On similarity in counterfactuals

Ana Arregui
University of Ottawa

1. Introduction

Judgments about similarity are important in the evaluation of counterfactual conditionals. It has often been noted that in interpreting counterfactuals, we consider alternatives in which some things change, and others stay the same. We talk about *similarity* to focus on the things that stay the same. Some of the most influential proposals for the analysis of counterfactuals have put similarity right in the centre. According to the theories of Lewis (a.o. Lewis 1973) and Stalnaker (a.o. Stalnaker 1968), counterfactuals of the form *if A, would B* are true iff the most similar A-worlds are also B-worlds (simplifying a little, an *LS-style semantics*). The nature of the similarity relation invoked by these constructions has been subject of much debate (before and after Lewis 1979 spelled out a fairly detailed view). The main objective of this paper is to investigate the role of similarity in the evaluation of counterfactuals, and to make a proposal about how it enters semantic composition.

Famously, the kind of similarity appealed to by LS-style semantics is *global* similarity (g-similarity). Worlds are compared to each other and all features 'count' (though their relative weight may vary from context to context). So, for example, in evaluating a counterfactual like *If I had followed the recipe, the strudel would have been delicious* we will care about worlds that are like the actual world with respect to the fact that I had an excellent recipe, the ingredients were in good condition and the oven worked, and are also like the actual world with respect to what I had for breakfast, the history of France and the Ice-Age. The counterfactual will be true iff in the maximally similar worlds in which I follow the recipe, the strudel works out. The aim of this paper is to articulate instead a *local* approach to similarity, according to which only certain features of the world 'count' (in the strudel example, the features would include that I had an excellent recipe, good ingredients and a working oven, but would not include my breakfast, the history of France or the Ice-Age). The intuition is that when a counterfactual is (contingently) true, there are certain facts or features of the world that make the counterfactual true and the rest don't matter. The paper spells out an analysis that characterizes counterfactuals as making claims about the features that matter. The analysis will be called *de re* because it involves modal predication over parts of the actual world.[1] Counterfactuals will be understood as modal predicates over features of the world. In a sense, the *de re* analysis is a significant departure from an LS-style semantics. According to g-similarity, the worlds that matter for the evaluation of counterfactuals are maximally similar to the actual world. According to the *de re* analysis, the worlds that matter are sufficiently similar to the actual world (they need only be similar with

[1] I will only discuss *would*-conditionals uttered in contexts in which it is known that the antecedent is false. For this reason, I refer to the *de re* analysis as a proposal for counterfactuals. However, the contextual facts are not crucial.

respect to certain features). However, in spite of differences, the *de re* analysis is clearly derived from and shares many properties of the proposals made by Lewis and Stalnaker. It is actually interesting to see that it is possible to tell apart an LS-inspired view in which some features are allowed to matter the most (g-similarity, appropriately weighed) from the *de re* view presented here, according to which some features matter exclusively (local similarity, with *de re* predication over the features that matter).

The paper relates the local evaluation of similarity in counterfactuals to a proposal about how similarity enters semantic composition. According to the *de re* analysis, similarity with respect to certain actual world facts results from the interaction between the semantics of tense and the semantics of *would* . Making use of a Kratzer-style situations framework, it is argued that past tense in counterfactuals is responsible for identifying the features of the world relevant for similarity. The situations framework will provide us with distinctions that are fine-grained enough to deal with partial dependency on facts. Evidence supporting the link between the resolution of similarity and the semantics of tense will come from counterfactuals in embedded contexts. We will see that different interpretations of tense result in different options regarding the resolution of similarity, supporting the link between the two.

There are thus two related claims at stake in the *de re* proposal. One is a claim about how we evaluate similarity in counterfactuals (locally instead of globally) and the other is a claim about meaning composition and the linguistic mechanisms at work in invoking similarity (the interpretation of tense and the semantics of *would*). Arguments will be presented both to distinguish global similarity from local similarity and to link the resolution of similarity to the semantics of tense. The structure of the paper is as follows. In §2 I will present the *de re* analysis, spelling out the basic assumptions about the interpretation of tense and the semantics of *would*. Some aspects of the syntax and semantics of counterfactuals will be simplified: I will provide a treatment of counterfactuals in which the modal combines with a clause providing the restrictor (*the antecedent clause*), and the result combines with the clause corresponding to the nuclear scope (*the consequent clause*). This structure will provide us with enough background for our discussion of the role of tense in counterfactuals, but it does not result in an account that is fully compositional and dynamic.[2] In §3 I will compare local and global similarity, arguing for the former. I will show that there are cases in which local similarity makes better predictions than g-similarity, and then show that there are cases in which it is just as good. In §4 the emphasis will be placed on relating the resolution of similarity to the semantics of tense. I will present arguments in favor of local similarity tied to the semantics of tense. Concluding remarks will be found in §5.

There has been much interest in recent literature in the interpretation of tense in counterfactuals and modal contexts more generally. In some cases, the authors have been interested in the relation between conditionals with simple vs. perfect *have* morphology in the antecedent (Ogihara 2000, Ippolito 2003, also Arregui 2004, 2007a). Other authors have worried about unusual interpretations of tense features (Iatridou 2000), or the relation between tense and modality more generally (Condoravdi 2001, Ippolito 2004). I have not attempted an overview of this literature here.[3] Neither have I been able to do justice to

[2] For a more sophisticated discussion of syntactic matters, the reader is referred to a.o. von Fintel (1994), Iatridou (1991), Bhatt and Pancheva (2006). It has also been pointed out that a satisfactory analysis of counterfactual structures must include a dynamic perspective, and the reader is referred to a.o. von Fintel (2001), Veltman (2005). My contribution in this paper can be thought of independently of the dynamic aspects.

[3] The reader is referred to Arregui (2004, 2007a) for (fairly) thorough discussions.

crosslinguistic observations (Palmer 1986, 2001, see also a.o. Han 2006, Iatridou 2000, Ippolito 2004, Legate 2003, Ogihara 2004, 2006). The cross-linguistic implications of this proposal remain for future work.

2. A *de re* analysis for counterfactuals

Counterfactuals that are true contingently are made true by facts in the actual world. The *de re* analysis is a proposal for working out the claim that not all facts in the actual world affect the truth-value of a counterfactual. It is argued that counterfactuals are 'made true' by parts of the evaluation world (where the parts can be relatively small or large). In §1 we noted the intuition that similarity matters in the evaluation of counterfactuals. The *de re* analysis will explain this intuition in terms of a proposal according to which counterfactuals make reference to parts of the evaluation world, and quantify over possibilities that match the actual world with respect to those parts. Caring only about match with respect to certain features, similarity will be 'local'. The main ingredients of the analysis will be an account of the role of tense in counterfactuals and a *de re* analysis of *would* in terms of Kratzer-style situations.

This section will be dedicated to the presentation of the *de re* proposal. The analysis will be spelled out here and further justifications and discussion will be found in §3 and §4. The section has four parts. §2.1 is dedicated to tense. Here I will propose an account of the interpretation of tense morphology in counterfactuals in terms of 'sequence of tense' and present a referential analysis of tense making use of Kratzer-style situations (Kratzer 1989, 2002, 2006a). §2.2 is dedicated to the modal *would*. Here I will spell out a *de re* analysis for *would*, and work out the modal consequences of adopting a referential view of tense within a situations framework. §2.3 presents some new data. Here I examine counterfactuals in the context of knowledge attribution, discussing some of the intuitive grounding for the *de re* proposal. §2.4 provides some perspective. Here I discuss alternative analysis of tense, as well as the pragmatic assumptions and intuitions that are relevant for the *de re* analysis to work.

2.1 Tense morphology and tense semantics in counterfactuals

The literature dealing with the interpretation of tense often notes that tense morphology in embedded contexts can be 'bleached' (emptied) of its usual meaning. This is known as 'sequence of tense' (see a.o. Enç 1987, Zagona 1995, Stowell 1996, Ogihara 1996, Abusch 1997, Kusumoto 1998, Kratzer 1998). I propose that the interpretation of tense morphology in English counterfactuals should be understood as a case of 'sequence of tense', with tense morphology bleached of its 'standard' meaning. Dudman (1984) provides the following sample:

(1)

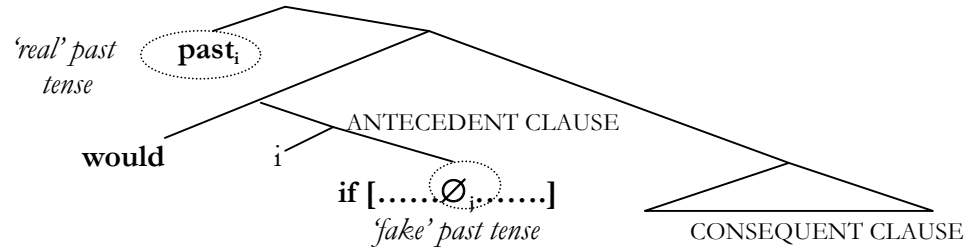
V-ed	present	If Her Majesty was here now, she would be revolted.
had V-en	future	If Grannie had missed the last bus on Friday (next Friday), she would have walked home *(she is actually dead).*
	present	If Her Majesty had been here now, she would have been revolted.
	past	If Grannie had missed the last bus on Friday (last Friday), she would have walked home *(luckily, she caught it).*

In the examples in (1), we see antecedent clauses that carry what seems to be past morphology. However, the past meaning is missing from the antecedent, and the eventuality presented by the antecedent can be set in the present, past or future.

