (55). The natural conclusion is that *if*-clauses, as other referential expressions, are subject to Condition C of Chomsky's Binding Theory.

4 Consequences of the referential analysis (II): referential classification

Referential expressions may appear with features that indicate how their denotation is situated with respect to the context of speech ('context-relative classification') or with respect to some other salient entity ('object-relative classification'). The first case is illustrated by the contrast between *I*, which must denote the speaker, and *he*, which normally may not do so. Similarly, the word *this* must denote an entity which is close to the speaker, while the word *that* must normally denote an entity which is further away. The second case ('object-relative classification') requires that we consider more exotic languages. In Algonquian, two sorts of third person agreement markers are distinguished. A 'proximate' expression must denote a salient entity which is the center of reference in a stretch of discourse. By contrast, an 'obviative' expression denotes some other entity, which is less salient than the referent of the proximate term. In English an object-relative system appears to be used in the temporal domain, where a time variable with pluperfect features must denote a moment which is prior to some other salient past moment.

In this section I suggest that the distinction between indicative and subjunctive conditionals should be analyzed by analogy with that between *this* and *that*. To simplify the analysis I assume that descriptions of worlds are always singular, although for reasons that were discussed earlier plural descriptions should probably be countenanced as well. I suggest in this simplified framework that an indicative *if*-clause must denote a world which is in the Context Set (i.e. a world which is compatible with what the speaker and hearer presuppose), and thus counts as 'close enough' to the context of utterance. A subjunctive *if*-clause normally denotes a world which is further away. This is almost *exactly* the analysis offered in Stalnaker 1975, except that now the theory is embedded within a general system of referential classification which applies to individuals and worlds alike (similar suggestions with respect to the tense/mood analogy are made in Iatridou 2000). I then extend this theory to examples involving two layers of subjunctive morphology ('double subjunctives'), which are analyzed as an instance of object-relative classification in the domain of worlds.

4.1 'This' vs. 'that'

Consider first the difference between *this* and *that*. It appears that *this* incorporates a presupposition that its denotation should count as close to the speaker. We may be tempted to define the opposite presupposition for *that*, i.e. that *that* may *not* denote an entity which is close to the speaker. This is too strong, however. Watching a scene in the mirror, I may find out that a table I was observing is in fact the table standing right next to me. I could then utter without presupposition failure: 'That is this!'. The same point carries over to other cases. If David observes through a mirror someone whose pants are on fire, he may at some point exclaim: 'He is me!'. Although it was presupposed all along that *I* referred to the speaker, it was *not* presupposed that *he* referred to a non-speaker (or else David's utterance would have resulted in presupposition failure, contrary to fact).

In order to analyze these facts, I will make use of a device inspired by Dekker 2000. Dekker observes that there can be uncertainty as to whom I am referring to through a use of the word *he*. For instance I may be unsure whether I am referring to John or to Sam, although I know that I am not referring to Peter. This fact can be formally captured by evaluating the sentence with respect to a set of assignments $S=\{s_1, s_2, ...\}$ rather than with respect to a single assignment. If I know who I am referring to, all elements of S will assign the same value to the pronoun I used. If I am not entirely sure who I am referring to, S will contain some assignments which, say, assign John to *he*, while others assign Sam to the same pronoun (though no element of S assigns Peter to it, since I know that I am *not* referring to Peter.)

We can then use this system to give an asymmetric definition of the semantics of $this_x$ and $that_y$, where x and y are variables whose value is contextually supplied (by a demonstration, encoded in the assignment function with respect to which the sentence is evaluated). In the case of $this_x$, the presupposition is that *x* refers to an object near the speaker. To put it more formally, for every member s of S, it must be the case that s(x) is near the speaker. For $that_y$, by contrast, the presupposition is simply that there is a *possibility* that the denotation of z isn't close to the speaker. This just requires that for some s in S, s(z) be far from the speaker. Thus no presupposition failure need arise when I utter something like: 'That is this'. This analysis is naturally cast within a dynamic semantics, as is done in Appendix I (again following Dekker's ideas). The set of assignments with respect to which the sentence is evaluated is modified in discourse, so that in uttering '$That_y$ is $this_x$' I eliminate from S those assignments in which $s(y)\neq s(x)$.

4.2 Indicative vs. Subjunctive

On Stalnaker's standard analysis (Stalnaker 1975), indicative mood incorporates the (default) assumption that the Selection function picks a world within the Context Set. From the present perspective, this is just to say that indicative mood expresses a presupposition similar to that of the word *this*, but in the domain of worlds rather than of individuals. The notion 'close to the context of utterance' is rendered, following Stalnaker, as: 'within the Context Set'. The Context Set also plays a second role, which is to model the speaker's uncertainty about what the actual world is. Thus when we compute the reference of a definite description of worlds $[\square_{w*}w: \square]$, we may not know with precision what the value of the point of reference w* is (in other words, there are assignments compatible with the speaker's state of knowledge which assign different values to w*). As a result, there will be uncertainty on the value of $[\square_{w*}w: \square]$, which by definition denotes the closest $\square$-world(s) to w*. Given our very weak semantics for *that*, we expect that subjunctive marking should only indicate that there is a *possibility* that $[\square_{w*}w: \square]$ denotes a world outside the Context Set. To quote Stalnaker 1975, subjunctive marking indicates that 'the selection function is one that may reach out' of the Context Set. This 'may' is now analyzed as: one of the assignments s with respect to which the sentence is evaluated is such that the value of $[\square_{w*}w: \square]$ under s is not in the Context Set.

This analysis, like Stalnaker's original theory, does *not* predict that subjunctive conditionals are counterfactual. This is a welcome result in view of the following example, due to Anderson 1951 (cited in von Fintel 1997 and also by Stalnaker):

(57) If Jones had taken arsenic, he would have shown just exactly those symptoms which he does in fact show. [So, it is likely that he took arsenic]

The speaker wants to argue that Jones took arsenic in the actual world. If so, by Centering the *if*-clause must pick out the actual world, which is in the Context Set. This need not cause any problem given the present theory. All the subjunctive marking indicates is that *some* of the assignments with respect to which the sentence is evaluated gives the *if*-clause a value that lies outside the Context Set. Within a dynamic framework the assertion indicates that these assignments should be thrown out of the initial information state; but this need not cause any presupposition failure.

