

Speaking of Possibility and Time

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1 Introduction

Ignorance and the passage of time are among the most fundamental and pervasive aspects of human life. People draw conclusions from unreliable evidence, revise their beliefs in view of new information, and base their plans and decisions on expectations about likely outcomes. People also *talk about* knowledge and ignorance, past and future, best guesses and their factual basis. All languages provide speakers with means to be explicit about varying degrees of confidence and hypotheticality, and to specify the temporal locations of the events they talk about, relative to each other and to the time of utterance. In English, conditional (*'if-then'*) sentences and modal expressions like *'must'*, *'may'*, and *'probably'* are typical examples of the former. Tenses (e.g., past *'-ed'*) and aspectual forms (e.g., Perfect, Progressive) are instances of the latter.

The value of modal and temporal linguistic expressions as an object of study goes far beyond purely linguistic concerns. They reflect the way we represent and reason about a wide range of extralinguistic concepts such as causality, (non)determinism, the relation between subjective uncertainty and objective chance, mutual beliefs and common ground, and the ontology of states and events. These notions are of interest to researchers across many disciplines, including philosophy, psychology, and artificial intelligence.

This project is aimed at deepening our understanding of the meaning and use of modal and temporal expressions, the inferences involved in their interpretation, and their semantic interactions with each other and with other grammatical categories. Both the extralinguistic concepts behind modal and temporal discourse and the linguistic expressions used in such discourse interact with each other in intricate ways. For instance, our talk of past possibilities reflects the interplay between likelihood and causal dependencies. Temporal expressions whose ordinary use is in referring to different times are recruited for reference to alternative hypothetical states of affairs. Similar interactions between the two realms are attested across a wide range

of genetically diverse languages. The commonalities and differences in the ways in which such interactions manifest themselves provide invaluable evidence about universal patterns in cognition.

2 Project outline

This project will cover an area that can be pictured as three concentric circles, from a core of foundational work on ontology and model theory, through theoretical issues in recent and current analyses, to explorations of new empirical data across languages. In this section I discuss each in turn.

2.1 Theoretical Foundations. The first leg of the project focuses on the ontological inventory and logical methods underlying formal theories of time and possibility. Since logicians began to formalize these notions in the second half of the 20th century, a major goal has been to account for the distinction between a “fixed” past and present on the one hand, and an “open” future, on the other (Reichenbach, 1956; Prior, 1967). The most influential notion to inform linguistic research in this area is that of *branching time*, couched in the framework of *possible worlds*: At any given moment, history has one past but multiple possible futures, exactly one of which eventually comes to pass (Thomason, 1970, 1984; Kamp, 1971).

The asymmetry is reflected in many linguistic expressions, but there is much variation in semantic detail, suggesting that different notions of “open future” are at work. Consider for example English ‘before’. It has long been observed that while ‘*B after A*’ entails *B*, ‘*A before B*’ does not (Anscombe, 1964). Thus (1a) may be true even though (1b) contradicts basic world knowledge. (The hash mark indicates that the sentence, though well-formed, cannot be asserted felicitously.) A branching model of time accounts for this: Whereas shortly before Joe’s death his not dying and therefore meeting his grandchildren is a “good possibility,” once he is dead this prior possible future has no corresponding “possible past.”

- (1) a. Joe died before he saw his grandchildren.
- b. #Joe saw his grandchildren after he died.

The relevant notion of “good possibility” has proven hard to pin down. Beaver and Condoravdi (2003) attribute to (1a) the implication that Joe’s seeing his grandchildren was “reasonably probable” at the time. However, certain examples cast doubt on this analysis, at least under the usual interpretation of “probability.” Thus the very meaning of the sentences in (2) implies that their ‘before’-clauses are unlikely to be true.

- (2) a. As everyone here always does, Joe returned his books before they were overdue.
- b. Meteors usually burn up before they hit the ground.

Intuitively, the main-clause event *terminated* a process which, if uninterrupted, would have resulted in the truth of the ‘*before*’-clause. Notice that this is a statement about causality rather than likelihood. In this sense, these data illustrate the intrusion of one upon the other mentioned in Section 1.