There is consensus that in sequence of tense languages like English, embedded tenses can be bleached of their deictic meaning when they are in the syntactic domain of (c-commanded by) another tense that does carry the expected deictic meaning. A distinction is made between 'real' tenses, in which tense morphology is associated with the expected deictic meaning, and 'fake' tenses, in which the deictic meaning is absent. In fake tenses, tense morphology is agreement morphology, devoid of semantic consequences.[4]

I would like to extend this division between real tenses and fake tenses to tenses in counterfactuals (see also Arregui 2004, 2008). I propose that the antecedent clause tense in counterfactuals is a fake tense. Tense morphology in the antecedent shows up as past because of agreement with a real past tense that is higher in the structure, outside the antecedent clause. This explains the presence of past morphology in the absence of past semantics. I propose the structure in (2), in which a fake (empty) past tense (here represented by $\varnothing_i$) shows up in the antecedent clause in the scope of a real (deictic) higher past tense:

(2)



A binder index *i* (à la Heim and Kratzer 1998) abstracts over the fake tense in the antecedent clause, and the modal *would* takes as its first argument a property of temporal entities (this will be followed-up on when we discuss *would* in §2.2).

Let us turn from the distribution of morphological features to the actual semantics of tense. There are many alternative approaches to tense and sequence of tense phenomena (see Kusumoto 1998, 2005). I will adopt a 'referential' analysis of tense, according to which tenses are simply referential expressions, a kind of pronoun (Partee 1973, Heim 1994, Kratzer 1998). Following Kratzer (1998), I propose to characterize the inventory of tenses in English as containing 'real' deictic tenses (i.e. $past_i$ and $present_i$) and fake tenses ($\varnothing_i$) (that Kratzer calls 'zero' tenses). Deictic tenses carry deictic features and denote temporal entities that satisfy the appropriate deictic constraints (past vs. present entities). Fake tenses refer in the same domain as deictic tenses but lack deictic features (their morphology is semantically vacuous agreement morphology). They are interpreted simply as tense variables, with denotations provided (without deictic constraints) by means of variable assignments. They can be free, and refer to a salient entity. Or they can be bound and give rise to 'bound variable' interpretations. With the assumption that binders may be present silently in a structure, it is possible to generate the configuration in (2), in which a binder abstracts over

[4] The idea of 'fake' morphological expressions of semantic operators has of course proven fruitful in many different domains (pronoun agreement, negative concord, etc.), see for example the proceedings of the 2006 ESSLII Workshop on Concord Phenomena and the Syntax-Semantics Interface (Dekker and Zeijlstra 2006).

the tense variable in the antecedent clause, and the denotation of the antecedent clause is a property of temporal entities.[5]

A lot can be said about the interpretation of tense without saying anything specific about how times or temporal entities are to be construed. However, part of the proposal to be made in this paper is that to understand the contribution made by tense in counterfactuals, it is important to elaborate on the nature of the entities referred to by tense. In the analysis proposed here, tenses refer to parts of the history of the world. I will begin by presenting Kratzer's situations framework, which will allow me to talk about parts of worlds (Kratzer 1989, 2002, 2006a). This is meant as an informal presentation, and some familiarity with Kratzer's proposal will be presupposed. According to Kratzer, parts of possible worlds are possible situations. At an intuitive level, we can think of a situation in the actual world as a 'piece' of what is going on in the actual world. The relation between any one part of what is going on and the parts that include it is the 'part of' relation, which is represented with the symbol ≤. Suppose, to use one of Kratzer's examples, that in the actual world it is true that Paula painted a still life with apples. Then, there is an aspect of the actual world, a piece or part of the actual world, that makes this true. This piece will be the situation of Paula painting the apples. This situation itself will have parts (like the situation of Paula painting the apple stalks). And it will be part of other situations (like the situation of Paula painting the still life and making dinner afterwards). Situations can get very 'big'. The actual world itself is a situation: the sum of all its parts. Worlds are distinguished within the set of situations in that they are maximal (i.e. they are not part of other situations). Situations can also get very 'small'. Different positions can be adopted regarding just how small situations can be. In this paper, I make use of relatively 'thick' situations, which consist of individuals with several properties.

In a referential account of tense within a situations framework, deictic tenses put temporal constraints on the situations they can refer to, while fake tenses do not. The proposal is presented in (3), where (3a) provides the semantics for deictic past and (3b) provides the semantics for fake (zero) tense:[6]

(3) a. $[[\textbf{past}_i]]^g = g(i) = s_i$, where s_i is presupposed to precede the speech event.
b. $[[\varnothing_j]]^g = g(j) = s_j$

According to (3), both real tenses (*past*$_i$) and fake tenses ($\varnothing_j$) receive an interpretation that depends on a variable assignment (g). In the case of (3a), there is a deictic constraint that the denotation should be past. There are no deictic constraints on the denotation of (3b), which is just a variable ranging over situations. In the structure in (2), the zero tense is found in the scope of a binder index, and the antecedent clause is interpreted as a property of situations:

[5] To justify the machinery presented here, it would be necessary to discuss sequence of tense data of various types. For reasons of space and focus, I have not attempted to provide a full formal presentation of analysis of sequence of tense. The reader is referred to Kratzer (1998) for a full presentation and discussion of a referential tense system, as well as to Heim (1994) and other references mentioned above. There has been a lot of recent interest in the interpretation of features in the linguistic literature, in particular with respect to deictic features both in the temporal and person domains. I have not attempted to review that literature here, the reader is referred to a.o. Sauerland (2002), Schlenker (2003), von Stechow (2003), Rullmann (2004), Heim (2005), Kratzer (2006b).

[6] The proposal in (3) makes use of ideas found in Kratzer (1998), Heim (1994) and others. Differences between the proposals will not be relevant to our discussion.

(4) [[[**i** [**if ……. ∅**$_i$ **……**]]]] = λs. […..s……]

A word about 'temporal precedence' in (3). I will take it that a situation precedes the speech event if it is a piece of the world that completely precedes the piece corresponding to the speech event. If we imagine, for the moment, the world divided into temporal slices, then a situation will precede the speech event iff the minimal temporal slice it belongs to precedes the minimal temporal slice the speech event belongs to (for a discussion of formal mechanisms to map event-structures to linear-orders, the reader is referred to Kamp (1979) and Landman (1991) (and references therein)).

As a last remark, let me note that I have spelled out the semantics of *past* and zero tense, but have not said anything about *present*. Following the thinking above, *present* would denote a temporal interval that is present. The semantics of present tense, however, will not be part of our discussion. I will only deal with *would*-conditionals, and follow the (relatively) standard practice of characterizing *would* as a modal in the scope of a past tense (see (2)). I will not have anything to say about *will*-conditionals or present tense.

2.2 A *de re* analysis for *would* in a situations framework

This section is dedicated to the interpretation of *would* within a situations-framework. Before turning to the semantics of *would* proper, I would like to introduce some preliminary clarifications that will help us later on. First: I will follow the common assumption that modals invoke contextually salient laws (see a.o. Kratzer 1977, 1981). The same modal may be associated with different laws in different contexts. For the sake of concreteness, I will assume that the modal *would* is associated with a free variable *L* that will be responsible for picking out a set of contextually relevant actual-world laws (L). The value of *L* will be provided by context by means of a variable assignment.[7] Law-like situations (s_L) are characterized as situations that are parts of worlds that follow the set of laws g(*L*) (where g is the contextually given variable assignment and g(*L*) = L). (I will not have anything to say about the nature of the laws that affect the evaluation of counterfactuals here).

Second*:* In using situations to make sense of *de re* counterfactuals, it will be necessary to identify the denotation of *past* across different worlds. The Lewis-style view of individuals that underlies Kratzer's situation semantics won't let us do that directly. According to Kratzer, situations are Lewis-style individuals, which means they are at most part of one world. Situations (indeed, all individuals) are identified 'across worlds' via similarity-based counterparts.[8] With a Lewis-style perspective, when we say that an actual world situation is also part of another world or other-worldly situation, we are claiming that the actual world situation has a counterpart (is appropriately similar to a situation) in another world, where the similarity relation underlying the counterpart relation is determined by context. To simplify definitions in what follows, I will introduce an auxiliary notion, that of a 'modal part of', that will help make explicit the role of counterparts in the semantics of *would*:

[7] The proposal is slightly simplified, and the reader is referred to von Fintel and Heim (2005) for a discussion of the types of free variables that can restrict modals. In setting up the semantics of *would* in relation to an associated free variable I have been inspired by von Fintel's resource domain variables (von Fintel 1994).

[8] See Lewis 1983 for a wider discussion of the different types of relations that can sustain a counterpart relation, some of which are not necessarily similarity-based. We will only be interested in similarity-based counterparts here.

(5) Given two situations s_i and s_j, we will use $\leq_m$ to talk about the 'modal part of' relation, and define it as follows:
$s_i \leq_m s_j$ *iff* s_i has a counterpart in s_j (i.e. there is some s_t such that s_t is a counterpart of s_i and $s_t \leq s_j$)

Given (5), the modal part-of relation is defined on the basis of counterparts. Counterparts invoke a contextually given notion of similarity that can be evaluated locally with respect to the individual at hand.

Third: Given the proposal in (2), the antecedent clause denotes a property of temporal entities, which we construe as a property of situations. I will follow Enç 1996 (a.o.) in viewing modals as responsible for manipulating the temporal location of clauses in their scope. In the case of counterfactuals, *would* shifts the antecedent clause to a time that is non-past. I will simplify the presentation of the semantics of *would* by ignoring the temporal manipulation of the embedded clause, and make reference directly to the shifted propositions. I will use the following abbreviations to talk about the temporally-shifted propositions that serve as the arguments of the modal:

(6) Where *p* is a property of situations (e.g. the denotation of the antecedent clause)
$p^* = \lambda s.\ \exists s'.\ s' \leq s \ \&\ s'$ is non-past $\&\ p(s') = 1$

In a counterfactual like *If Her Majesty was here now, she would be revolted* the antecedent clause denotes a property of situations in which Her Majesty is here, and the modal locates the situation at a non-past (in this case, present) time. In *If Grannie had missed the bus, she would have walked* the antecedent clause denotes a property corresponding to the result-state of Grannie having missed the bus. The modal locates this property at a non-past time. If the result-state is in the present, then Grannie missed the bus before the speech time. If the result state is in the future, then Grannie may have missed the bus before or after the speech time (see Arregui 2007a for details). In both cases, the temporal location of the antecedent clause is decided by the modal, and is independent of the semantics of the higher past tense.