A final point is in order. The Context Set constantly evolves in discourse, since each assertion reduces the set of assignments (and possible worlds) which are compatible with the speaker's beliefs/assertion. But since the Context Set serves to define which worlds count as 'close' to the context of utterance, the notion of closeness itself must change throughout a discourse. This is modeled in some detail in Appendix I.

4.3 'Double Subjunctives'

The indicative/subjunctive distinction has now been analyzed in terms of a context-dependent system of classification. As was mentioned earlier, however, there are also *object*-dependent systems of classification in natural language. We cited without much discussion the proximate/obviative distinction in Algonquian; we could also have cited the pluperfect in English, whose denotation must precede some other salient past moment rather than simply the time of utterance. As one would expect, such systems also exist in the domain of reference to worlds. The relevant facts are discussed, among others, in Dahl 1997 and Jespersen 1965. The latter observes that the pluperfect may, in colloquial speech, be used 'of the present time, simply to intensify the unreality irrespective of time'[18]. He gives the following example:

[18] Thanks to Frank Veltman for bringing these examples to my attention.

(58) If I had had money enough (at the present moment), I would have paid you.

The facts might be clearer in other languages. French displays the following minimal pairs:

(59) [John, a professional tennis player, had a terrible injury and is now at the hospital. He definitely cannot participate in the competition which is to take place tomorrow. Talking to him, I say:]

a. Si tu avais joué demain, tu aurais gagné.
If you had played tomorrow, you would-have won
'If you had played tomorrow, you would have won'

b. #Si tu jouais demain, tu gagnerais/aurais gagné
If you played tomorrow, you would win/would-have won
'If you played tomorrow, you would win/would have won'

In this situation, John's participation in the event is not only counterfactual (it is presupposed that it won't happen), but it is particularly remote. *Not* using the pluperfect (interpreted as a double subjunctive) would in fact come across as insensitive, as it would disregard John's unfortunate situation.

From the present perspective an account suggests itself: in its modal uses just as in its temporal uses, the pluperfect is a device of object-relative classification. In the case at hand it indicates that the worlds picked out by the *if*-clause are more remote that some worlds which are themselves outside the Context Set. The latter are presumably worlds in which John did not have an accident. The implementation offered in the appendix simply involves a dyadic predicate '<' (which applies across domains, i.e. to individuals, times and worlds alike). In the world domain, □□<□□ indicates that the value of □ is more remote than the value of □ (this, in turn, can be defined in terms of Stalnaker's Selection function) (see also Stechow 2003 for a similar analysis of temporal uses of the pluperfect).

5 Conclusion

If the present theory is on the right track, a large part of the semantics of conditionals can be derived from independent grammatical mechanisms. *If* is simply the form taken by *the* when it applies to a description of worlds. The non-monotonicity of conditionals can thus be seen as a special case of the non-monotonicity of definite descriptions. *If*-clause can be topicalized because they are referring expression. A precise notion of co-reference between *then* and an *if*-clause can thus be developed, which accounts for Iatridou's and Izvorski's insights concerning the analogy between *then* and pronominal forms, and also predicts - correctly - binding-theoretic effects with world-denoting expressions (as anticipated in Percus 2000). Finally, the distinction between indicative, subjunctive and double subjunctive conditionals can be analyzed in terms of a general system of referential classification which situates the value of the word(s) denoted by the *if*-clause with respect to the context or with respect to some salient world. If successful, this analysis may play a part in a general attempt to reduce the semantics of natural language to a few abstract semantic modules which apply in identical fashion to different sortal domains.

Appendix I. A Fragment

We provide a formal implementation of some of the main ideas presented in the paper. For simplicity, this system is restricted to singular descriptions, and thus adheres strictly to Stalnaker's original definition of Selection functions. The theory is stated as much as possible in a sortally-neutral fashion, i.e. whenever possible a single symbol applies to individuals, to times and to worlds [in this article no use is made of generalization to time of the relevant notions].

- *Vocabulary*

Logical Vocabulary
-Non-sortal vocabulary:
&, □, □ □, =
-Sortal vocabulary:
for each □□{'x', 't', 'w'}, for each i □IN, a first-order variable $\square_i$.
We say that the sortal domain of 'x' is D, the sortal domain of 't' is T and the sortal domain of 'w' is W. By extension, $\square_i$ is said to have the sortal domain of □. We write: sort('x')=D, sort('t')=T, sort('w')=W. And by extension: sort($\square_i$)=sort(□)

Non-logical vocabulary
For each m, n, p in IN, the non-logical vocabulary contains an infinite set $R^{<x:\ m,\ t:\ n,\ w:\ p>}$ of predicates taking m individual variables, n time variables and p world variables.
Proper names (individual sort): *John, Mary, Wisahkechahk, Fox* (proper names are sometimes abbreviated in what follows with their first letter only)

Features
local, <local, LOCAL, <LOCAL, <

Note: 'local' indicates that an expression must denote a coordinate of the context (speaker, time, or world of utterance). '<local' indicates that an expression must denote an entity which is distant from the context on some measure. 'LOCAL' indicates that the value of an expression must lie in the neighborhood of the context. '<LOCAL' forces the value of an expression *not* to lie in the neighborhood of the context. Finally, '<' is a dyadic predicate that indicates for □□<□□ that the value of □ is more remote than the value of □ (from the standpoint of the context).

Parentheses and brackets: (,), [,], {, }

Note: (,) are used to indicate constituency; [,] are used to symbolize quantifiers. {, } indicate presuppositions.