What may at first seem like a minor technicality in a small data set turns out to be but one instance of a much more pervasive phenomenon with important ramifications for our thinking about the modal-temporal interface: Many expressions make reference to interactions between events and states – causation, prevention, etc. – for which an analysis in terms of likelihood is not adequate. In my own work, I have faced the need to combine a possible-worlds model with a representation of causal (in)dependencies in the analysis of certain conditionals (Kaufmann, 2005b; see also Schulz, 2007). More interestingly, I found a distinction between a “likelihood” reading and a “prevention” reading lexicalized in two Japanese expressions of temporal precedence, both corresponding to English ‘*before*’ in their temporal import (see Section 2.3 below).

The ubiquity of this phenomenon raises the methodological question as to what ontological entities and model-theoretic representations should underlie the analysis of such expressions. Possible worlds are *total* objects, but here we seem to require reference to their proper parts. One line of research in this direction, originally inspired by work in artificial intelligence (McCarthy and Hayes, 1969; Shoham, 1988; Shanahan, 1997), suggests that once direct reference to processes and their interactions is available, the possible worlds containing them are mere limiting cases with no special theoretical status (Fernando, 2005, 2007, 2008; see also Steedman, 2002; van Lambalgen and Hamm, 2004). Somewhat related are models of partial worlds in the interpretation of conditionals (Kratzer, 2002; Veltman, 2005; Schulz, 2007).

For all their ingenuity, these proposals tend to be formally disparate and, superficially at least, incompatible with mainstream approaches. In this part of the project I will work towards an integrated framework which preserves the desirable features of standard possible-worlds models while also facilitating the analysis of expressions for which that standard approach is too blunt a tool. I envision a model in which possible worlds and their parts are explicitly represented, a language rich enough to express assertions about both sorts of entities, and axioms supporting inferences about one from the other.

2.2 Modal-temporal resource sharing. Expressions whose primary meaning is temporal are often “overloaded” for use in the modal realm, and vice versa. Counterfactual conditionals (those ‘*if A, then C*’ sentences which typically imply that *A* is unlikely or false) like (3) present one such case.

- (3) a. If John had come yesterday, it would have been fun.
b. If John was here now, it would be fun.
c. If John came tomorrow, it would be fun.

Both the antecedents (the subordinate ‘*if*’-clauses) and the consequents (the main clauses) in (3a–c) carry past or perfect morphology that is not interpreted in the usual way. In (3b), for instance, the Past tense is used with reference to the present time. Similar uses of Past or Perfect morphology are widely attested across languages, suggesting that the connection between past and counterfactuality is not accidental.

There are two schools of thought on such uses of the Past. The first appeals to branching time and argues that in order to “access” the relevant hypothetical occurrences of John’s coming, one must “rerun” history from an earlier time at which his coming was still possible. Given this “backshift,” one can maintain that the Past does have a temporal interpretation after all. Glossing over many differences in detail, this view has supporters in philosophy (Dudman, 1984; Edgington, 1995, and many others) and linguistics (Tedeschi, 1981; Ippolito, 2006; Arregui, 2007). The alternative view holds that the Past in (3) is “redirected” from the temporal dimension in which it normally enables reference to different times, to the perpendicular dimension of possible worlds, now allowing for reference to alternative states of affairs (James, 1982; Fleischman, 1989; Dancygier, 1998; Iatridou, 2000). The underlying mechanism has been described somewhat vaguely as “metaphorical transfer,” and the authors espousing this view are generally less concerned with rigorous formalization than those working in the “back-shifting” tradition (but see Schulz, 2007).

These alternative approaches raise important questions: Are there decisive theoretical or empirical arguments that would favor one over the other? Are both required, for different sets of data? Indeed, how are they to be distinguished on empirical grounds? There are at present no satisfactory answers to these questions. A rigorous investigation requires, firstly, a formalization and comparison of both in a common logical framework, and secondly, an analysis of a wide range of data, including but not limited to counterfactuals and reaching beyond English as an object language.