We can now turn to the semantics of *would*. Given the structure in (2), *would* combines with the antecedent and consequent clauses, and with *past*. I propose the semantics in (7):

(7) *Would*
Given two propositions p* and q*, and a past situation s in w,
$[[\mathbf{would_L}]]^{w,g}(p^*)(q^*)(s) = 1$ iff
$\{s_L' : s \leq_m s_L' \ \&\ p^*(s_L') = 1\} \subseteq \{s_L' : \exists s_L''.\ s_L' \leq s_L'' \ \&\ q^*(s_L'') = 1\}$,
where s_L is a situation that satisfies the set of laws L of w salient in the context.

According to (7), a counterfactual will be true of s iff the set of law-like situations that contain (a counterpart of) s in which the antecedent* is true is a subset of the set of law-like situations that can be extended to situations in which the consequent* is true. Given (7), the domain of quantification of the modal only includes law-like situations that are *sufficiently* similar to the actual world: they all contain a counterpart of whatever is the past situation singled out as the denotation of *past*. Similarity with respect to the actual world counts only with respect to the part of the world singled out by *past*. In addition, according to (7), the situations quantified over are also situations in which the future-oriented proposition (p*) is

true. These will be situations that contain a non-past situation in which the antecedent proposition p is true. Notice that the antecedent* proposition (p*) is not predicated of the denotation of *past* (in fact, given (6), the situation the antecedent (p) is claimed to be true in is not in the past). It is the modal in the counterfactual, not the past tense, that is responsible for manipulating the temporal location of the antecedent-situations.

According to (7) the whole counterfactual is construed as a predicate of an actual world situation. Since we are dealing with a modal property predicated of an actual world entity, I call this analysis *de re*. In a sense, the counterfactual is 'about' whatever actual world situation is the denotation assigned to *past*, which constitutes the *res* of predication. To see the proposal at work, let's examine example (8) below. Suppose I have a friend called Sara who is very allergic to cats. In the actual world there is a (past) situation that is Sara's suffering from allergy (it will include past parts of Sara and her body being in a certain state and there being certain chemical things going on). Suppose also that I have two cats at home. Then:

(8) If Sara had visited my house (last Monday), she would have sneezed.

Given the proposal in (7), (8) will be true if the claim in (9) is true:

(9) $\{s_L'$: $s \leq_m s_L'$ & Sara has visited my house in $s_L'\} \subseteq$
$\{s_L'$: $\exists s_L''$. $s_L' \leq s_L''$ & Sara has sneezed in $s_L''\}$,
where s_L is a situation that satisfies the set of laws L of w salient in the context (and these includes those pertaining to people and their allergic reactions) and s is the past situation corresponding to the denotation of *past* in (8).

(9) will be true if *past* in (8) has as denotation a situation that includes the features of the world corresponding to Sara's allergic state and me having cats at home. Tense refers to these features in the world, and the conditional is understood in terms of *de re* predication over these features. What is claimed in (9) is that all law-like situations that include (counterparts of) these features in which Sara has visited my house can be extended to law-like situations in which she has sneezed (where the antecedent and consequent propositions are non-past).

The schema in (10) allows us to follow what happens with (9) more closely. Suppose that s_2 is the past actual world situation of Sara's allergic state (her body in a certain chemical make-up, etc.) and s_3 is the situation of me having Mina and Max at home. Suppose moreover that the denotation of *past* in (8) is s_4, the situation corresponding to the sum of these two:

(10)

Suppose further that s_5 is a counterpart of s_4 within the situation s_6. This will allow s_5 to be different from s_4 (and this is a good thing as the situations have different properties, they are part of different worlds and different things have probably been happening in the different worlds). But at the same time, the counterpart relation requires that s_5 be appropriately similar to s_4 (in this context, this will mean that s_5 will include a counterpart of Sara's allergic body and my hairy cats). For example: in both the actual world and in s_6 Sara's body will have the chemical make-up that leads to sneezing, but whereas in the actual world Sara's body was located at her house on Monday, in s_6 it could be located somewhere else (for this counterpart relation, the location is not important). Imagine now that s_6 is a situation that respects the set of laws relevant in the context and in which Sara has visited my house. Then, according to (9), the counterfactual in (8) will be true iff it is possible to extend s_6 to a law-like situation in which Sara sneezes.

To gain a better understanding of the claims made by (7), consider now the counterfactual in (11) in the same scenario:

(11) If Sara had visited my house, she would have had teary eyes.

Imagine now that teary eyes are compatible with allergy (they are permitted by the 'allergy laws') but they are not 'necessary' (they don't occur in all cases of allergic reaction). We would judge (11) false. It would have been possible for Sara to visit my house without having teary eyes. The proposal in (7) gives us correct results also in this case. Suppose we give *past* in (11) the same denotation as *past* in (8). Then the domain of quantification of the modal will consist of all law-like situations that (modally) include Sara's allergic state and my cats in which she visits my house. In some of these situations, she will have visited my house and not have had teary eyes. Situations in which she does not have teary eyes when she visits cannot be extended to situations in which she does have teary eyes when she visits, so (11) will be false with this valuation of *past*. Suppose now that we give *past* in (11) a denotation different from the one in (8). We will still fail to predict that (11) is true. There aren't facts in the actual world that necessarily lead to Sara having teary eyes when visiting my house. There isn't a denotation for *past* that makes (11) true.[9] As we see, the proposal in (7) correctly predicts that (11) is false in the circumstances described.

The semantics in (7) has been inspired by proposals to use situations to rescue E-type analyses for pronouns in donkey sentences (a.o. Heim 1990). A more familiar/expected

[9] Notice that if we assign *past* a denotation that is not compatible with the antecedent* proposition (in the case of (11), this could be the fact that Sara did not visit my house at the relevant time) then the domain of quantification will be empty, and the subset claim corresponding to universal quantification in (7) will be true. However, in this paper I will adopt the common assumption that universal claims that are vacuously true are infelicitous, so assignments to *past* that make a counterfactual vacuously true will not be considered an option.

alternative to (7) would be an analysis formulated directly in terms of entire worlds. Then, the proposal would have looked like (12):

(12) *Worldly alternative:*
Given two propositions p* and q*, and a past situation s in w,
$[[\textbf{would}_L]]^{w,g}(p^*)(q^*)(s) = 1$ iff
$\{w_L: s \leq_m w_L \ \& \ p^*(w_L) = 1\} \subseteq \{w_L: q^*(w_L) = 1\}$

(12) claims that all the law-like worlds that contain a counterpart of the denotation of *past* in which the antecedent is true are also worlds in which the consequent is true. The importance of considering antecedent situations smaller than possible worlds will be discussed and argued for in §3. 1.

In the remainder of this section I will clarify some features of the analysis in (7). One observation is that the antecedent situations need be law-like only with respect to a subset of the laws of the evaluation world. This is important in order not to restrict (unduly) the way in which the *res* situation is 'inserted' into the antecedent situations. The intuition here (reported in the literature, see Bennett (2003) for discussion) is that we do not usually care too much about how the antecedent comes about. In the case of (8), for example, we might consider situations in which Sara suddenly appears at my doorstep. We can explain this indifference by saying that the way in which the counterpart of the *res* situation fits in with the rest of the antecedent situations need not satisfy <u>all</u> the laws of the evaluation world. In his (1979) discussion of similarity, Lewis considered that laws were broken in order to accommodate the antecedent ('small miracles' happened). In LS-style analyses, this issue is sometimes tackled in terms of 'ramps': the ramp is the portion of the antecedent worlds leading up to the hypothesized eventuality. In 'ramps', the laws of the evaluation world can be broken (Bennett 2003). By treating the modal as a context dependent expression that brings into play a contextually specified set of laws, we allow counterfactuals to be evaluated with respect to a subset of the actual world laws, and in this sense permit 'small miracles'.

Another feature of the proposal is that, even if the truth of a counterfactual depends on what happens in (small) situations that include a counterpart of the *res* situation, the counterfactual will only be true if it is true also in the worlds (maximal situations) that include a counterpart of the *res* situation. The proposal in (7) (as opposed to the alternative in (12)) puts constraints both on worlds that contain the *res* situation in which the antecedent is true, and in smaller situations that do so. We will see in §3.1 why this is important.

Finally, the proposal in (7) predicts that a counterfactual with an antecedent true in the actual world can be true (there is no presupposition that the antecedent must be false in the actual world). It also predicts that a counterfactual with true antecedent and true consequent could be false. This is because quantification takes place over situations (worlds) in which there is a counterpart of the *res* situation that obey the (relevant) laws. If the consequent does not follow from the *res* situation plus laws, the counterfactual could well be false. We would find examples like this with counterfactual claims in which both the antecedent and consequent were true, but there was no 'law-like' connection between the two. Translated into a Lewis-style vocabulary, we would say that this proposal identifies the antecedent worlds in the manner of a *weakly-centered* system of similarity spheres (a system in which there is no world more similar to the actual world than the actual world, but the actual world need not be the most similar world to the actual world, so other worlds could be as similar to the actual world as the actual world). Lewis disfavored a weakly-centered

conception of similarity, but agreed that the evidence was not conclusive. A weakly-centered approach to similarity predicts that examples like *If the sky were blue, the grass would be green* could come out false. A strongly centered approach predicts they are true. I will not be able to offer insights on this topic, and simply point out this feature of my proposal. Lewis noted that the oddness of the relevant examples gets in the way of our judgments: *In fact, the oddity dazzles us. It blinds us to the truth value of the sentences, and we can make no confident judgment one way or the other. We ordinarily take no interest in the truth value of extreme oddities, so we cannot be expected to be good at judging them. They prove nothing at all about truth conditions.* (Lewis 1973: 28).