- *Terms and Formulas*

-Each variable and each constant of sort s is a term of sort s.
-If $\square_1$, ..., $\square_m$, $\square'_1$, ..., $\square'_n$, $\square'_1$, ..., $\square'_p$ are respectively m, n and p terms of sorts D, T, W, if R□$R^{<x:\ m,\ t:\ n,\ w:\ p>}$, if $\square_1$ and $\square_2$ are formulas, and if i□IN and □□{'x', 't', 'w'}, the following are formulas:
R($\square_1$, ..., $\square_m$, $\square'_1$, ..., $\square'_n$, $\square'_1$, ..., $\square'_p$)|□□ | ($\square_1$&$\square_2$) | □$\square_i$□|$\square_1$=$\square_2$|$\square'_1$=$\square'_2$|$\square'_1$=$\square'_2$

-If □ is a formula, if □□{'x', 't', 'w'} and if i□IN, [□$_k$□,□] is a term of the same sort as □

-If □, □' are terms of sort s, the following are terms of sort s: □{local} | □{<local} |□{LOCAL} | □{<LOCAL} | □{<□'}

- *Models*

A model M=<D, T, W, I, f> consists of:
(i) three non-empty, non-intersecting sets: D, T and W (=the sortal domains or simply the 'sorts' of 'x', 't' and 'w', in the terminology introduced above)
(ii) an interpretation function I which assigns
-a subset I(R) of D^m□T^n□W^p to each letter R of $R^{<x: m, t: n, w: p>}$
-an element I(c) in the sortal domain of c to each constant c
(iii) a selection function from (D□𝒫(D))□(T□𝒫(T))□(W□𝒫(W)) into D□T□W which satisfies Stalnaker's Conditions (generalized across domains):
-Condition 1 (minimum condition on Choice Functions)
□S□{D, T, W} □a□S □A□S (f(a, A)=# or (f(a, A)□A))
-Condition 2 (condition for a Choice Function to select the 'closest' element on some measure)
□S□{D, T, W} □a□S □A□S □A'□S (A'□A & f(a, A)□A') □ f(a, A)=f(a, A')
-Condition 3: Referential failure
□S□{D, T, W} □a□S □A□S (f(a, A)=# □ A=Ø)
-Condition 4: Centering
□S□{D, T, W} □a□S □A□S (a□A □ f(a, A)=a)

<u>Note 1</u>: We can define the derived notions '$<_a$' '$\leq_a$'for each a in some sortal domain:
□S□{D, T, W} □a, a', a''□S (a''$\leq_a$a' □ $_{def}$ f(a, {a', a''})=a').
□S□{D, T, W} □a, a', a''□S (a''$<_a$a' □ $_{def}$ (a'≠a'' & f(a, {a', a''})=a').

<u>Note 2</u>: < is taken to represent salience for individuals, temporal remoteness in the past for times, and modal remoteness for worlds.

<u>Note 3</u>: Stalnaker's conditions on f induce implausibly strong conditions on <, esp. for times and worlds.

- *Information States*

-An information state is a set S of triples of the form:
s=<<d, t, w>, g>, with <d, t, w>□D□T□W, and g an assignment function which assigns to each variable □$_i$ for □□{'x', 't', 'w'}, i□IN a value from its sortal domain.

<u>Note</u>: Intuitively, an information state represents what the speaker knows about his context of speech (here identified to a triple <d, t, w>), as well as about objects he might be referring to with demonstrative terms.

<u>Terminology</u>: With s defined as above, we write: context(s)=: <d, t, w> and local(D)(s)=: d, local(T)(s)=: t, local(W)(s)=: w. If □ is a variable, we write s(□)=:g(□).

-We also need to determine what a speaker in a given information state considers to be the objects that count as 'close' to the context of speech. We assume that a function LOCAL is given which associates to each element s of an information state S a triple of the form

<d⁺, t⁺, w⁺>□ 𝒫(D)□𝒫(T)□𝒫(W)
with the stipulation that (with the notation used above) d□d⁺, t□t⁺, w□w⁺.

Notation: For LOCAL(s, S) defined as above, we write LOCAL(D)(s, S)=:d⁺, LOCAL(T)(s, S)=: t⁺, LOCAL(W)(s, S)=: w⁺

<u>Stipulation:</u> Stalnaker's notion of Context Set
For each information state S, we stipulate that:
□s□S LOCAL(W)(s, S)={local(W)(s): s□S}
Let us think of S as representing the speaker's state of belief. The Stipulation has the effect of forcing LOCAL(W)(s, S) to represent Stalnaker's notion of 'Context Set' : these are the worlds which, for all the speaker knows, could be the world he lives in.

- *Reference and truth relative to an assignment and to an information state*

The definition is in two steps. First, we define reference and satisfaction under an assignment s *in an information state S*. The assignment s is not enough because S serves indirectly to determine which worlds count as 'close', which in turn determines which descriptions of worlds fail to refer (this occurs for instance when the presupposition introduced by LOCAL is violated). In a second step, we define updates on information states.

