# Conditionals as Definite Descriptions[1]

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*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.

## 1 A Problem for Strawson... and Russell (Lewis 1973; Heusinger 1994)

### 1.1 *A Problem for a Strawsonian Analysis*

#### *1.1.1 Predictions*

A Strawsonian account predicts that the patterns below should hold w*hen all the definite description(s) involved can be used felicitously* (i.e. when their presuppositions are satisfied):

(1) a. If *[The $\phi$] $\psi$*, then *[The $\phi$ & $\phi$'] $\psi$*
b. If *[The $\phi$] $\psi$*, then *[The $\neg\psi$] $\neg\phi$*
c. If *[The $\phi$] $\psi$* and *[The $\psi$] $\chi$*, then *[The $\phi$] $\chi$*

(a) If *The $\phi$* can be used felicitously, there is exactly one $\phi$-individual in the domain of discourse. Hence if *The $\phi$ & $\phi$'* can also be used felicitously, it must denote the same individual, and therefore the entailment should hold.

(b) The same reasoning applies: if both *The $\phi$* and *The $\neg\psi$* can be used felicitously, there is exactly one $\phi$-individual and one $\neg\psi$-individual in the domain of discourse. If the former has property $\psi$, then it must be distinct from the latter, which thus couldn't have property $\phi$ (or else there would be two $\phi$-individuals in the domain, contrary to hypothesis).

(c) if *The $\phi$* and *The $\psi$* can both be used felicitously, then there is exactly one $\phi$-individual and one $\psi$-individual in the domain of discourse. Thus if the first one has property $\psi$, it must be identical to the second, hence the entailment.

The same predictions hold of plural descriptions if these are analyzed in terms of maximality operators. For if *The $\phi$* denotes the maximal $\phi$-set in the domain of discourse, and it is included in a $\psi$-set, then:

[1] This talk is based on my 'Conditionals as Definite Descriptions (A Referential Analysis)', published in *Research on Language and Computation* in 2004. New data have been incorporate thanks to data communicated to me by Russ Schuh.



(i) *a fortiori* the same holds for the maximal $\phi\&\phi$'-set, which derives a;

(ii) the maximal $\neg\psi$-set cannot contain any $\phi$-elements (or else the maximal $\phi$-set would contain these elements too, and would thus fail to be included in a $\psi$-set); this, in turn, derives b.

(iii) c is derived in similar fashion: if the maximal $\phi$-set $s_1$ is included in a $\psi$-set $s_2$ and the maximal $\psi$-set (which must include $s_2$) is contained in a $\chi$-set $s_3$, then of course $s_1$ must be included in $s_3$.

#### *1.1.2 Data*

(2) 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.

(3) 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.

### 1.2 *Is a Russellian Analysis Better Off?*

Superficially it would seem that Russell fares slightly better than Strawson, since on a Russellian analysis a and 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:

(4) a. Refutation of a: If *The $\phi$, $\psi$*, then *The $\phi$ & $\phi$', $\psi$*
Suppose that $[\![\phi]\!]=[\![\psi]\!]=\{d\}$, $[\![\phi \,\&\, \phi']\!]=\emptyset$
b. Refutation of b: If *The $\phi$, $\psi$*, then *The $\neg\psi$, $\neg\phi$*
Suppose that $[\![\phi]\!]=[\![\psi]\!]=\{d\}$, $[\![\neg\psi]\!]=\emptyset$

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

(5) Proof of c: If *The $\phi$, $\psi$* and *The $\psi$, $\chi$*, then *The $\phi$, $\chi$*
From *The $\phi$, $\psi$*, we obtain: $|[\![\phi]\!]|=1$ and $[\![\phi]\!]\subseteq[\![\psi]\!]$. From *The $\psi$, $\chi$*, we obtain: $|[\![\psi]\!]|=1$ and $[\![\psi]\!]\subseteq[\![\chi]\!]$. Taken together, these conditions entail: $|[\![\phi]\!]|=1$ and $[\![\phi]\!]\subseteq[\![\chi]\!]$

Still, a Russellian analysis predicts that the following should be incoherent (note that the negation has *narrow* scope):

(6) a. [The $\phi$] $\psi$, but [the $\phi$ & $\phi$'] $\neg\psi$
(Problem: If there is exactly one $\phi$-individual, and it is $\psi$, it cannot be that there is exactly one $\phi$ & $\phi$'-individual, and it is $\neg\psi$)
b. [The $\phi$] $\neg\psi$, but [the $\neg\psi$] $\neg\phi$
(Problem: If there is exactly one $\phi$-individual, and it is $\neg\psi$, it cannot be that there is exactly one $\neg\psi$-individual, who is $\neg\phi$)