2.3 On *aboutness* in counterfactuals: knowledge as a diagnostic

Before comparing the *de re* analysis and global-similarity in §3, I would like to provide support for the idea that counterfactuals are about situations by pointing out that we have intuitions as to the situations counterfactuals are about. This is an important point, since it allows us to say that we can use those intuitions in the pragmatic exercise of figuring out the denotation of tense. Support for this point is provided by examples with counterfactuals embedded under *know*.

We will start with the proposal for *know* found in Kratzer (2002). In that paper, Kratzer presents and defends a view of knowledge attribution as justified true belief that addresses the well-known problems posed to such views by Gettier's examples. In Kratzer (2002), knowledge is characterized as *de re* belief about facts. The proposal is given in (13) (Kratzer 2002: 664):

(13) S knows *p* iff
- (i) There is a fact *f* that exemplifies *p*[10],
- (ii) S believes *p de re* of *f*, and
- (iii) S can rule out relevant possible alternatives of *f* that do not exemplify *p*.

The different clauses in (13) take care of different aspects of the problem of knowledge attribution: (i) makes sure that we can only know propositions that are true, (ii) makes sure that we have come to believe the proposition for the right reasons/ in the right way, and (iii) makes sure we are 'epistemically competent'.

To see (13) at work, consider one of Gettier's examples, discussed by Kratzer:

(14) Smith knows that either Jones owns a Ford or Brown is in Barcelona.

Smith has strong evidence that Jones owns a Ford, because Jones has owned a Ford for many years, and he has just offered Smith a ride in a Ford. Given his belief that Jones owns a Ford, Smith is willing to accept the proposition that either Jones owns a Ford or Brown is in Barcelona (Brown is another friend, whose whereabouts Smith doesn't actually know). However, as luck would have it, Jones doesn't own a Ford anymore and is driving around in the car of a friend, and moreover, Brown is in Barcelona. Gettier's point was that, in such circumstances, even though Smith believes a true proposition, we judge the sentence in (14)

[10] Kratzer uses the word *fact* in a technical sense: *If s is a possible situation and p is a proposition, then s is a fact exemplifying p iff for all s' such that s'≤s and p is not true in s', there is an s" such that s'≤s"≤s and s" is a minimal situation in which p is true. (A minimal situation in which p is true is a situation that has no proper parts in which p is true.)* (Kratzer 2002: 660)

false. The explanation provided by Kratzer's proposal in (13) is that Smith is not properly acquainted with the fact that makes the proposition true.

Counterfactual conditionals make hypotheses that are false in the actual world, yet they are made true by the actual world. What are the features of the actual world that make a counterfactual true? In Kratzer's terms: what are the facts that exemplify a counterfactual? We can probe our intuitions regarding such facts by embedding counterfactuals under *know*. Consider a famous counterfactual discussed by Kit Fine (Fine 1975):

(15) If Nixon had pushed the button, there would have been a nuclear holocaust.

Let us now embed it under *know*, in the context of a Gettier-style scenario:

(16) Smith knows that if Nixon had pushed the button, there would have been a nuclear holocaust.

Imagine that at some point in the past the button had been connected to an A-set of missiles, and that if those had been launched, there would have been a nuclear holocaust. Suppose also that Smith was aware that the button was connected to those missiles. But at some later point there was a change in military strategy, and the button was disconnected from the A-missiles and connected to a B-set of missiles. If those had been launched, there would also have been a nuclear holocaust. Smith never found out that the wiring had been changed. In such circumstances we would be unwilling to grant that (16) is true, even if we grant that (15) is true. Following Kratzer, we can say that (16) is false because Smith is not properly acquainted with the facts that make (15) true. In order to judge (16) true we would want Smith to be acquainted with the facts concerning the history of the button: we would want him to know that it had been attached to the B-set of missiles. Those are the features of the world that make (15) true.

The context of knowledge attribution can be used to motivate the idea that counterfactuals are about situations in the actual world. This in itself does not support the analysis proposed in §2.1 and §2.2. Even if there are (relatively small) situations that support the truth of counterfactuals, this does not mean that the semantics of counterfactuals need mention those situations, nor that the LF of counterfactuals need include expressions that make reference to them. The conclusion is only a useful preliminary step.

2.4 Reference or quantification over the *res* situation?

In choosing a pronoun analysis for tense, I claim that in counterfactuals we make reference to the *res* situation. This is a claim about the linguistic mechanisms that make similarity relevant to the evaluation of counterfactuals. An alternative would have been to argue for a quantificational approach to tense, according to which the *res* situation is existentially quantified over.[11] In this section I will examine some difficulties faced by a quantificational approach, and argue that the referential account fares better. I will also spell out details of the pragmatic assumptions needed to make a referential account work.

I will start by presenting a quantificational view of tense within a situations framework (17):

(17) $[[\textbf{PAST}]] = \lambda p_{<s,t>} . \exists s.\ \text{past}(s) \ \&\ p(s) = 1$

[11] For an overview of the debate in the domain of times, see Kusumoto (1998, 2005).

where past (s) is true iff s precedes the speech event

Adopting (17) instead of (3), and with the appropriate modification to the modal, we would end up with (18):

(18) [[**PAST**]] ([[**would**$_L$]] (p*)(q*)) = 1 iff
$\exists$s. past (s) & {s_L': $s \leq_m s_L$' & p*(s_L') = 1} $\subseteq$ {s_L': $\exists s_L$". s_L' $\leq s_L$" & q*(s_L")= 1}

According to (18), a counterfactual is true iff there is some past actual-world situation such that all the law-like situations in which it has a counterpart in which the antecedent is true can be extended to law-like situations in which the consequent is true.

The reason for choosing a referential approach over a quantificational approach is that the truth conditions generated by the quantificational approach (18) appear to be too weak. To see this, consider examples that have traditionally been discussed as possibly involving 'ties' in similarity:

(19) a. If New York had been in Georgia, New York would have been in the south.
b. If New York had been in Georgia, Georgia would have been in the north.

It is hard to imagine (19a) and (19b) true in the same context. A referential approach to tense correctly predicts this: in a given context, the tense pronoun will make reference to a particular situation (the actual world features corresponding to either the geographical location of new York or Georgia), and one or the other counterfactual will be true. A Lewis style approach to the resolution of similarity can also predict this, since in a particular context, one or the other feature of the actual world could be more important for the resolution of similarity (in his 1973 book, Lewis provides an analysis of these examples as *de re* regarding Georgia and New York respectively). Existential quantification as in (18), however, makes wrong predictions. There is an actual world situation such that all possible worlds that match the actual world with respect to that situation in which New York is in Georgia are also worlds in which New York is in the south (i.e. the actual world features regarding Georgia's location). And there is also an actual world situation such that all possible worlds that match the actual world with respect to that situation in which New York is in Georgia are also worlds in which Georgia is in the north (i.e. the actual world features regarding New York's location). The prediction therefore is that the conditionals should be compatible. After all, they are about different situations.[12]

The pronoun analysis of tense allows us to cash in on the intuition that judgments regarding counterfactuals are made with respect to 'certain facts'. The technology used to implement this intuition are the variable assignments responsible for the interpretation of tense variables. However, this could be a worry, since free variables are usually associated with salient entities and we can utter counterfactuals in contexts in which it is not clear that there is any (salient) situation under discussion. This means that for this analysis to be tenable, the resolution of the *past* pronoun in counterfactuals cannot be thought of as

[12] There are cases in which existential claims are incompatible. For example, we hear a noise and somebody says: *A man sneezed.* Another person answers: *No, a man giggled.* In this case, the existential claims are incompatible because they are meant to be true of the same thing. But the existential claims could be independent, and perfectly fine: *A man sneezed. / Yes, and a man giggled.* Crucially, this kind of follow-up is not possible with the counterfactuals in (19).

imposing exactly the same felicity conditions on contexts as the resolution of free pronouns that refer to people (for example). I would like to suggest that this is correct, and comes about because with *past* pronouns in counterfactuals we have knowledge that allows us to reason our way towards the relevant (intended) interpretation of the pronoun. Let us consider Sara again:

(20) If Sara had visited my house (last Monday), she would have sneezed.

If *past* in (20) is interpreted as making reference to the actual world features corresponding to Sara's allergic body and my cats, then the conditional will be true. If *past* in (20) is interpreted as making reference to the actual world features corresponding to the geographical location of New York, it will be false (given that there are no laws that tie such a situation to the consequent given the antecedent). There is a fact of the (discourse) matter about what the interpretation of *past* is: it is whatever the variable assignment says it is. And different ways of interpreting *past* may result in different truth-values for the counterfactual. However, there are pragmatic constraints on the interpretation of free variables. We conceptualize variable assignments for free pronouns as encoding shared knowledge and mutual understanding about communicative intentions. A cooperative listener hearing (20) will accommodate that the relevant variable assignment is one that makes (20) (non-vacuously) true. And given the listener's knowledge about the world and its laws (allergic bodies are prone to sneezing) the listener will assume that the speaker had in mind the actual situation corresponding to Sara's body and the pets in my house. The listener can use knowledge about laws to identify the situation that is relevant for the interpretation of the tense pronoun (and probably the speaker's intended referent). In examining counterfactuals embedded under knowledge predicates, we observed that we do have intuitions regarding the features of the world that counterfactuals are about. These intuitions guide us in resolving the denotation of past tense in counterfactuals.