Let s be an element of an information state S.
-If □ is a constant, [[□]]^{s, S}=I(□)
-If □ is a variable, [[□]]^{s, S}=s(□)
-[[R(□, ..., □_m, □'_1, ..., □'_n, □''_1, ..., □''_p)]]^{s, S}≠# iff each of [[□]]^{s, S}, ..., [[□''_p]]^{s, S} is ≠#.
If ≠#, [[R(□, ..., □_m, □'_1, ..., □'_n, □''_1, ..., □''_p)]]^{s, S}=1 iff <[[□]]^{s, S}, ..., [[□''_p]]^{s, S}>□I(R)
-[[□ □]]^{s, S}≠# iff [[□]]^{s, S}≠#. If ≠#, [[□ □]]^{s, S}=1 iff [[□]]^{s, S}=0
-[[(□_1&□_2)]]^{s, S}≠# iff [[□_1]]^{s, S}≠# and for S'={s'□S: [[□_1]]^{s', S}=1}, [[□_2]]^{s, S'}≠#.
If ≠#, [[(□_1&□_2)]]^{s, S}=1 iff [[□_1]]^{s, S}=1 and [[□_2]]^{s, S}=1.
-[[[□_k □_i□]]]^{s, S}≠# iff
(a) □e□sort(□): [[□]]^{s[□_i□ e], S}≠#, and
(b) f(s(□_k), {e□sort(□): [[□]]^{s[□_i□ e],S}=1})≠#, i.e. (given Condition 3) {e□sort(□): [[□]]^{s[□_i□ e], S}=1}≠Ø
If ≠#, [[[□_k □_i□]]]^{s, S}=f(s(□_k), {e□sort(□): [[□]]^{s[□_i□ e], S}=1})
-If □ is a term:
[[□{local}]]^{s,S}≠# iff □s'□S[[□]]^{s',S}≠# and □s'□S [[□]]^{s',S}=local(sort(□))(s'). If ≠#, [[□{local}]]^{s,S}=[[□]]^{s,S}
[[□{<local}]]^{s,S}≠# iff □s'□S [[□]]^{s', S}≠# and □s'□S [[□]]^{s', S}≠local(sort(□))(s'). If ≠#, [[□{<local}]]^{s,S}=[[□]]^{s,S}
[[□{LOCAL}]]^{s,S}≠# iff □s'□S[[□]]^{s', S}≠# and □s'□S [[□]]^{s',S}□LOCAL(sort(□))(s, S). If ≠#, [[□{LOCAL}]]^{s, S}=[[□]]^{s, S}
[[□{<LOCAL}]]^{s,S}≠# iff □s'□S [[□]]^{s', S}≠# and □s'□S [[□]]^{s', S}□LOCAL(sort(□))(s, S). If ≠#, [[□{LOCAL}]]^{s, S}=[[□]]^{s, S}
[[□{<□'}]]^{s,S}≠# iff □s'□S [[□]]^{s',S}≠# and [[□']]^{s',S}≠# and □s'□S [[□]]^{s',S} <_{local(sort(□))(s')}[[□']]^{s',S}. If ≠#, [[□{<□'}]]^{s,S}=[[□]]^{s,S}
-[[□ □_i□]]^{s, S}≠# iff □e□sort(□): [[□]]^{s[□_i□ e], S}≠#.
If ≠#, [[□ □_i□]]^{s, S}=1 iff for all e□sort(□): [[□]]^{s[□_i□ e], S}=1.
-[[□=□']]^{s, S}≠# iff [[□]]^{s, S}≠# and [[□']]^{s, S}≠#. If ≠#, [[□=□']]^{s, S}=1 iff [[□]]^{s, S}=[[□']]^{s, S}

- *Updates*

This is a standard update semantics, in which $S[\square]$ is the result of updating information state S with the formula □

Let S be an information state. Then:

$-S[R(\square_1, ..., \square_m, \square'_1, ..., \square'_n, \square'_1, ..., \square'_p)] \neq \#$ iff $\square s \square S\ [\![R(\square_1, ..., \square_m, \square'_1, ..., \square'_n, \square'_1, ..., \square'_p)]\!]^{s, S} \neq \#$. If $\neq \#$, $S[R(\square_1, ..., \square_m, \square'_1, ..., \square'_n, \square'_1, ..., \square'_p)] = \{s \square S: [\![R(\square_1, ..., \square_m, \square'_1, ..., \square'_n, \square'_1, ..., \square'_p)]\!]^{s, S}=1\}$

$-S[\square\square] \neq \#$ iff $S[\square] \neq \#$. If $\neq \#$, $S[\square\square]=S-S[\square]$

$-S[(\square_1 \& \square_2)] \neq \#$ iff $S[\square_1] \neq \#$ and $S[\square_1][\square_2] \neq \#$. If $\neq \#$, $S[(\square_1 \& \square_2)]=S[\square_1][\square_2]$

$-S[\square \square_i \square] \neq \#$ iff $\square s \square S\ \square e \square sort(\square): [\![\square]\!]^{s[i \square e], S} \neq \#$. If $\neq \#$, $S[\square \square_i \square]=\{s \square S: \square e \square sort(\square)\ [\![\square]\!]^{s[i \square e], S}=1\}$

$-S[\square=\square'] \neq \#$ iff $\square s \square S\ [\![\square=\square']\!]^{s, S} \neq \#$. If $\neq \#$, $S[\square=\square']=\{s \square S: [\![\square]\!]^{s, S}=[\![\square']\!]^{s, S}\}$

- *Truth*

□ is true with respect to s iff {s}[□]={s} (in other words, the singleton {s} updated with □ is {s} itself).

- *Examples*

(I depart from the 'official' notation for predicates, for which I use English words.)

(60) a. He_i is me_k (*is not a presupposition failure*)
b. $x_i\{<local\}=x_k\{local\}$
c. $S[b] \neq \#$ iff $\square s \square S\ [\![x_i\{<local\}=x_k\{local\}]\!]^{s, S} \neq \#$
iff $\square s \square S(\square s' \square S\ [\![x_i]\!]^{s', S} \neq local(D)(s')\ \&\ \square s' \square S\ [\![x_k]\!]^{s', S}=local(D)(s'))$
iff $\square s' \square S\ s'(x_i) \neq local(D)(s')\ \&\ \square s' \square S\ s'(x_k)=local(D)(s'))$
If $\neq \#$,
$S[b]=\{s \square S: [\![x_i\{<local\}]\!]^{s, S}=[\![x_k\{local\}]\!]^{s, S}\}=\{s \square S: s(x_i)=s(x_k)\}$

Note: Intuitively, the definedness condition indicates that (i) there must be a possibility that 'he_i' doesn't refer to the speaker, i.e. it must *not* be presupposed that 'he_i' refers to the speaker, and (ii) it must be presupposed that 'me_k' refers to the speaker.