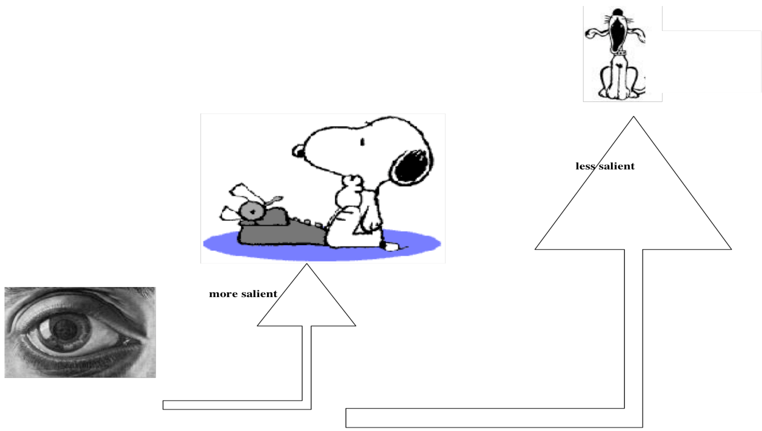
The following sentences would seem to refute these predictions:

(7) 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

### *1.3 Lewis 1973 and Heusinger 1994: Hierarchies of Salience*

First approximation:

| |
|---|
| Uttered in context c, *the $\phi$* denotes the <u>most salient</u> $\phi$-individual in c. If there is no (single) most salient $\phi$-individual in c, *the $\phi$* denotes #. |




(8) 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)] $\neg$G; but [the (P & F & S)] G; but ...



## 2 From Definite Descriptions to Conditionals (Lewis 1973, Bittner 2001)

### *2.1 The Non-Monotonicity of Conditionals*

When conditionals are analyzed as material or as strict implications, they are predicted to satisfy the following patterns:

*(9)* a. Strengthening of the Antecedent: If *If $\phi$, $\psi$*, then *If $\phi$ & $\phi$', $\psi$*
b. Contraposition: If *If $\phi$, $\psi$*, then *If $\neg\psi$, $\neg\phi$*
c. Transitivity: If *If $\phi$, $\psi$* and *If $\psi$, $\chi$*, then *If $\phi$, $\chi$*

But these patterns are refuted by the following facts:

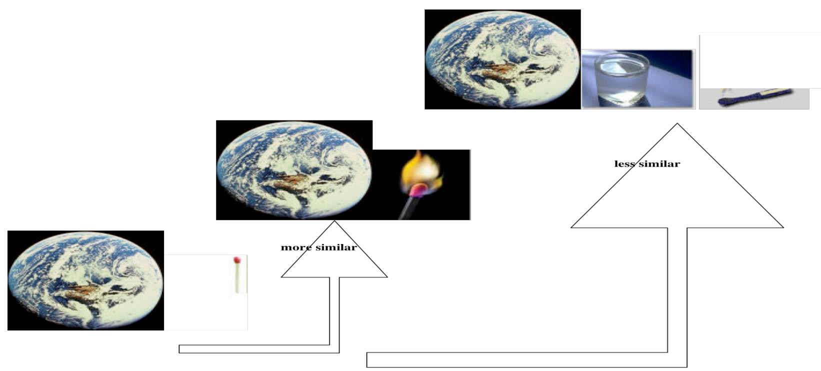
(10) a. Failure of Strengthening of the Antecedent
If this match were struck, it would light, but if this match had been soaked in water overnight and it were struck, it wouldn't light (modified from Stalnaker 1968)
b. Failure of Contraposition
(Even) if Goethe had survived the year 1832, he would be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

(11) 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... (Lewis)
b. If O, L; but if O & A, $\neg$L; but if O & A & W, L; but ...

### *2.2 Stalnaker's Analysis*

First approximation:

| |
|---|
| Uttered in context c, *if $\phi$* denotes the <u>closest</u> $\phi$-world in c. If there is no closest $\phi$-world in c, *if $\phi$* denotes #, which is an 'impossible world' in which all propositions are true (Stalnaker). |



## 3 Analysis

### *3.1 Can Domain Restrictions Explain Away Non-Monotonicity?*

(i) The argument from changing domain restrictions

(12) [*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 (after D. Westerstahl)

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.

(ii) Reply: contrasts between definite descriptions and other quantifiers

(13) [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!
e. #Wait, all girls have a question!
f. #Wait, all the girls have a question!
g. #Wait, each of the girls has a question!

### *3.2 Choice Functions across Domains I: Stalnaker's Analysis*

-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* $\phi$ is taken to 'select' the world most similar to the actual world which satisfies $\phi$ (if there is no such world we will assume that a presupposition failure occurs, although this isn't Stalnaker's analysis; see below). *If* $\phi, \psi$ is then taken to be true just in case the world selected by *if* $\phi$ satisfies $\psi$ (this is simply a case of predication).
-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.

#### *3.2.1 A generalized ι -operator (with one additional argument)*

We write *the* and *if* as *ι*. When *ι* is followed by an individual variable, it represents *the*; when it is followed by a world variable, it represents *if*. *ι* 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:

(14) 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[2].