Let us examine (7) at work in three further examples: *Example (1).* Consider allergic Sara again. But imagine now that she takes allergy medication. In this scenario, we would judge (20) false. What does the *de re* proposal say? What is the difference between the first scenario, in which Sara has allergies and takes no medication, and a second scenario in which Sara has allergies and takes medication (and, to simplify things a little, has done so since birth). In both cases, the situation that is relevant to the resolution of the counterfactual in (20) is the chemical state of Sara's body in the actual world (as well as my cats, but I will set them aside for the moment). If Sara takes medication, as in the second scenario, Sara's body won't have been in a chemical state that would have led her to sneeze in the presence of my cats. *Past* will not refer to a *res* situation such that all law-like situations that include it in which Sara visits me have law-like extensions in which she sneezes. As a matter of fact, there will be no features in the actual world that guarantee the truth of (20). In these circumstances, (20) is correctly predicted to be false. *Example (2).* Consider again the scenario in which allergic Sara takes no medication. According to (7), the counterfactual in (20) asks us to consider all law-like extensions of the *res* situation (which includes Sara's allergic body). Shouldn't we worry that in some of these law-like extensions she could take allergy medication?[13] If such situations were included in the domain of quantification, the prediction would mistakenly be that the counterfactual would be false in the actual world even if in the actual world she does not take medication. Here is where I think that our

[13] I am grateful to an anonymous reviewer for pointing out this possibility and its relevance.

intuitions regarding the features that matter will help. In looking for counterparts of the *res* situation in the law-like situations quantified over by the modal, we will look for situations that are appropriately similar. We will not find a counterpart of her current allergic body in a world in which she takes allergy medication. In that world, her body will be in a different chemical state, medicated, and the *res* situation will have no counterpart there. The similarity relation that underlies the notion of counterpart will leave out of the domain of quantification law-like situations in which she takes allergy medications. *Example (3)*. For the sake of completeness, let us consider one last example. Again, Sara has allergies in the actual word, and I have cats at home. Consider now a situation that matches actual world Sara with respect to her allergies, and in which I have cats at home. But imagine now that in this situation a huge tidal wave strikes (out of no-where) when Sara visits me. In this situation she drowns, with no time to sneeze. Would this situation count as a falsifying case for the counterfactual in (20)? I think the answer is 'no'. Part of what makes the counterfactual in (20) true are the facts corresponding to my house. My two cats and the absence of tidal waves. If the denotation of *past* in (20) includes these facts about my house, situations with tidal waves in my living room will be kept out of the quantificational domain of the modal and will not falsify the counterfactual claim.

3. A global similarity relation vs. reference to situations

Both a *de re* analysis and a global-similarity analysis end up predicting that quantification in counterfactuals takes place over worlds that are similar to the actual world in some respects. How can we actually tell the analyses apart? In this section I will show that in some cases local similarity makes better predictions than g-similarity (§3.1), and also that in key cases, it makes predictions at least as good (§3.2).

3.1 The importance of counterparts

Support for the *de re* analysis comes from the observation that in general in evaluating counterfactuals we put into play the same strategies we use when evaluating counterfactuals that are predicated *de re* of ordinary individuals (people). By showing that we resolve similarity in counterfactuals in the same way that we find counterparts for ordinary individuals, we argue for the view according to which similarity in counterfactuals stems from reference to individuals.

The examples presented here will be based on cases in which one individual in the actual world has more than one counterpart in another world.[14] Such scenarios can be useful in elucidating the mechanisms by which language accesses possible individuals and worlds. We begin with an observation by Lewis (1973: 36) regarding counterfactuals predicated *de re* over ordinary individuals. Lewis examined the case of Ripov, a man who bribed the judges to win. Of Ripov, Lewis claims: *If he had reformed, he would have confessed* (x reforms $\rightarrow_{count}$ x confesses). According to Lewis, the claim is true iff in the most similar worlds in which Ripov's counterpart reforms, he confesses. Lewis goes on to point out that if Ripov has more than one counterpart, this holds for all of them:

(21) *What if he has multiple counterparts at one of the closest worlds where he vicariously reforms? It is not enough if one reforms and another confesses; it is not even enough if one reforms and confesses and another reforms without confessing. What we must require is that at every closest world where*

[14] Allowing for more than one counterpart per individual in the same world raises interesting logical questions. The reader is referred to Hazen (1979) for some discussion.

> *one of Ripov's counterparts reforms all of those who reform also confess – that is, none reform without confessing.* (Lewis 1973: 42)

The example of Ripov indicates that when a counterfactual is *de re* about an individual (Ripov), we care about what happens to all individuals that are (relevantly) similar. That is, if Ripov has more than one counterpart in a world under consideration, what happens to all counterparts will count. As soon as we identify an individual as being similar enough to Ripov to <u>be</u> Ripov, what happens to the individual will affect our judgments regarding the truth of a counterfactual predicated *de re* of Ripov. In evaluating the *de re* claim, we check each counterpart separately.

Lewis's example involves a counterfactual claimed to be predicated *de re* of an ordinary actual world individual. The *de re* proposal claims that all counterfactuals are predicated *de re* of an actual world individual (situation). If the *de re* proposal is right, we expect our intuitions in the Ripov-example to be replicated by all counterfactuals in multiple-counterparts scenarios. Below we will show that this is indeed the case.

The first example concerns Smith, a man who sells candied apples and pop-corn in a park. One day he had very little sugar left, enough to make only one candied apple. He didn't sell it. Later on, he discovered that the sugar had actually been contaminated with rat-poison. Smith became very upset, and reproached himself with (22):

(22) If a child had bought and eaten a candied apple, he would have been very sick! [15]

In the scenario described before, we would judge this counterfactual true. Which features of the world make it true? Well, the features include the situation of Smith making the apple with the contaminated sugar and having it for sale in the park. Under the *de re* analysis, the counterfactual in (22) claims that all law-like situations that include this situation in which a child has bought and eaten a candied apple can be extended to situations in which the child has become very sick (the 'laws' that matter could include the laws that determine that the child's body finds the substance in the apple toxic, etc.). Let us now play the Ripov-game. Imagine a relevantly lawful world in which the actual world situation that (22) is claimed to be about is actually found more than once. An example could be a world whose history consists of cyclic repetitions of (parts of) the history of the actual world, with slight variations. Let's call this world w_{rep}.[16] Things that happen in the actual world happen over and over in w_{rep}, in slightly different ways. In each cycle, things change a little. Looking at the history of w_{rep} stretched out before us, we may find many instances of what we would be willing to call 'now', and 'us', and 'Smith' (i.e. parts of w_{rep} sufficiently similar to us, now and Smith to <u>be</u> us, now and Smith in w_{rep}). Suppose that in each of the successive cycles, we find Smith selling candied apples in the park in a situation relevantly similar to the actual world situation we claim (22) is about (there was one apple, the sugar was contaminated with

[15] Smith's self-reproach carefully spells out his concern. It may have been more natural for Smith to say simply *If a child had bought a candied apple, he would have been very sick*, and rely on the generalization that children who buy candied apples eat them. I have decided to spell out Smith's worries carefully to avoid having to rely on secondary assumptions which are not relevant to the point I am making.

[16] A world like w_{rep} could be judged 'implausible' or far-fetched. Whatever our judgements regarding its 'plausibility', it is a respectable member of logical space. The world w_{rep} is presented as an example of a multiple-counterparts world. It is not necessary that a world include several instances of the entire history of the actual world to include multiple counterparts for an actual world situation. Multiple match may take place with respect to smaller parts of the actual world.

rat-poison, etc.). Suppose that in some of those situations (which are slightly different from the actual world events), a child did buy and eat a candied apple. If we judge (22) true, we expect all the children who bought and ate a candied apple in the relevant situation to become very sick. Each instance of a relevantly similar situation in which a child has bought and eaten a candied apple will count towards the truth-value of the counterfactual. As in the case of Ripov, we care about each case of match with the actual world situation that the counterfactual is claimed to be about. Suppose now that, as a matter of fact, some of the children who bought and ate a candied apple in a relevantly similar situation in w_{rep} got sick, and some did not. We would then judge (22) false.

Let us examine the theoretical predictions regarding (22) and a multiple-counterparts world like w_{rep}. A g-similarity analysis could plausibly claim to make no predictions about what happens in w_{rep}. Such a world seems very different from the actual world (there are many Smiths, many toxic apples, etc.), and could plausibly be considered different enough to lie outside the quantificational domain of the modal. But this move would be disadvantageous since it would leave unexplained our intuitions regarding the relation between the truth of (22) and what happens in w_{rep}.

What happens if we somehow pull w_{rep} into the quantificational domain of the modal? Let us consider two options: (1) *Simple-minded quantifiers*: A simple-minded (unrestricted) way of understanding the antecedent quantifiers would lead to incorrect predictions. In w_{rep} both the antecedent and consequent clause propositions of (22) appear to be true: there is a child who has bought and eaten an apple who became very sick. Our judgements that w_{rep} falsifies (22) are not explained. (2) *Sophisticated quantifiers*: A sophisticated approach needs to take into account that the quantifiers in (22) are meant to be understood with some restriction in mind. In the case of (22) we are interested in a child who bought a candied apple from Smith in the park (after all, it would be very mean to agree with Smith about (22) if we knew that Smith's apples were not toxic, but another apple seller had made poisoned apples). We could slot in quantifier restrictions so that the antecedent clause proposition is *if a child had bought and eaten an apple from Smith in the park*. However, this would not be enough, since in w_{rep} there is a child who bought and ate an apple from Smith in the park who became very sick. Again, our intuition that w_{rep} falsifies (22) would go unexplained.

The *de re* proposal introduced in (7) (repeated here) sets up a domain of quantification that is fine-grained enough to capture our intuitions regarding (22), and thus fares better than a g-similarity approach in these scenarios. The proposal in (7) worries about the worlds that contain a counterpart of the situation that supports the counterfactual, but it also worries about all the smaller situations containing such counterparts. This will allow us to catch all the counterparts and consider them as separate cases:[17]

(7) Given two propositions p* and q*, and a past situation s in w,
$[[\textbf{would}_L]]^{w,g}(p^*)(q^*)(s) = 1$ iff
$\{s_L' : s \leq_m s_L' \ \& \ p^*(s_L') = 1\} \subseteq \{s_L' : \exists s_L''.\ s_L' \leq s_L'' \ \& \ q^*(s_L'') = 1\}$

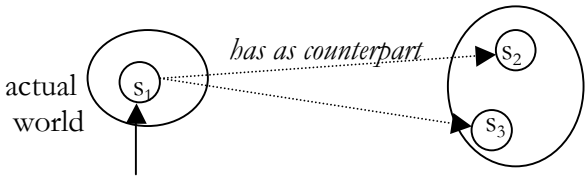
Given (7), the modal in (22) quantifies over all law-like situations that include (a counterpart of) the *res* situation in which the antecedent proposition is true. The domain of

[17] Just to clarify, notice that in our proposal similarity with respect to the *res* of predication and similarity to the world of the *res* of predication have been collapsed into one measure. For this reasons, we do not evaluate similarity twice, with respect to the *res* and with respect to the world, as Lewis did in his presentation of the Ripov example.

quantification therefore includes the minimal law-like extensions of the *res* situation in which the antecedent is true, and also the maximal law-like (worlds) situations that include the *res* situation in which the antecedent is true. The claim is that all such situations can be extended to law-like situations in which the consequent is true.[18] Since we end up quantifying over all lawful situations that include the *res* situation, we make sure that all relevant counterparts are taken into account. Each counterpart will count as an independent case, and the fact that multiple counterparts may be found in the same world will not matter.