(61) a. $That_i$ is $this_k$ (*is not a presupposition failure*)
b. $x_i\{<LOCAL\}=x_k\{LOCAL\}$
c. $S[b] \neq \#$ iff $\square s \square S\ [\![x_i\{<LOCAL\}=x_k\{LOCAL\}]\!]^{s, S} \neq \#$
iff $\square s \square S(\square s' \square S\ [\![x_i]\!]^{s', S} \square LOCAL(D)(s', S)\ \&\ \square s' \square S\ [\![x_k]\!]^{s', S} \square LOCAL(D)(s', S)$
iff $\square s' \square S\ s'(x_i) \square LOCAL(D)(s', S)\ \&\ \square s' \square S\ s'(x_k) \square LOCAL(D)(s', S)$
If $\neq \#$,
$S[b]=\{s \square S: [\![x_i\{<LOCAL\}]\!]^{s, S}=[\![x_k\{LOCAL\}]\!]^{s, S}\}=\{s \square S: s(i)=s(k)\}$

(62) a. $Wisahkechahk^{PROX}$ leave-behind $Fox^{\mathbf{OBV}}$ *(proximate vs. obviative in Algonquian)*
b. $leave(W\{<local\}, F\{<W\{<local\}\}, t_0, w_0))$
c. $S[b] \neq \#$ iff $\square s \square S\ [\![leave(W\{<local\}, F\{<W\{<local\}\}, t_0, w_0)]\!]^{s, S} \neq \#$
iff $\square s \square S\ I(W) \neq local(D)(s)\ \&\ \square s \square S\ I(F) <_{local(D)(s)} I(W)$

If ≠#,
S[b]={s□S: <I(W), I(F), s(t_0), s(w_0)>□I(leave)}

<u>Note:</u> Proximate marking is analyzed as simple 3[rd] person features in English. Obviative marking on 'Fox' is analyzed as a presupposition that Fox is less salient than another individual which is denoted using a proximate expression (in this case, 'Wisahkechahk').

(63) a. The man is coughing *(need not refer to the speaker even if the speaker is male)*
b. cough([□$_k$ x_i man(x_i, t_0, w_0)], t_0, w_0)
c. S[b]≠# iff □s□S {e□D: [[man(x_i, t_0, w_0)]]$^{s[x_i□ e], S}$=1}≠Ø , iff □s□S {e□D: <e, s(t_0), s(w_0)>□I(man)}≠Ø
If ≠#,
S[b]={s□S: <f(s(x_k), {e□D: <e, s(t_0), s(w_0)>□I(man)}), s(t_0), s(w_0)>□I(coughing)}

<u>Note</u>: If the point of reference s(x_k) is a man, then by Centering 'the man' must refer to s(x_k). In particular, if s(x_k) is the speaker and the speaker is a man, then 'the man' must refer to the speaker. However nothing forces x_k to denote the speaker, and thus in general 'the man' could refer to someone other than the speaker even if the latter is a man.

(64) a. The pig is grunting, but the pig with floppy ears isn't grunting *(need not be a contradiction)*
b. [□$_k$ x_i pig(x_i,t_0,w_0)] grunting(x_i,t_0,w_0) & [□$_k$ x_i((pig(x_i,t_0,w_0) & floppy(x_i,t_0,w_0))]□grunting(x_i,t_0,w_0)
c. S[b]≠# iff □s□S {e□D: <e, s(t_0), s(w_0)>□I(pig)}≠Ø and □s□S s.t. <f(s(x_k), {e□D: <e, s(t_0), s(w_0)>□I(pig)}), s(t_0), s(w_0)>□I(grunting)}, {e□D: <e, s(t_0), s(w_0)>□I(pig) & <e, s(t_0), s(w_0)>□I(floppy)}≠Ø
If ≠#,
S[b]={s□S: <f(s(x_k), {e□D: <e, s(t_0), s(w_0)>□I(pig)}), s(t_0), s(w_0)>□I(grunting) & {e□D: <e, s(t_0), s(w_0)>□I(pig) & <e, s(t_0), s(w_0)>□I(floppy), s(t_0), s(w_0)>□I(grunting)}

<u>Note:</u> If the closest pig doesn't have floppy ears, the selection function f will not select the same individual for the two descriptions 'the pig' and 'the pig with floppy ears', which explains that the sentence isn't contradictory.

(65) a. If John came, Mary would be happy, but if John came and he was drunk, Mary wouldn't be happy *(need not be a contradiction)*
b. [□$_{w_0}$ w_i came(J,t_0,w_i)]happy(M,t_0,w_i) & [□$_{w_0}$ w_i came(J,t_0,w_i) & drunk(J,t_0,w_i)] □happy(M,t_0,w_i)
c. S[b]≠# iff □s□S {e□W: <I(J), s(t_0), e>□I(came)}≠Ø and □s□S s.t. <I(M), s(t_0), f(s(w_0), {e□W: <I(J), s(t_0), e>□I(came)})>□I(happy)}: {e□W: <I(J), s(t_0), e>□I(came) & <I(J), s(t_0), e>□I(drunk)}≠Ø
If ≠#,
S[b]={s□S: <I(M), s(t_0), f(s(w_0), {e□W: <I(J), s(t_0), e>□I(came)})>□I(happy) & <I(M), s(t_0), f(s(w_0), {e□W: {e□W: <I(J), s(t_0), e>□I(came) & <I(J), s(t_0), e>□I(drunk)})>□I(happy)}

[For simplicity I have disregarded mood in this example. See below]

Note: If the closest world in which John comes is one in which he isn't drunk, the selection function f will not select the same world for the two descriptions 'if John comes' 'if John comes and is drunk', which explains that the sentence isn't contradictory.