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:

(15) 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 (15)a *the dog* may be taken to denote the most salient dog relative to the speaker. In (15)b, by contrast, it is plausible that *the dog* denotes the most salient dog *relative to John* rather than relative to the speaker. (15)c makes the same point more forcefully, since for various dog-owners the most salient dog is of course not the same[3]. The data are correctly handled by binding the additional argument of the ι-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:

(16) $[\forall x: \text{friend}(x)] \ldots [\iota_x y: \text{dog}(y)\ \&\ C(x)] \ldots$

Thus there appears to be independent motivation for providing Choice Functions that are used to model salience with an additional individual argument[4].

#### *3.2.2 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.

<u>Condition 1</u> (=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* $\phi$ must satisfy the predicate $\phi$. For conditionals, this means that the world denoted by *if* $\phi$ must satisfy the sentence $\phi$. Both conditions are uncontroversial.

<u>Condition 2</u> (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

[2] The second argument could just as well be taken to be a sentence rather than a set of worlds (=a proposition).
[3] 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).
[4] 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 ι-operator is bound by a λ-operator introduced by the *that*-clause:
(i) a. John said that the dog had gotten into a fight with another dog.
b. John said that $\lambda x\ \lambda w\ [\iota_x\ y: \text{dog}(y, w)]$ got into a fight with another dog

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:

<u>Condition 2'</u> (=Stalnaker's Condition (4)): For each element d and any sets E and E', if $f(d, E')\in E$ and $f(d, E)\in E'$, then $f(d, E)=f(d, E')$.
*Claim:* Condition 2 and Condition 2' are equivalent given Condition 1.
*Proof:* (i) Condition 2 $\Rightarrow$ Condition 2'. Suppose $f(d, E')\in E$ and $f(d, E)\in E'$. By Condition 1, $f(d, E')\in E'$ and hence $f(d, E')\in E\cap E'$; and similarly $f(d, E)\in E$ and hence $f(d, E)\in E\cap E'$. By Condition 2, $f(d, E)=f(d, E\cap E')=f(d, E')$.
(ii) Condition 2' $\Rightarrow$ Condition 2. Suppose $E'\subseteq E$ and $f(d, E)\in E'$. By Condition 1, $f(d, E')\in E'$, and hence $f(d, E')\in E$ since $E'\subseteq E$. Thus $f(d, E)\in E'$ and $f(d, E')\in E$. By Condition 2', $f(d, E)=f(d, E')$.

<u>Condition 3</u> (=Stalnaker's Condition (2)): For each element and each set E of elements, $f(d, E)=\#$ iff $E=\emptyset$.
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 $\lambda$*) as* 'the *absurd world* - the world in which contradictions and all their consequences are true'.[5] In Stalnaker's system any 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* $\varphi$, $\psi$ is true just in case the world selected by *if* $\varphi$, i.e. $\lambda$, satisfies $\psi$; but $\lambda$ satisfies every proposition). By contrast, on the present view a conditional with a *clearly* impossible antecedent is deemed infelicitous. Thus *if* $\varphi$ fails to refer just in case there is no world whatsoever, even a particular distant one, which satisfies $\varphi$. 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*[6].

### 3.2.3 *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* $\varphi$ always selects the world of evaluation in case $\varphi$ is true in that world. For instance, in an unembedded environment, this

[5] Stalnaker further stipulates that $\lambda$ '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'.
[6] 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.



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*.

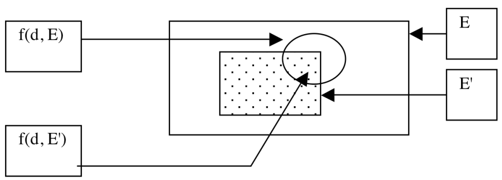
This, however, is a problem only so long as it is assumed that the speaker necessarily serves as the default point of evaluation for the Choice/Selection Function used to model salience. But this might well be too strong. In fact, when I utter a sentence I typically take for granted some perceptual situation 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.

### *3.3 Choice Functions Across Domains II: Adding Plurality*

(17) 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.

<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)∩E' ⊆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)∩E'≠Ø, any element of E'-f(d, E) must be less highly ranked than the elements of E'∩f(d, E), and hence couldn't belong to f(d, E'). This yields the inclusion: f(d, E')⊆E'∩f(d, E)

<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=Ø.

As Ede Zimmermann (p.c.) points out, when # is reinterpreted as the empty set, Condition 1*, Condition 2* and Condition 3* turn out to be equivalent to:

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

*Note:* von Fintel's suggestion on Conditional Excluded Middle

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:

(18) 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.