The schema in (23) presents an illustration of what happens if the *res* situation has multiple counterparts in a lawful world, some of them associated with an apple-buying-and-eating child who does become sick and some associated with an apple-buying-and-eating child who does not (for ease of presentation, in (23) I will make use of w_1, a simplified version of w_{rep} with just two counterparts of the *res* situation):

(23)



situation of Smith making the apple that is offered for sale in the park

w_1: a law-like world in which there are two Smiths, two makings of the candied apples, etc.

Consider w_1, a world that obeys all the relevant laws of the actual world, in which the actual world *res* situation (s_1) has two counterparts (s_2 and s_3). In that world, a child buys and eats one of the apples (the apple made in s_2), and becomes sick, and another child buys and eats the other apple (the apple made in s_3), and does not become sick. As we have said, such a world would lead us to consider (22) false. The *de re* analysis in (7) predicts this. For there will be a lawful situation (part of w_1) that contains a counterpart of s_1 (s_3) in which a child buys and eats a candied apple which has no extension in which he becomes sick. This situation will be a counterexample to the quantificational claim made by the counterfactual and so the *de re* analysis can correctly predict that faced with this world, we judge (22) false.

This concludes the discussion of the first example presented to argue that all counterfactuals are understood *de re* of an actual world individual (situation). The second example to be presented making this point responds to a possible objection that could be raised against the discussion above. It would be argued that in discussing (22) we have failed to take into account the correct semantics for the indefinite *a child* in the antecedent clause. Maybe the indefinite, by itself, triggers 'universal like' readings. If the indefinite is interpreted universally, the counterfactual will only be true if all children who buy and eat an apple in the worlds quantified over become sick. If a world like w_{rep} in which there are multiple Smiths and multiple children buy and eat toxic apples actually makes it into the domain of quantification, the prediction is that all children who bought and ate an apple become sick (because of the universal reading of the indefinite). I am not sure about the exact working out of this possibility, since it would be wrong to characterize (22) (as uttered by Smith) as claiming that ALL children who bought and ate an apple would become sick (instead of only those appropriately related to a Smith apple). However, let us grant the point for the

[18] Some kind of 'matching' as proposed by Rothstein (1995) would guarantee that not all situations in the antecedent be extended to include the same situation in the consequent.

moment. If there was an independent reason for why indefinites result in a universal-like reading, one might object that the example in (22) in the multiple-counterpart scenario does not really argue in favour of the *de re* analysis. To show that the solution to the puzzle posed by (22) will not come via the semantics of the indefinite, I will now discuss a variant of the example without indefinites. As we will see, the multiple-counterparts puzzle can be reproduced in this case too, showing that the answer is not tied to the semantics of the indefinite.

Second example. This time Smith and his friend are just walking in the park, and the park-guardian has set up bee-hives in an attempt to liven up the place. It is currently night-time, and the bees are all asleep. Smith says:

(24) It is a pity it is night-time. If it was day-time, there would be bees buzzing around.

What are the actual world facts (situation) that makes (24) true? They include the facts pertaining to the park-keeper setting bee-hives in the park with many healthy bees inside. Imagine now a law-like world that contains multiple counterparts of this park with all its bee-hives. Imagine now that some of those situations differ from the actual one in that Smith and his friend are walking around at day-time. If there were bees buzzing around in only some of those situations, we would not judge (24) true. The *de re* analysis predicts this. The denotation of past tense in the counterfactual in (24) will include the features of the actual world corresponding to the park and the park guardian setting up beehives. According to the *de re* analysis, (24) claims that all counterparts of that situation in law-like situations in which it was daytime will also be parts of situations in which there were bees buzzing around. Making use of counterparts, the *de re* analysis, correctly predicts that all relevantly similar situations will be considered independently.

To sum up: in this section I have argued that there is a parallelism between the way we identify counterparts of individuals and the way we resolve similarity in counterfactuals. This has been presented as an argument in favor of the *de re* analysis, according to which similarity results from reference to individuals. The need to identify such individuals across worlds calls upon counterparts, and, as in the case of Ripov, all counterparts count.

3.2 Further examples

The success of the *de re* analysis presented here depends on its ability to do at least as well as a g-similarity approach. In this section I will discuss the *de re* proposal with respect to two important issues in the semantics of counterfactuals: the invalidity of certain inference patterns in counterfactuals, and the 'packaging' puzzles of Tichy-style examples. The conclusion will be that the *de re* proposal offers results as good as g-similarity.

One of the triumphs of the g-similarity approach has been to explain the failure in counterfactuals of several inference patterns that are validated by other conditionals. Consider the cases of contraposition, strengthening of the antecedent, and syllogisms illustrated in (25):

(25) a. *Contraposition* (attributed to Kratzer in von Fintel (2001))
i. (even) If Goethe hadn't died in 1832, he would still be dead now.
ii. (therefore) If Goethe were alive now, he would have died in 1832.
b. *Strengthening of the antecedent* (Lewis 1973)
i. If the US threw its weapons into the sea, there would be war.
ii. (therefore) If the US and Russia threw their weapons into the sea, there

would be war.

c. *Hypothetical Syllogism* (Stalnaker 1968)
   i. If Hoover had been born in Russia, he would have been a Communist.
   ii. If Hoover had been a Communist, he would have been a traitor.
   iii. (therefore) If Hoover had been born in Russia, he would have been a traitor.

The g-similarity approach correctly predicts failure of contraposition in (25a): the fact that the most similar worlds in which Goethe didn't die in 1832 are worlds in which he is still dead says nothing about the most similar worlds in which Goethe is alive. Similarly, g-similarity predicts failure of strengthening of the antecedent in (25b) (the most similar worlds in which the US threw its weapons into the sea need not include the most similar worlds in which the US and Russia threw their weapons into the sea) and syllogistic reasoning in (25c) (the similarity requirement for the antecedents in each case breaks the relation between the conditionals).

A *de re* analysis also makes correct predictions in such cases. The fact that there is a situation in the actual world that makes (25a(i)) true (Goethe's human nature and his date of birth) does not guarantee that there should be a situation making (25a(ii)) true (there isn't). Similarly, the fact that there may be a situation making (25b(i)) true (the situation of Russia having many weapons and hostile intentions), doesn't guarantee that that situation will make (25b(ii)) true, nor that there will be some situation making (25b(ii)) true.[19] The same can be said for (25c): we can find situations in the actual world that make (25c(i)) and (25c(ii)) true, and not find situations that make (25c(iii)) true. The *de re* analysis appears to be comparable to the g-similarity approach with respect to the predictions made about these inference patterns.

One famous problem in the semantics of counterfactuals is the need to explain our intuitions regarding which features stand and fall together when evaluating similarity, and which features are independent (I will refer to this as the 'packaging' problem). I will not attempt an overview of this problem here. It has been addressed a.o. by the definitions of 'lumping' (Kratzer 1989) and 'retraction' (Veltman 2005) in the framework of premise semantics, and by the notion of 'causal chain' (Bennett 2003), within Lewis-Stalnaker style analysis. Here I exemplify a packaging problem with Tichy-inspired examples by Bennett (Bennett 2003: 234-236). The issue, in a nutshell, is how to tell (26) and (27) apart:

(26) Peter presses the button in a completely random coin-tossing device, and the coin comes up heads.
   a. If Susan had pressed the button, the coin would have come up heads.

(27) A friend wants to make a bet with you, offering you odds that the coin will not come up heads. You refuse. Your friend presses the lever in the completely random coin-tossing device, and the coin does come up heads. Your friend says:

[19] Following up on a reviewer's comment, let me add some details to (25b): Suppose that the actual world situation that makes (25bi) true is the situation of Russia having many weapons and hostile intentions. The set of law-like situations that include (a counterpart of) this situation in which the US has thrown its weapons into the sea will have extensions in which there is war (assuming for example the generalization that superpowers attack rivals that they perceive to be weaker). However, this actual world situation will not make (25bii) (non-vacuously) true: the situation of Russia having many weapons will not find a counterpart in law-like situations in which Russia has thrown its weapons into the sea. Moreover, there isn't any situation in the actual world that will make (25bii) (non-vacuously) true. Strengthening of the antecedent fails.

a. If you had bet heads, you would have won.

The observation is that we are inclined to judge (26a) false and (27a) true. Bennett points out that if we assume that similarity chooses worlds that spatio-temporally match the actual world up to the time of the tossing of the coin, and obey the laws afterwards, we end up with the wrong predictions: both conditionals are predicted to be false (this was Tichy's point). In a Lewis-Stalnaker analysis, the tool to deal with such problems is the weighing of the similarity relation, but it would be difficult to argue independently for a view of similarity that made worlds in which the coin came up heads in the case of (27) be more similar to the actual world than worlds in which the coin came up heads in the case of (26). The problem described here is a version of the packaging problem: we understand the outcome of the coin tossing to be 'packaged with' (related to) the pressing of the button. Such features of the world should stand and fall together. If we look at worlds that differ with respect to the pressing, they should be allowed to differ with respect to the outcome.