(66) a. If John is sick, Mary is unhappy *(indicative conditional)*

b. unhappy(Mary, t_0{local}, [$□_{w_0}$ w_i sick(J,t_0{local},w_i)]{LOCAL})

c. S[b]≠# iff □s□S ({e□W: <I(J), s(t_0), e>□I(sick)}≠Ø & s(t_0)=local(T)(s)& f(s(w_0), {e□W: <I(J), s(t_0), e>□I(sick)})□LOCAL(W)(s, S), with LOCAL(W)(s, S)={local(W)(s): s□S} (=the Context Set), by the Stipulation introduced above.)

If ≠#,

S[b]={s□S: <I(M), s(t_0),f(s(w_0), {e□W:<I(J),s(t_0), e>□I(sick)})>□I(unhappy)}

[Present tense and mood are treated in terms of the features 'local' and 'LOCAL']

(67) a. If John were sick, Mary would be unhappy *(subjunctive conditional)*

b. unhappy(Mary, t_0{local}, [$□_{w_0}$ w_i sick(J,t_0{local},w_i)]{<LOCAL})

c. S[b]≠# iff □s□S ({e□W: <I(J), s(t_0), e>□I(sick)}≠Ø & s(t_0)=local(T)(s))& □s□S (f(s(w_0), {e□W: <I(J), s(t_0), e>□I(sick)})□LOCAL(W)(s, S)), with LOCAL(W)(s, S)={local(W)(s): s□S} (=the Context Set), by the Stipulation introduced above.

If ≠#,

S[b]={s□S: <I(M), s(t_0),f(s(w_0), {e□W:<I(J),s(t_0), e>□I(sick)})>□I(unhappy)}

(68) a. If John had been sick (now), Mary would have been unhappy *(double subjunctive conditional)*

b. unhappy(Mary, t_0{local}, [$□_{w_0}$ w_i sick(J,t_0{local},w_i)]{<w_1{<LOCAL}}))

c. S[b]≠# iff

(i) □s□S s(w_1)□LOCAL(W)(s, S), with LOCAL(W)(s, S)={local(W)(s): s□S} (=the Context Set), by the Stipulation introduced above.

[this is the presupposition introduced by w_1{<LOCAL})

(ii) □s□S s(t_0)=local(T)(s) [presupposition introduced by t_0{local}]

(iii) □s□S {e□W: <I(J), s(t_0), e>□I(sick)}≠Ø [presupposition introduced by the *if*-clause]

(iv) □s□S f(s(w_0), {e□W:<I(J),s(t_0), e>□I(sick)}) $<_{local(W)(s)}$ s(w_1)

If ≠#,

S[b]={s□S: <I(M), s(t_0),f(s(w_0), {e□W:<I(J),s(t_0), e>□I(sick)})>□I(unhappy)}

Appendix II. Further Remarks on Plural Choice Functions

Recall the first three conditions that were imposed on our Plural Choice/Selection Functions:

<u>Condition 1*</u>: For each element d and each non-empty set E of elements, f(d, E)≠# and f(d, E) □E.

<u>Condition 2*</u>: For each element d, each set E and each set E', if E'□E and f(d, E)□E'≠Ø, then f(d, E')=f(d, E)□E'.

<u>Condition 3*</u>: For each element d and each set E, f(d, E)=# if E=Ø.

In what follows, we assume that # is the empty set Ø (by contrast, in the rest of this article we took # to indicate referential failure, which forced us to develop the analysis in a three-valued logic; we are now going back to a bivalent system). We further assume that each subset of the domain has a name. The semantic value of a formula A is written as ⟦A⟧ or simply as **A**.

A. Axioms corresponding to Condition 2* (Valentina Gliozzi)
Valentina Gliozzi (p.c.) makes the following observations. Condition 2* can be seen as the conjunction of Condition 2*a and Condition 2*b:

<u>Condition 2*a</u>: For each element d, each set E and each set E', if E'□E and f(d, E)□E'≠Ø, then f(d, E')□f(d, E)□E'.

<u>Condition 2*b</u>: For each element d, each set E and each set E', if E'□E and f(d, E)□E'≠Ø, then f(d, E')⊇f(d, E)□E'.

Gliozzi then remarks that, in the presence of Condition 1* and Condition 3*, Condition 2*a is satisfied if and only if the axiom (CV) holds, and similarly that Condition 2*b holds if and only if (DT) holds:

(CV) (A>B & □(A>□C)) □ ((A&C) > B)

(DT) ((A&C)>B) □ A > (C□ B)

<u>Claim 1:</u> Condition 2*a is satisfied iff (CV) holds

<u>Proof</u>: (i) Condition 2*a => (CV)
Assume that Condition 2*a holds. Assume further that (A>B & □(A>□C)) is true. This means that f(d, **A**)□**B** and not f(d, **A**)□⟦□C⟧, i.e. f(d, **A**)□**C**≠Ø. Since **A**□**C**□**A** and f(d, **A**)□**C**≠Ø, by Condition 2*a we have: f(d, **A**□**C**) □ f(d, **A**)□(**A**□**C**)□**B**. This gives immediately: A&C > B

(ii) (CV) => Condition 2*a
Assume that (CV) holds. Assume further that E'□E and f(d, E)□E'≠Ø. Since we have assumed that each subset of the domain has a name, we may posit that E=⟦A⟧, E'=⟦A&C⟧, and ⟦B⟧=f(d, **A**). By Condition 1* and Condition 3*, f(d, **A**)□**A**□**B**, hence A>B holds; and f(d, **A**) □⟦A&C⟧≠Ø, hence f(d, **A**)□**C**≠Ø, which entails that □(A>□C) holds. Thus the antecedent of

(CV) is satisfied, and by (CV) f(d, E')□**B**=f(d, **A**)=f(d, E). By Condition 1* and Condition 3*, f(d, E')□E'. Thus in the end f(d, E')□f(d, E)□E'.