## 4 Consequences of the referential analysis

### *4.1 Morphological Evidence*

**-Bittner 2001: ambiguity between definite descriptions and conditionals (Warlpiri)**

(19) 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
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 [(19)] — 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 [(19)] 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: Conditional clauses as Free Relatives**

As noted in Izvorski 1996 and Bhatt & Pancheva 2001, there are systematic similarities between *if ... then* structures and 'correlative constructions' in languages that allow them, i.e. structures that involve both a referential (or interrogative) expression and an overt pronoun that doubles it:

(20) Marathi (example cited in Bhatt & Pancheva 2001, from Pandharipande 1997)
a. (dzar) tyane abhyas kela tar to pa hoil
*if he-ag studying do.Past.3MSg then he pass be.Fut.3S*
'If he studies, he will pass (the exam)'.
b. dzo manus tudzhya sedzari rahto to manus lekhar ahe
*which man your neighborhhod-in lives that man writer is*
'The man who lives in your neighborhood is a writer'
(Lit. 'Which man lives in your neighborhood, that man is a writer').

As can be seen the 'dzar' / 'dzo and 'tar' / 'to' appear to be morphologically related, which suggests that a unified analysis of the individual-denoting and of the world-denoting constructions is called for.

**-Schuh 2005: Definite morphology in Conditionals**

Source: R. Schuh, 'Yobe State, Nigeria as a Linguistic Area', *Proceedings of the Berkeley Linguistics Society*, 2005.

| | Clause type | Clause marking | Determiner source |
|---|---|---|---|
| Bole | 'if/when'<br>'when' | bằ...(**ye**)<br>...(**ye**) | Definite article: **tèmshi yê** 'the sheep'<br>(same) |
| Ngamo (G) | 'if/when'<br>'when' | **na**...(**-i**)<br>(no marking) | Definite article: **tèmshis'è** 'the sheep'<br>(cf. **–i** inYaya **tèmshì'i** 'the sheep') |
| Karekare | 'if/when'<br>'when' | ...**ye**/**ya**<br>...(**ma**) | Definite article: **lo-yi** 'the meat'<br>Demonstrative: **kwàrà 'âm** 'that house'<br>(cf. Kanakuru **gamī mè** 'this ram') |
| Ngizim | 'if/when'<br>'when' | ...**-n**/**nən**<br>...(**tənu**/**ngum**) | < Masculine proximal demonstrative:<br>cf. Bade (G).: **kwàm-ầni** 'that bull'<br>"Known" demonstrative: **tlà tənu** 'that cow'<br>Cf. Definite article: **sōnồ-gu** 'the shoe' |

***4.2 Conditionals as Correlative Constructions: Iatridou 1994, Izvorksi 1996, Bhatt & Pancheva 2001.***

-As mentioned Bhatt & Pancheva 2001 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 suggests that this could derive the semantic/pragmatic restrictions on the distribution of *then*:

(21) a. If you come, Mary will be happy.
b. If you come, then Mary will be happy.



(22) a. If you come, Mary will be happy. And if you don't come, Mary will also be happy.
b. #If you come, Mary will be happy. And if you don't come, then Mary will also be happy.

(23) If you come, Mary will be happy. And if you don't come, then too Mary will be happy.

- Connection with Strong Pronouns:

(24) a. [Les étudiants]$_i$, ils$_i$ ont compris
*[The students]$_i$, they$_i$-weak$_F$ have understood too*
b. [Les étudiants]$_i$, eux$_i$ ont compris
*[The students]$_i$, them$_i$-strong$_F$ have understood too*

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

(26) Everybody understood. The professors understood, the staff understood, and...
[Les étudiants]$_i$, eux$_i$ aussi ont compris
*[The students]$_i$, them$_i$-strong$_F$ too have understood*

-Focus and Implicatures

(27) 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

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').

***4.3 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 ccommanding 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 (28), whose structures are given in (30):

(28) a. $\text{John}_i$ likes [people who admire $\text{him}_i$]
b. *$\text{He}_i$ likes [people who admire $\text{John}_i$]
c. [$\text{His}_i$ mother] likes [people who admire $\text{John}_i$]

(29) a. [R-$\text{expression}_i$ [$_{VP}$ [$_{NP}$ ... $\text{pronoun}_i$ ...]]]
b. * [$\text{pronoun}_i$ [$_{VP}$ [$_{NP}$ ... R-$\text{expression}_i$ ...]]]
c. [[... $\text{pronoun}_i$ ...] [$_{VP}$ [$_{NP}$ ... R-$\text{expression}_i$ ...]]]

As is shown in (28)-(29)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 (28)b. Exactly the same pattern can be replicated with *if*-clauses, construed as referential terms, and the word *then*, analyzed as a world pronoun:

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

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 (29). The natural conclusion is that *if*-clauses, as other referential expressions, are subject to Condition C of Chomsky's Binding Theory.

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### *Appendix. Conditionals as Definite Descriptions: 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:
$\&, \neg, \iota, \forall, =$
-Sortal vocabulary:
for each $\xi \in \{$'x', 't', 'w'$\}$, for each $i \in \mathbb{N}$, a first-order variable $\xi_i$.
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, $\xi_i$ is said to have the sortal domain of $\xi$. We write: sort('x')=D, sort('t')=T, sort('w')=W. And by extension: sort($\xi_i$)=sort($\xi$)

*Non-logical vocabulary*
For each m, n, p in $\mathbb{N}$, 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, <

<u>Note</u>: '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 $\ulcorner\alpha<\beta\urcorner$ that the value of $\alpha$ is more remote than the value of $\beta$ (from the standpoint of the context).