What does a *de re* analysis say here? Suppose that in (26a), *past* denotes the situation corresponding to the state of the button in the actual world (it was in good working order, not rigged, etc.). The prediction is that the conditional should be false, since there are worlds in which this situation has a counterpart, Susan presses the button, and the coin comes up tails. What about (27a)? In the case of (27a) we seem to take if for granted that the outcome of the tossing of the coin is as in the actual world. Suppose that in (27a) *past* denotes a situation that includes the outcome of the tossing of the coin (a situation in which the coin comes up heads). This would capture our intuitions regarding similarity and predict that the conditional is true. The question, of course, is why couldn't *past* denote a situation in which the coin comes up heads in (26a).

One possibility would be to say that such an assignment is impossible in (26a) because it 'trivializes' the consequent. With such a denotation the truth of the conditional is, in a sense, presupposed. We are putting in the denotation of *past* the very features that we are trying to confirm in the consequent, and there could be pragmatic reasons for disallowing this. However, I don't think that, in this simple form, the answer is a good enough. There are conditionals that appear to do something a lot like this (these are conditionals in which *the antecedent does not necessitate the consequent* (Pollock 1976), sometimes expressed in English with *even if*). Consider (28):

(28) The straps in the baby seat were very sturdy, and the cushioning was excellent.
a. So, if the baby had turned over, she would have been safe.

In examples like (28a), there isn't a causal-relation between turning over and being safe. Rather, independent features of the world make the consequent true. The counterfactual will be true if *past* makes reference to those features (the straps were sturdy, the cushioning was excellent, etc.). In examples like this there is no problem in including in the denotation of *past* features that guarantee the truth of the consequent independently of the laws triggered by the antecedent. We could even set up a counterfactual in which the consequent was more explicit regarding the baby's state:

(29) If the baby had turned over, she would have been strapped into a safe seat.

In some contexts, (29) would be quite reasonable. Imagine a conversation in which one worried parent scolds the other over her reckless driving techniques (*The baby could have turned*

over!), and gets (29) as an annoyed reply (*Well, if the baby had turned over, she would have been strapped into a safe seat!*). In (31), the features of the world that make the counterfactual true correspond very closely to the consequent proposition.

So, a pragmatic account for why the denotation of *past* in (26a) does not include the situation that the coin turned up heads can't be (simply) that *past* is not allowed to make reference to a situation that by itself supports the truth of the consequent. However, a more sophisticated version of a pragmatic account might be tenable. If *past* in (26a) denotes the situation that the coin turned up heads, the laws set in motion by the antecedent will in a sense be 'void'. We usually understand that it is the laws (of chance!) that determine the outcome of the tossing of the coin. But in the worlds quantified over in (26a) given this particular assignment to *past*, they wouldn't do that. One way to set up the problem pragmatically would be to say that with that resolution of the reference of *past*, we put in motion machinery that we do not actually 'use' and we are not allowed to do that. The packaging problem exemplified in (26) is thus reorganized here in the following way: the reason we do not consider the consequences of the tossing of the coin (the situation of the coin having come up heads) as a possible denotation for *past* when considering alternatives to the tossing of the coin itself is that doing so would render the laws set in motion by the counterfactual 'vacuous'.

4. Tying dependence on situations to the semantics of tense

In this section I will discuss examples with embedded conditionals. Embedding contexts are useful since they illuminate features of the interpretation that are sometimes hidden in matrix contexts. The main objective of this section is to provide evidence in favour of linking the local similarity requirement in counterfactuals to the semantics of tense. I will discuss embedded counterfactuals in two different contexts: in complement clauses embedded under propositional attitude verbs (we will examine the case of *believe*) and in relative clauses.

In the literature dealing with the interpretation of tense, a distinction is usually made between the interpretation of tenses in complement clauses and the interpretation of tenses in relative clauses. In relative clauses, tenses appear 'free' and receive an interpretation that depends on temporal entities made salient by context (they have a 'referential' interpretation). In complement clauses, on the other hand, tenses are bound by operators (they have a 'bound variable' interpretation). Arguments in favor of this distinction are provided by considering the relation between embedded tenses and matrix tenses in each case, as well as the semantics of propositional attitude verbs (I will not present the argumentation and data standardly provided in favor of this distinction, and refer readers to Abusch (1997), Ogihara (1996), Kratzer (1998), Kusumoto (1998, 2005) a.o.). In this section I will build on this distinction, and show that the different interpretations of tense correlate with differences in the way we can evaluate similarity in embedded counterfactuals. The fact that the semantics of tense allows us to predict the possibilities available for evaluating similarity in counterfactuals will be taken as an argument in favor of the idea that tense is (partly) responsible for the calculation of similarity.

4.1 Counterfactuals under *believe*

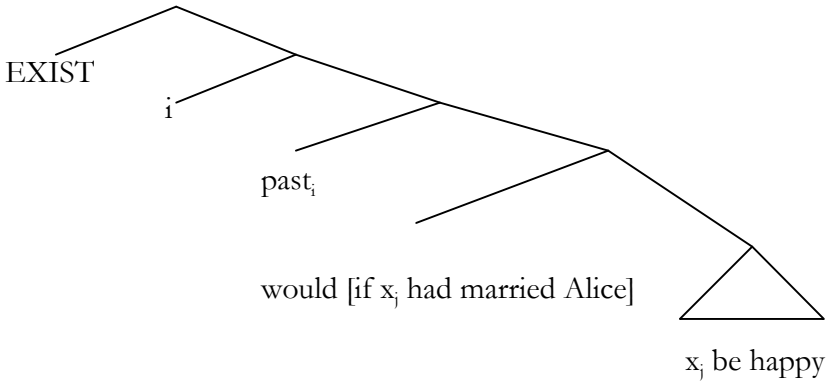
Some remarks are needed to understand how *de re* counterfactuals fit into the complement of *believe*. Consider (30):

(30) Both men believed that if they had married Alice, they would have been happy.

I'll work with the assumption that *believe* combines with a propositional complement. I will take as default the case in which we have beliefs about the world we live in (we could also have beliefs about smaller situations, but I will set this option aside here). Embedded in structures like (31), *de re* counterfactuals can provide suitable objects of belief (where x_j is the variable to be bound by the higher quantificational subject):

(31) a. [believed that if they had married Alice, they would have been happy]

b.



The index *i* functions as an abstractor, binding the index on the tense pronoun and generating a property of situations. This is a property that is true of situations that support the truth of the embedded counterfactual. I take it that when an individual believes a counterfactual, s/he believes s/he inhabits a world in which there is such a situation. We can generate propositions at the level of possible worlds by relating the embedded property of situations to worlds (maximal situations) via an operator resembling an aspectual operator in the modal domain: EXIST.[20] According to this proposal, the EXIST operator is responsible for existentially quantifying over the situations that support the counterfactual, and locating them in larger situations (worlds), generating a proposition that is a suitable object of *believe*. In (32a) I spell out the interpretation of EXIST and in (32b) the denotation of (31b) (I have simplified the antecedent and consequent propositions slightly):

(32) a. Where p is a property of situations,
[[EXIST]] (p) = λw. $\exists$s. s$\leq$ w & p(s) = 1

b. λw. $\exists$s: s is past. s$\leq$ w &
{s'$_L$: s$\leq_m$ s'$_L$ & g(j) married Alice in s'$_L$} $\subseteq$
{s'$_L$: $\exists$s"$_L$. s'$_L\leq$s"$_L$ & g(j) is happy in s"$_L$}

According to (32b), the complement of *believe* in (30) is the proposition that is true in a world if there is a past situation in that world such that all the law-like situations that include it in which the antecedent is true can be extended to law-like situations in which the consequent is true. The analysis correctly ties the truth of belief-ascriptions to what happens in the

[20] There could be other ways of relating properties of 'small' situations to bigger ones, but I leave this issue aside here. I mention a similarity with respect to aspect because aspectual operators are often characterized as establishing a relation between an event time and its reference time. The EXIST operator relates a situation with its world.

subject's belief-worlds.[21] Crucially, (32b) allows the subjects in (30) to hold the beliefs for what we could term, intuitively, very different reasons. Suppose that John, maybe mistakenly, believed that Alice was rich and that money would have made him happy, while Jack believed Alice was beautiful and that beauty would have made him happy. In each of their belief worlds there is a situation (Alice's wealth or Alice's beauty) such that they believed that all law-like situations containing this situation in which they marry Alice have extensions in which they are happy.

There are reasons to think that the *de re* analysis implemented in (32) is preferable to a g-similarity version according to which embedded conditionals are evaluated relative to a single, contextually given, measure of similarity. To see the problem with a unique measure of similarity, consider the following example:

(33) John is well informed, and believes that Verdi was Italian and Bizet was French. Jack however, believes that Verdi and Bizet were twins, and that both were French.
   a. Both men believe that if Bizet had been Italian, Verdi and Bizet would have been compatriots.

The conditional in (33a) can be true in the context described. But it is not clear that a g-similarity approach would guarantee that result. In order for (33a) to be true, the most g-similar worlds to John's belief worlds have to be worlds that match the belief-worlds with respect to Verdi's nationality: the antecedent worlds are worlds in which Verdi is Italian and Bizet is Italian too. But in order for (33a) to be true, it also has to be the case that in the most g-similar worlds to Jack's belief worlds in which Bizet is Italian, Verdi is also Italian. This is ensured if the antecedent worlds are similar to the belief-worlds in that Bizet and Verdi are twins. But then, the antecedent worlds are worlds that do not match the belief-worlds with respect to Verdi's nationality. If similarity with respect to Verdi's nationality were really important, Jack would judge the conditional *if Bizet had been Italian, Verdi and Bizet would have been compatriots* false (giving priority to facts about Verdi's nationality would force Jack to disregard the fact that they were twins: *If Bizet had been Italian, Verdi and Bizet would not have been twins* would come out true).