<u>Claim 2</u>: Condition 2*b is satisfied iff (DT) holds

<u>Proof:</u> (i) Condition 2*b => (DT)
Assume that Condition 2*b holds. Assume further that ((A&C)>B) is true, i.e. that f(d, [[A&C]])□[[B]]. Then:
-if f(d, **A**)□[[A&C]]=Ø, there are two cases:
Case 1. f(d, **A**)=Ø. By Condition 3* and our assimilation of # to Ø, this entails that **A**=Ø, which in turn entails (again by Condition 3*) that A > (C□ B) holds.
Case 2. f(d, **A**)≠Ø. Since by Condition 1* f(d, **A**)□**A**, it must be the case that f(d, **A**)□[[□C]], and hence f(d, **A**)□[[C□ B]]
-if f(d, **A**)□[[A&C]]≠Ø, by Condition 2*b f(d, **A**)□[[A&C]]□f(d, [[A&C]]), hence f(d, **A**)□[[C]]□f(d, [[A&C]]), hence f(d, **A**)□[[C]]□[[B]], and thus A > (C□ B) is true.

(ii) (DT) => Condition 2*b
Assume that (DT) holds and that E'□E and f(d, E)□E'≠Ø. Since we have assumed that each subset of the domain can be named, we can posit that E'=[[A&C]]□E=[[A]]. Let [[B]]=f(d, E')=f(d, [[A&C]]). The antecedent of (DT) is (trivially) satisfied, hence so is the consequent. This means that f(d, A)□[[C]]□[[B]], hence also f(d, A)□[[A&C]]□[[B]], and thus that f(d, E)□E'□f(d, E').

B. Restating Condition 1* and Condition 2* in terms of a transitive well-founded relation (Ede Zimmermann).

With the same assumptions as in A., Ede Zimmermann (p.c.) observes that for any d in the domain, the conjunction of Condition 1*, Condition 2* and Condition 3* holds if and only if (TWF) below holds:

(TWF) There is a transitive well-founded relation $\leq_d$ such that f(d, E)={e□E | for all e'□E: e$\leq_d$e'}.

<u>Proof:</u>
"<="
*Condition 1** follows from the well-foundedness of $\leq_d$
Condition 2*: Suppose E'□E and f(d, E)□E'≠Ø, i.e. {e□E | for all e'□E: e$\leq_d$e'}□E'≠Ø. By (TWF), f(d, E')={e□E' | for all e'□E': e$\leq_d$e'}
Clearly, f(d, E)□E'={e□E' | for all e'□E: e$\leq_d$e'}□{e□E' | for all e'□E': e$\leq_d$e'}=f(d, E') (because E'□E)
Conversely, assume e□{e□E' | for all e'□E': e$\leq_d$e'}. Pick any e*□f(d, E)□E' (which is ≠Ø, by assumption). Then e$\leq_d$e* because e*□E'. For any e'□E, e*≤e' because e*□f(d, E), and by the transitivity of $\leq_d$, e$\leq_d$e'. Hence e□f(d, E)□E'
*Condition 3**: f(d, Ø)={e□Ø | for all e'□E: e$\leq_d$e'}=Ø.

"=>"
Assume Condition 1*, Condition 2* and Condition 3*, and let
$\leq_d$={<e, e'>□D□D| e□f(d, {e, e'})}. Then:

(i) $\leq_d$ is transitive

Assume e≤e' and e'≤e". It is enough to show that e□f(d, {e, e', e"}): since e□f(d, {e, e', e"})□{e, e"}, Condition 2* implies e□f(d, {e, e"}), i.e. e≤e".

To show that e□f(d, {e, e', e"}), we consider two cases:

Case 1. e'□f(d, {e, e', e"}). Hence f(d, {e, e', e"})□{e, e'}≠Ø, and by Condition 2* (since e≤e') e□f(d, {e, e'})=f(d, {e, e', e"})□{e, e'}. Hence e□f(d, {e, e', e"}).

Case 2. e'□f(d, {e, e', e"}). If e□f(d, {e, e', e"}), f(d, {e, e', e"})={e"} (by Condition 1*). But by Condition 2* f(d, {e', e"})=f(d, {e, e', e"})□{e', e"}={e"}, contradicting e'$\leq_d$e". Contradiction.

(ii) $\leq_d$ is well-founded

Let E be a non-empty subset of the domain. We must show that there exists e*□E such that for all e□E, e*$\leq_d$e. By Condition 1*, f(d, E)≠Ø. Pick any e*□f(d, E), and consider an arbitrary e□E. By Condition 2*, f(d, {e*, e})=f(d, E) □{e*, e} since e*□f(d, E) □{e*, e}. Thus e*□ f(d, {e*, e}) (again because e*□f(d, E) □{e*, e}), i.e. e*≤e.

(iii) f(d, E)={e□E | for all e'□E: e$\leq_d$e'}

-If e□f(d, E), then e□f, by Condition 1*. Furthermore, if e'□E, {e, e'}□E and f(d, E)□{e, e'}≠Ø, hence by Condition 2* f(d, {e, e'})=f(d, E)□{e, e'). Since e□f(d, E)□{e, e'), e□f(d, {e, e'}). Thus f(d, E) □{e□E | for all e'□E: e$\leq_d$e'}

-Suppose e□E and for all e'□E: e$\leq_d$e'. E≠Ø, hence by Condition 1* there is some e*□f(d, E)□E. Since for all e'□E: e$\leq_d$e', e≤e*, i.e. e□f(d, {e, e*})=f(d, E)□{e, e*} by Condition 2*. So e□f(d, E).

References

Anderson, Alan Ross (1951). A Note on Subjunctive and Counterfactual Conditionals. *Analysis* 11, 35-38.

Bhatt, R. & R. Pancheva (2001) 'The Syntax of Conditionals', ms., University of Texas at Austin & University of Southern California.

Bittner, M. (2001) 'Topical Referents for Individuals and Possibilities'. In R. Hastings et al (eds.), *Proceedings from SALT* XI, pp. 36-55. CLC, Cornell University, Ithaca.

Chierchia, G. (1989) 'Anaphora and Attitude De Se', in R. Bartsch, J. Van Benthem, and P. van Emde Boas (eds.) *Semantics and Contextual Expressions*, Foris, Dordorecht, pp.1-31.