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

<u>Note</u>: (, ) 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 $\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p$ are respectively m, n and p terms of sorts D, T, W, if $R \in R^{<x:\, m,\ t:\, n,\ w:\, p>}$, if $\varphi_1$ and $\varphi_2$ are formulas, and if $i \in \mathbb{N}$ and $\xi \in \{$'x', 't', 'w'$\}$, the following are formulas:
$R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p) \mid \neg\varphi \mid (\varphi_1 \& \varphi_2) \mid \forall\xi_i\varphi \mid \tau_1=\tau_2 \mid \tau'_1=\tau'_2 \mid \tau''_1=\tau''_2$
-If $\varphi$ is a formula, if $\xi \in \{$'x', 't', 'w'$\}$ and if $i \in \mathbb{N}$, $[\iota_{\xi_k}\xi_i\varphi]$ is a term of the same sort as $\xi$



-If $\tau, \tau'$ are terms of sort s, the following are terms of sort s: $\tau\{local\} \mid \tau\{<local\} \mid \tau\{LOCAL\} \mid \tau\{<LOCAL\} \mid \tau\{<\tau'\}$

- *Models*

A model $M=\langle D, T, W, I, f\rangle$ 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 $D^m \times T^n \times W^p$ 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 $(D\times\mathcal{P}(D)) \cup (T\times\mathcal{P}(T)) \cup (W\times\mathcal{P}(W))$ into $D \cup T \cup W$ which satisfies Stalnaker's Conditions (generalized across domains):
-Condition 1 (minimum condition on Choice Functions)
$\forall S \in \{D, T, W\}\ \forall a \in S\ \ \forall A \subseteq S\ \ (f(a, A)=\#$ or $(f(a, A) \in A))$
-Condition 2 (condition for a Choice Function to select the 'closest' element on some measure)
$\forall S \in \{D, T, W\}\ \forall a \in S\ \ \forall A \subseteq S\ \forall A' \subseteq S\ (A' \subseteq A\ \&\ f(a, A) \in A') \rightarrow f(a, A)=f(a, A')$
-Condition 3: Referential failure
$\forall S \in \{D, T, W\}\ \forall a \in S\ \ \forall A \subseteq S\ (f(a, A)=\# \leftrightarrow A=\emptyset)$
-Condition 4: Centering
$\forall S \in \{D, T, W\}\ \forall a \in S\ \ \forall A \subseteq S\ (a \in A \rightarrow f(a, A)=a)$

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

<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:
$s=\langle\langle d, t, w\rangle, g\rangle$, with $\langle d, t, w\rangle \in D\times T\times W$, and g an assignment function which assigns to each variable $\xi_i$ for $\xi \in \{$'x', 't', 'w'$\}$, $i \in \mathbb{N}$ 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 $\langle d, t, w\rangle$), 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)=: $\langle d, t, w\rangle$ and local(D)(s)=: d, local(T)(s)=: t, local(W)(s)=: w. If $\xi$ is a variable, we write $s(\xi)=:g(\xi)$.

-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
$\langle d^+, t^+, w^+\rangle \in \mathcal{P}(D)\times\mathcal{P}(T)\times\mathcal{P}(W)$

with the stipulation that (with the notation used above) $d \in d^+$, $t \in t^+$, $w \in w^+$.