The g-similarity approach predicts that in (33a) the weighing of similarity will obey the same criteria in both cases (there is a contextually supplied similarity relation), and as we have seen, this does not correctly handle the fact that the men have different reasons to hold the beliefs. The *de re* approach fares better with this example, since there are situations in John's belief worlds that support the counterfactual, and there are also situations in Jack's belief worlds that support the counterfactual.

Before moving on to the next section, let me make an observation regarding counterfactuals in propositional attitude contexts. By shifting to world-level propositions via existential quantification over situations, we make predictions regarding embedded counterfactuals that involve ties in similarity. Consider (34):

(34) Sara believes that if New York were in Georgia, New York would be in the south, and that if New York were in Georgia, Georgia would be in the north.

[21] I will not be able to discuss knowledge attribution here, which, as noted in the brief presentation of Kratzer's semantics for *know*, poses challenges different from those of beliefs.

Imagine that Sara is well informed. Then in her belief worlds there is a situation that supports the truth of *if New York were in Georgia, New York would be in the south* (the situation that Georgia was established in the south), and there is also a situation that supports the truth of *if New York were in Georgia, Georgia would be in the north* (the situation that New York was established in the north). Yet an utterance of (34) would be very odd. I am not able to expand on this topic here, and simply note it as a prediction regarding belief contexts.

4.2 Counterfactuals in relative clauses

After examining (33), one might be tempted to forget about tense, maintain g-similarity, and allow the similarity relation to be existentially closed (the truth of a counterfactual would then depend on the existence of a similarity relation delivering the relevant results, as opposed to the contextual salience of such a similarity relation). This could in principle help in (33), since the existential quantifier could distribute under the quantified subjects and this would allow the similarity relation responsible for finding the antecedent worlds in John's case to differ from the similarity relation responsible for finding the antecedent worlds in Jack's case (there would be independent concerns that existentially quantifying over similarity would be too weak for the semantics of counterfactuals, but let us set those concerns aside for the moment, somewhat artificially). With existential quantification over similarity, the clause embedded in (35a) would receive the denotation in (35b):

(35) a. Both men believe that if Bizet had been Italian, Verdi and Bizet would have been compatriots.

b. Where S is a similarity relation that relates a world *w* and a proposition *p* to the most similar worlds to *w* in which *p* is true, A is the antecedent proposition, and C the consequent proposition,
$\lambda w.\ \exists S.\{w': S(w)(A)(w') = 1\} \subseteq \{w': C(w') = 1\}$

The embedded clause in (35a) corresponds to the proposition true in a world w iff there exists a similarity relation S such that the most S-similar worlds to w in which Bizet is Italian are also worlds in which Verdi and Bizet are compatriots (35b). When this proposition is embedded under the quantified subject, the existential quantifier can distribute under the quantified subject and this allows for the possibility that there be a different similarity relation for each man.

Suppose that similarity relations associated with counterfactuals were simply quantified over (as in (35b)), and unrelated to the semantics of tense. Then, it should be possible to find diverse similarity relations for counterfactuals embedded under quantifiers independently of what was happening to the interpretation of tense. We would have no link between tense and similarity. But examples with relative clauses indicate that this is not correct:

(36) At the party, John met Jane and Jim met Joan. Jane and Joan had both been in the space program at NASA, though some years apart. They were both expelled.

a. At that party, both men met a woman who would have been the first woman in space if she hadn't been expelled from NASA.

In the circumstances described, we wouldn't judge (36) true. And this is so even though the counterfactuals in (37) could well both be true:

(37) a. If Jane hadn't been expelled from NASA, she would have been the first woman in space.
b. If Joan hadn't been expelled from NASA, she would have been the first woman in space.

Imagine that Jane, more advanced in the program, had been chosen by NASA to be the first woman in space. Something happens, and she is expelled. The counterfactual in (37a) is true (*past* refers to the situation of Jane having been chosen to be the first woman in space). Joan then becomes NASA's first-woman choice. But she is also expelled. The counterfactual in (37b) is also true (*past* refers to the situation of Jane having been chosen to be the first woman in space). [22]

Our intuitions regarding (36a) are predicted by a *de re* view. For the sentence to be true, there would have to be an actual world situation supporting the truth of the embedded counterfactual in *x met a woman who would have been the first woman in space if she hadn't been expelled from NASA* for both choices of men. But there isn't such a situation and (36a) is false. The generalized quantifier corresponding to the object DP with the relative clause would look like (38) (slightly simplified):

(38) $\lambda P\ \exists x$ (x is a woman
& $\{s_L'$: $s \leq_m s_L'$ & x has not been expelled from NASA in $s_L'\}$
$\subseteq \{s_L'$: $\exists s_L''$. $s' \leq s''$ & x is the first woman in space in $s_L''\}$ & $P(x) = 1)$
where $[[\textbf{past}]]^{w, g}$ in the relative clause counterfactual is s.

Tense in the relative clause is referential, and picks out a particular actual world situation. Even though the indefinite can take narrow scope with respect to the subject and thus allow for an interpretation in which each man met a different woman, there will still be a single actual world situation expected to support the embedded counterfactual(s). And this won't work. Suppose we consider the situation that is the combination of the features that make each of the counterfactuals in (37) true. This situation won't make both counterfactuals true (a situation that includes all the features needed to make one of the counterfactuals true would not support the truth of the other counterfactual).

To see that what matters in (37) is the interpretation of tense, consider a version with the counterfactuals further embedded into complement clauses, in which tense is bound:[23]

(39) At the party, John met Jane and Jim met Joan. Jane and Joan had both been in the space program at NASA, though some years apart. They were both expelled.
a. At that party, both men met a woman who they believed would have been the first woman in space if she hadn't been expelled from NASA.

[22] It would be odd to find these conditionals in a sequence. I think that is because we tend to interpret sequences of conditionals by simply adding the conditions. For example: *If Jane hadn't been expelled from NASA, she would have been the first woman in space. And if the American Science Council had been thorough, they would have given her a medal.* Obviously, this way of interpreting the conditionals in (37) would not make sense. To 'reset' the context and shift the interpretation of tense, it helps to use focus contrastively: A: *If Jane hadn't been expelled from NASA, she would have been the first woman in space.* B: *OK, but she WAS expelled. And given that, if JOAN hadn't been expelled, SHE would have been the first woman in space.*

[23] I am grateful to an anonymous reviewer for mentioning this version.

In the complement clause, tense in the counterfactual will be bound, and the EXIST operator will anchor the counterfactual to different situations in the different worlds corresponding to the men's beliefs. No inconsistency will arise. The denotation of the existential DP with a relative clause in (39) is given in (40) (slightly simplified): y is the variable that will be bound by the subject quantifier *both men* and the semantics of belief-attribution is presented in terms of a proposition true in all the worlds compatible with an individual's actual beliefs.

(40) λP ∃x (x is a woman
& for all worlds w compatible with y's beliefs in the actual world,
∃s: s is past. s≤w & {s_L': s$\leq_m s_L$' & x has not been expelled from
NASA in s_L'}⊆ {s_L': ∃s_L". s'≤s" & x is the first woman in space in s_L"} & P(x) = 1)

Since the counterfactual in (40) is in a propositional attitude complement, tense receives a bound variable interpretation and the situation that supports the truth of the counterfactual is quantified over. A quantified subject will bind the variable y corresponding to the believer, and the existential quantifier over situations will pick out different situations in the worlds that represent the beliefs of the various men quantified over. In such a 'distributive' context, no inconsistency will arise.

A proposal to deal with (36) with an existential quantifier over similarity relations, as we entertained to deal with the problems in (35), would make wrong predictions in these examples. Consider (36) again. With existential quantification over similarity relations, the indefinite in (36a) would look like (41):

(41) λP ∃x (x is a woman
& ∃S. {w': S(w)(λ*w. x is not expelled from NASA in w*)(w') = 1}
⊆ {w': x is the first woman in space in w'} & P(x) = 1)
where w is the evaluation world.

If we allow for existential quantification over the similarity relation, we predict that in the case of relative clauses, similarity should distribute under quantified subjects just as we proposed for the complement clause example in (35). Given the possibility of calculating similarity independently in each case (for each choice of man), there should be no problem in judging (36a) true. We could use the similarity relation we use in (37a) in one case, and the one we use in (37b) in the other. Existential quantification over similarity relations makes wrong predictions in the case of relative clauses.

To round up the discussion, further examples with the basic format of (36) are provided in (42):

(42) a. #Each woman drove a car that would have won the race if it hadn't broken down.
b. #Both professors had a student who would have discovered DNA if she had persevered.

To conclude: Counterfactuals embedded under quantified subjects have shown us that there is a correlation between the interpretation of tense and the options available for calculating similarity. When tense is bound, it is possible to evaluate similarity with respect to

different facts in each case quantified over (this is what happens in the complement of *believe*). When tense is referential, the same facts are invoked in all cases quantified over (this is what happens in relative clauses). The fact that there is a link between the interpretation of tense and the resolution of similarity supports the view that it is tense that is feeding the resolution of similarity.

5. Conclusion

I have presented a proposal for the interpretation of counterfactuals that ties the resolution of similarity to the semantics of tense. Several issues remain open for future research (amongst them the investigation of more complex examples, a study of the laws that matter for counterfactuals and cross-linguistic implications). However, I hope to have shown that there are interesting consequences to thinking about counterfactuals from the perspective of sufficient similarity as opposed to maximal similarity. I also hope to have shown that it is worthwhile to investigate how exactly similarity comes to play a role in the semantics of counterfactuals. The *de re* proposal ties similarity to reference to situations, and assigns a major role to tense.

According to the *de re* analysis of counterfactuals, tense is responsible for similarity with respect to actual world facts and the modal is responsible for similarity with respect to actual world laws. On the surface, the *de re* analysis represents a significant departure from the global similarity that characterizes LS-style semantics. However, it can also be thought of as a generalization of the semantics of *de re* modality. There is nothing surprising about the idea that some counterfactuals are *de re* about things. My move has been to generalize this and claim that all counterfactuals are *de re* about things.

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Ana Arregui
Linguistics Department
University of Ottawa
aarregui@uottawa.ca