Dekker, P. (2000) 'Coreference and Representationalism', in K. von Heusinger and U.Egli, *Reference and Anaphoric Relations,* Kluwer

Fintel, K. von (1997) 'Bare Plurals, Bare Conditionals, and Only'. *Journal of Semantics*, 14(1): 1–56.

Fintel, K. von (1999) 'NPI-Licensing, Strawson-Entailment, and Context-Dependency' *Journal of Semantics*, 16: 97–148.

Fintel, K. von (2001) 'Counterfactuals in a Dynamic Context'. In Kenstowicz, M., ed., *Ken Hale: A Life in Language*, pp. 123–152. MIT Press Cambridge, MA.
Frank, A. (1997) *Context Dependence in Modal Constructions*. Doctoral Dissertation, University of Stuttgart

Geurts, B. (1999) *Presuppositions and Pronouns,* Elsevier.

Hale, K. (1976) 'The Adjoined Relative Clause in Australia'. In R. Dixon (ed.) *Grammatical Categories in Australian Languages*, 78–105. Australian Institute of Aboriginal Studies, Canberra.

Harper, W. L. & R. Stalnaker & G. Pearce, eds. (1981) *Ifs,* Reidel

Heim, Irene (1991). 'Artikel und Definitheit.' In A. v. Stechow and D. Wunderlich (eds) *Handbuch der Semantik*. Berlin: de Gruyter, 1991

Heim, I. (1984) 'A Note on Polarity Sensitivity and Downward Entailingness.' *Proceedings of NELS 14*: 98-107.

Heim, I. (1992) 'Presupposition Projection and the Semantics of Attitude Verbs'. *Journal of Semantics* **9**:183–221.

Heusinger, K. von (1996) *Salienz und Referenz (Der Epsilonoperator in der Semantik der Nominalphrase and anaphorischer Pronomen).*

Heusinger, K. von (2000) 'Reference and Salience', available online at:
http://ling.uni-konstanz.de/pages/home/heusinger/publications/ftp/ap71_2.pdf

Iatridou, S. (1994) 'On the Contribution of Conditional *Then', Natural Language Semantics* 2: 171-199

Iatridou, S. (2000) 'The Grammatical Ingredients of Counterfactuality', *Linguistic Inquiry* 31:231 270.

Izvorski, R. (1996) 'The Syntax and Semantics of Correlative Proforms', in Kusumoto, ed., *Proceedings of NELS 26.*

Kratzer, A. (1991) 'Conditionals', in A. von Stechow, D. Wunderlich (ed.) *Semantik: ein internationales Handbuch der zeitgenössischen Forschung*.

Lewis, D. (1973) *Counterfactuals,* Harvard

Lewis, D. (1979) 'Scorekeeping in a Language Game'. *Journal of Philosophical Logic* 8, 339-359.

Löbner, Sebastian (1985), 'Definites', *Journal of Semantics,* **4**, 279-326.

Löbner, Sebastian (1987a), 'The Conceptual Nature of Natural Language Quantification', in I. Ruzsa and A. Szabolcsi (eds.), *Proceedings of the '87 Debrecen Symposium on Logic and*

Language, Akadémiai Kaidó, Budapest, 81-94.

Matthewson, Lisa: 2001. 'Quantification and the Nature of Crosslinguistic Variation'. *Natural Language Semantics,* 9: 145–189.

McCawley, James (1979) 'Presupposition and Discourse Structure', in ed. Oh & Dinneen, *Syntax & Semantics 11.*

Nute, D. (1980) *Topics in Conditional Logic,* Reidel

Percus, O. (2000) 'Constraints on Some Other Variables in Syntax', *Natural Language Semantics* Vol. 8, Issue 3

Roberts, C. (1989), 'Modal subordination and pronominal anaphora in discourse', *Linguistics and Philosophy*, 12: 683-721.

Rooth, M. (1996) 'Focus', in Lappin, ed. *Handbook of Contemporary Semantic Theory,* Blackwell.

Schein, B. (2001) 'Adverbial, descriptive reciprocals.' In R. Hastings, B. Jackson & Z. Zvolenszky, eds., *Proceedings of Semantics and Linguistic Theory XI.* Ithaca: CLC Publications, Department of Linguistics, Cornell University.epartment of Linguistics, Cornell University.

Schlenker, P. (1999/2000) *Propositional Attitudes and Indexicality (A Cross-Categorial Approach),* Doctoral Dissertation, MIT (Introduction revised, August 2000).

Schlenker, P. (1999) 'Semantic Uniformity', hand-out of a talk given at the First International Symposium on Linguistics (LICSSOL1), Lyons, France, October 12-15, 1999

Schlenker, P. (2000) 'Towards a Null Theory of Conditionals', hand-out of a talk given at the Conference on (Preferably) Non-Lexical Semantics, Paris, May 30th, 2000

Schlenker, P. (2001) 'A Referential Analysis of Conditionals', in *Proceedings of the Amsterdam Colloquium,*

Stalnaker, Robert (1968) 'A Theory of Conditionals', *Studies in Logical Theory, American Philosophical Quaterly,* Monograph: 2.

Stalnaker, R. (1975) 'Indicative Conditionals', *Philosophia* 5: 269-86

Stanley, J. and Szabo, Z. (2000) 'On Quantifier Domain Restriction', *Mind and Language* 17

Stechow, A. von (2002) 'Binding by Verbs: Tense, Pronouns and Mood under Attitudes'. In *The Syntax and Semantics of the Left Periphery*, eds. H. Lohnstein and Susanne Trissler, 44. Berlin: de Gruyter.

Stechow, A. von (2003) 'Feature Deletion under Semantic Binding: Tense, Person and Mood under Verbal Quantifiers', *Proceedings of NELS 33*

Stone, M. (1997) 'The Anaphoric Parallel between Modality and Tense', IRCS Report 97-06, University of Pennsylvania