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

Stipulation: Stalnaker's notion of Context Set
For each information state S, we stipulate that:
$\forall s \in S$ LOCAL(W)(s, S)={local(W)(s): $s \in S$}
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 $\xi$ is a constant, $\llbracket \xi \rrbracket^{s, S}=I(\xi)$
-If $\xi$ is a variable, $\llbracket \xi \rrbracket^{s, S}=s(\xi)$
-$\llbracket R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p) \rrbracket^{s, S} \neq \#$ iff each of $\llbracket \tau_1 \rrbracket^{s, S}$, ..., $\llbracket \tau''_p \rrbracket^{s, S}$ is $\neq \#$.
If $\neq \#$, $\llbracket R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p) \rrbracket^{s, S}=1$ iff $<\llbracket \tau_1 \rrbracket^{s, S}, ..., \llbracket \tau''_p \rrbracket^{s, S}> \in I(R)$
-$\llbracket \neg \varphi \rrbracket^{s, S} \neq \#$ iff $\llbracket \varphi \rrbracket^{s, S} \neq \#$. If $\neq \#$, $\llbracket \neg \varphi \rrbracket^{s, S}=1$ iff $\llbracket \varphi \rrbracket^{s, S}=0$
-$\llbracket (\varphi_1 \& \varphi_2) \rrbracket^{s, S} \neq \#$ iff $\llbracket \varphi_1 \rrbracket^{s, S} \neq \#$ and for S'={$s' \in S$: $\llbracket \varphi_1 \rrbracket^{s', S}=1$}, $\llbracket \varphi_2 \rrbracket^{s, S'} \neq \#$.
If $\neq \#$, $\llbracket (\varphi_1 \& \varphi_2) \rrbracket^{s, S}=1$ iff $\llbracket \varphi_1 \rrbracket^{s, S}=1$ and $\llbracket \varphi_2 \rrbracket^{s, S}=1$.
-$\llbracket \iota_{\xi_k} \xi_i \varphi \rrbracket^{s, S} \neq \#$ iff
(a) $\forall e \in sort(\xi)$: $\llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S} \neq \#$, and
(b) $f(s(\xi_k), \{e \in sort(\xi): \llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S}=1\}) \neq \#$, i.e. (given Condition 3) $\{e \in sort(\xi): \llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S}=1\} \neq \emptyset$
If $\neq \#$, $\llbracket \iota_{\xi_k} \xi_i \varphi \rrbracket^{s, S}=f(s(\xi_k), \{e \in sort(\xi): \llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S}=1\})$
-If $\tau$ is a term:
$\llbracket \tau\{local\} \rrbracket^{s,S} \neq \#$ iff $\forall s' \in S \llbracket \tau \rrbracket^{s',S} \neq \#$ and $\forall s' \in S$ $\llbracket \tau \rrbracket^{s',S}=local(sort(\tau))(s')$. If $\neq \#$, $\llbracket \tau\{local\} \rrbracket^{s,S}=\llbracket \tau \rrbracket^{s,S}$
$\llbracket \tau\{<local\} \rrbracket^{s,S} \neq \#$ iff $\forall s' \in S$ $\llbracket \tau \rrbracket^{s', S} \neq \#$ and $\exists s' \in S$ $\llbracket \tau \rrbracket^{s', S} \neq local(sort(\tau))(s')$. If $\neq \#$, $\llbracket \tau\{<local\} \rrbracket^{s,S}=\llbracket \tau \rrbracket^{s,S}$
$\llbracket \tau\{LOCAL\} \rrbracket^{s,S} \neq \#$ iff $\forall s' \in S \llbracket \tau \rrbracket^{s', S} \neq \#$ and $\forall s' \in S$ $\llbracket \tau \rrbracket^{s',S} \in LOCAL(sort(\tau))(s, S)$. If $\neq \#$, $\llbracket \tau\{LOCAL\} \rrbracket^{s, S}=\llbracket \tau \rrbracket^{s, S}$
$\llbracket \tau\{<LOCAL\} \rrbracket^{s,S} \neq \#$ iff $\forall s' \in S$ $\llbracket \tau \rrbracket^{s', S} \neq \#$ and $\exists s' \in S$ $\llbracket \tau \rrbracket^{s, S} \notin LOCAL(sort(\tau))(s, S)$. If $\neq \#$, $\llbracket \tau\{LOCAL\} \rrbracket^{s, S}=\llbracket \tau \rrbracket^{s, S}$
$\llbracket \tau\{<\tau'\} \rrbracket^{s,S} \neq \#$ iff $\forall s' \in S$ $\llbracket \tau \rrbracket^{s',S} \neq \#$ and $\llbracket \tau' \rrbracket^{s',S} \neq \#$ and $\forall s' \in S$ $\llbracket \tau \rrbracket^{s',S} <_{local(sort(\tau))(s')} \llbracket \tau' \rrbracket^{s',S}$. If $\neq \#$, $\llbracket \tau\{<\tau'\} \rrbracket^{s,S}=\llbracket \tau \rrbracket^{s,S}$
-$\llbracket \forall \xi_i \varphi \rrbracket^{s, S} \neq \#$ iff $\forall e \in sort(\xi)$: $\llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S} \neq \#$.
If $\neq \#$, $\llbracket \forall \xi_i \varphi \rrbracket^{s, S}=1$ iff for all $e \in sort(\xi)$: $\llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S}=1$.
-$\llbracket \tau=\tau' \rrbracket^{s, S} \neq \#$ iff $\llbracket \tau \rrbracket^{s, S} \neq \#$ and $\llbracket \tau' \rrbracket^{s, S} \neq \#$. If $\neq \#$, $\llbracket \tau=\tau' \rrbracket^{s, S}=1$ iff $\llbracket \tau \rrbracket^{s, S}=\llbracket \tau' \rrbracket^{s, S}$



- *Updates*

This is a standard update semantics, in which $S[\varphi]$ is the result of updating information state S with the formula $\varphi$
Let S be an information state. Then:
-$S[R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p)] \neq \#$ iff $\forall s \in S$ $\llbracket R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p) \rrbracket^{s, S} \neq \#$.
If $\neq \#$, $S[R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p)]=\{s \in S: \llbracket R(\tau_1, ..., \tau_m, \tau'_1, ..., \tau'_n, \tau''_1, ..., \tau''_p) \rrbracket^{s, S}=1\}$
-$S[\neg \varphi] \neq \#$ iff $S[\varphi] \neq \#$. If $\neq \#$, $S[\neg \varphi]=S-S[\varphi]$
-$S[(\varphi_1 \& \varphi_2)] \neq \#$ iff $S[\varphi_1] \neq \#$ and $S[\varphi_1][\varphi_2] \neq \#$. If $\neq \#$, $S[(\varphi_1 \& \varphi_2)]=S[\varphi_1][\varphi_2]$
-$S[\forall \xi_i \varphi] \neq \#$ iff $\forall s \in S$ $\forall e \in sort(\xi)$: $\llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S} \neq \#$. If $\neq \#$, $S[\forall \xi_i \varphi]=\{s \in S: \forall e \in sort(\xi)\ \llbracket \varphi \rrbracket^{s[\xi i \rightarrow e], S}=1\}$
-$S[\tau=\tau'] \neq \#$ iff $\forall s \in S$ $\llbracket \tau=\tau' \rrbracket^{s, S} \neq \#$. If $\neq \#$, $S[\tau=\tau']=\{s \in S: \llbracket \tau \rrbracket^{s, S}=\llbracket \tau' \rrbracket^{s, S}\}$

- *Truth*

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

- *Examples*

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

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

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.

(32) a. $That_i$ is $this_k$ (*is not a presupposition failure*)
b. $x_i\{<LOCAL\}=x_k\{LOCAL\}$
c. $S[b] \neq \#$ iff $\forall s \in S$ $\llbracket x_i\{<LOCAL\}=x_k\{LOCAL\} \rrbracket^{s, S} \neq \#$
iff $\forall s \in S(\exists s' \in S$ $\llbracket x_i \rrbracket^{s', S} \notin LOCAL(D)(s', S)$ & $\forall s' \in S$ $\llbracket x_k \rrbracket^{s', S} \in LOCAL(D)(s', S)$
iff $\exists s' \in S$ $s'(x_i) \notin LOCAL(D)(s', S)$ & $\forall s' \in S$ $s'(x_k) \in LOCAL(D)(s', S)$
If $\neq \#$,
$S[b]=\{s \in S: \llbracket x_i\{<LOCAL\} \rrbracket^{s, S}=\llbracket x_k\{LOCAL\} \rrbracket^{s, S}\}=\{s \in S: s(i)=s(k)\}$

(33) a. $Wisahkechahk^{PROX}$ leave-behind $Fox^{OBV}$ *(proximate vs. obviative in Algonquian)*
b. $leave(W\{<local\}, F\{<W\{<local\}\}, t_0, w_0))$
c. $S[b] \neq \#$ iff $\forall s \in S$ $\llbracket leave(W\{<local\}, F\{<W\{<local\}\}, t_0, w_0) \rrbracket^{s, S} \neq \#$
iff $\exists s \in S$ $I(W) \neq local(D)(s)$ & $\forall s \in S$ $I(F) <_{local(D)(s)} I(W)$
If $\neq \#$,
$S[b]=\{s \in S: <I(W), I(F), s(t_0), s(w_0)> \in I(leave)\}$

<u>Note:</u> Proximate marking is analyzed as simple 3rd 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').

(34) a. The man is coughing *(need not refer to the speaker even if the speaker is male)*
b. $\mathrm{cough}([\iota_{x_k} x_i\, \mathrm{man}(x_i, t_0, w_0)], t_0, w_0)$
c. $S[b] \neq \#$ iff $\forall s \in S\ \{e \in D: [\![\mathrm{man}(x_i, t_0, w_0)]\!]^{s[x_i \rightarrow e], S} = 1\} \neq \emptyset$ , iff $\forall s \in S\ \{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{man})\} \neq \emptyset$
If $\neq \#$,
$S[b] = \{s \in S: <f(s(x_k), \{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{man})\}), s(t_0), s(w_0)> \in I(\mathrm{coughing})\}$

<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.

(35) a. The pig is grunting, but the pig with floppy ears isn't grunting *(need not be a contradiction)*
b. $[\iota_{x_k} x_i\, \mathrm{pig}(x_i,t_0,w_0)]\ \mathrm{grunting}(x_i,t_0,w_0)\ \&\ [\iota_{x_k} x_i((\mathrm{pig}(x_i,t_0,w_0)\ \&\ \mathrm{floppy}(x_i,t_0,w_0))]\ \neg\, \mathrm{grunting}(x_i,t_0,w_0)$
c. $S[b] \neq \#$ iff $\forall s \in S\ \{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{pig})\} \neq \emptyset$ and $\forall s \in S$ s.t. $<f(s(x_k), \{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{pig})\}), s(t_0), s(w_0)> \in I(\mathrm{grunting})\}$, $\{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{pig})\ \&\ <e, s(t_0), s(w_0)> \in I(\mathrm{floppy})\} \neq \emptyset$
If $\neq \#$,
$S[b] = \{s \in S: <f(s(x_k), \{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{pig})\}), s(t_0), s(w_0)> \in I(\mathrm{grunting})\ \&\ \{e \in D: <e, s(t_0), s(w_0)> \in I(\mathrm{pig})\ \&\ <e, s(t_0), s(w_0)> \in I(\mathrm{floppy}), s(t_0), s(w_0)> \notin I(\mathrm{grunting})\}$

<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.

(36) 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. $[\iota_{w_0} w_i\, \mathrm{came}(J,t_0,w_i)]\mathrm{happy}(M,t_0,w_i)\ \&\ [\iota_{w_0} w_i\, \mathrm{came}(J,t_0,w_i)\ \&\ \mathrm{drunk}(J,t_0,w_i)]\ \neg\, \mathrm{happy}(M,t_0,w_i)$
c. $S[b] \neq \#$ iff $\forall s \in S\ \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{came})\} \neq \emptyset$ and $\forall s \in S$ s.t. $<I(M), s(t_0), f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{came})\})> \in I(\mathrm{happy})\}$: $\{e \in W: <I(J), s(t_0), e> \in I(\mathrm{came})\ \&\ <I(J), s(t_0), e> \in I(\mathrm{drunk})\} \neq \emptyset$
If $\neq \#$,
$S[b] = \{s \in S: <I(M), s(t_0), f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{came})\})> \in I(\mathrm{happy})\ \&\ <I(M), s(t_0), f(s(w_0), \{e \in W: \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{came})\ \&\ <I(J), s(t_0), e> \in I(\mathrm{drunk})\})> \notin I(\mathrm{happy})\}$

[For simplicity I have disregarded mood in this example. See below]
<u>Note:</u> 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.



(37) a. If John is sick, Mary is unhappy *(indicative conditional)*
b. $\mathrm{unhappy}(\mathrm{Mary}, t_0\{\mathrm{local}\}, [\iota_{w_0} w_i\, \mathrm{sick}(J,t_0\{\mathrm{local}\},w_i)]\{\mathrm{LOCAL}\})$
c. $S[b] \neq \#$ iff $\forall s \in S$ $(\{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\} \neq \emptyset\ \&\ s(t_0) = \mathrm{local}(T)(s)\ \&\ f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\}) \in \mathrm{LOCAL}(W)(s, S)$, with $\mathrm{LOCAL}(W)(s, S) = \{\mathrm{local}(W)(s): s \in S\}$ (=the Context Set), by the Stipulation introduced above.)
If $\neq \#$,
$S[b] = \{s \in S: <I(M), s(t_0), f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\})> \in I(\mathrm{unhappy})\}$

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

(38) a. If John were sick, Mary would be unhappy *(subjunctive conditional)*
b. $\mathrm{unhappy}(\mathrm{Mary}, t_0\{\mathrm{local}\}, [\iota_{w_0} w_i\, \mathrm{sick}(J,t_0\{\mathrm{local}\},w_i)]\{<\mathrm{LOCAL}\})$
c. $S[b] \neq \#$ iff $\forall s \in S$ $(\{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\} \neq \emptyset\ \&\ s(t_0) = \mathrm{local}(T)(s))\ \&\ \exists s \in S$ $(f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\}) \notin \mathrm{LOCAL}(W)(s, S))$, with $\mathrm{LOCAL}(W)(s, S) = \{\mathrm{local}(W)(s): s \in S\}$ (=the Context Set), by the Stipulation introduced above.
If $\neq \#$,
$S[b] = \{s \in S: <I(M), s(t_0), f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\})> \in I(\mathrm{unhappy})\}$

(39) a. If John had been sick (now), Mary would have been unhappy *(double subjunctive conditional)*
b. $\mathrm{unhappy}(\mathrm{Mary}, t_0\{\mathrm{local}\}, [\iota_{w_0} w_i\, \mathrm{sick}(J,t_0\{\mathrm{local}\},w_i)]\{<w_1\{<\mathrm{LOCAL}\}\})$
c. $S[b] \neq \#$ iff
(i) $\exists s \in S\ s(w_1) \notin \mathrm{LOCAL}(W)(s, S)$, with $\mathrm{LOCAL}(W)(s, S) = \{\mathrm{local}(W)(s): s \in S\}$ (=the Context Set), by the Stipulation introduced above.
[this is the presupposition introduced by $w_1\{<\mathrm{LOCAL}\}$)
(ii) $\forall s \in S\ s(t_0) = \mathrm{local}(T)(s)$ [presupposition introduced by $t_0\{\mathrm{local}\}$]
(iii) $\forall s \in S\ \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\} \neq \emptyset$ [presupposition introduced by the *if*-clause]
(iv) $\forall s \in S\ f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\}) <_{\mathrm{local}(W)(s)} s(w_1)$
If $\neq \#$,
$S[b] = \{s \in S: <I(M), s(t_0), f(s(w_0), \{e \in W: <I(J), s(t_0), e> \in I(\mathrm{sick})\})> \in I(\mathrm{unhappy})\}$