The issue is of particular interest to me because it bears on my ongoing work on temporal reference in conditionals. In Kaufmann (2005a) and Kaufmann *et al.* (2006) I developed analyses of tenses and temporal reference in simple sentences like (4a) and “indicative” conditionals like (4b):

- (4) a. John comes tomorrow.
b. If John comes tomorrow, it will be fun.

In this project I will extend this work into a unified analysis which covers in addition counterfactuals and related instances of the peculiar Past tense illustrated in (3). Informed by a comparison of different approaches with regard to both their logical properties and their empirical coverage, this work will result in the most comprehensive theory of tense and temporal reference in conditionals so far.

2.3 Cross-linguistic studies. The third leg of the project investigates commonalities and variation across languages. The main focus is on Japanese, continuing collaborations that are already underway.

One such collaboration is concerned with Japanese expressions of temporal precedence. For instance, the two expressions ‘*mae*’ ‘*before*’ and ‘*-nai uti*’ (lit. ‘while not yet’) both correspond to English ‘*before*’ in their temporal import: In a scenario in which the speaker learns that the bus she rode home was later involved in an accident, both of (5a,b) are true.

- (5) Ziko-ga {a. okoru mae-ni / b. okora-nai uti-ni } basu-o orita
 accident-SUBJ occur before-LOC occur-NEG while-LOC bus-ACC exit-PAST
 I got off the bus before there was an accident.

However, both differ in the way in which likelihood and causal dependencies enter the “counterfactual” interpretation: Supposing further that everyone on the bus was injured in the accident, (6a) is also true, whereas (6b) implies the speaker expected at the time she got off the bus that there would be an accident.

- (6) {a. Kega suru mae-ni / b. #Kega sinai uti-ni } basu-o orita
 get injured before-LOC get injured-NEG while-LOC bus-ACC exit-PAST
 I got off the bus before I got injured.

I mentioned this contrast in Section 2.1 as an overt manifestation of a distinction between “likelihood” and causal “prevention” in our talking about past possibilities. It has no close analog in English. The gloss with ‘*before*’ in (6), like (6b) and unlike (6a), implies that the accident was expected at the relevant time.

Interestingly, the English counterfactual conditional in (7a) patterns with Japanese ‘*mae*’ (6a), hence not with English ‘*before*’, in that it is true with “hindsight” and does not imply that the accident was likely.

- (7) If I had not gotten off the bus, I would have been injured.

In this way, the Japanese data alert us to a potential problem with our fundamental assumptions about English: What exactly is the semantic relationship between “counterfactual” ‘*before*’ and counterfactual conditionals? Is the former label misleading? What else have we overlooked?

I have recently completed a study of the temporal interpretation of Japanese tenses in embedded contexts (Kaufmann and Miyachi, under review). With Yukinori Takubo (Kyoto University), I have begun to explore the modal dimension of examples like the above (Kaufmann and Takubo, 2005, in preparation). Over the course of this project, we will extend this comparative work to a broader range of Japanese temporal expressions. The focus will generally be on ways in which differences within and across languages can shed light on broad theoretical questions.

2.4 Summary The parts of this project are connected by overarching questions of central importance not only in linguistics, but also in philosophy and cognitive science: What do linguistic data reveal about the concepts and operations behind our modal and temporal reasoning? What can we learn about the relationship between these two semantic dimensions from interactions between the linguistic expressions associated with them? What do cross-linguistic comparisons tell us about universal patterns and constraints on these interactions? As well as advancing our understanding in each of these areas individually, the papers produced by this project will in their totality showcase the importance of keeping these very general questions in mind while carrying out highly focused and detailed analyses.

3 Research plan

I plan to work on this project for twelve consecutive months from September, 2009 through August, 2010. I will spend about half of this time at Northwestern University, where I will be on sabbatical leave, relieved of teaching and administrative duties, for the academic year. Family obligations preclude continuous absences from Evanston for more than about three months at a time. The most tangible products of this project will be single- and co-authored journal articles (more details on four planned papers are given below). I will also work towards the dissemination of the results through other means such as talks at conferences and colloquia. The time-line and detailed plans for the project are best presented in four phases of about one quarter each, as below. However, given the interconnectedness of the parts, the changing topics assigned to each quarter indicate shifts in emphasis rather than abrupt changes of direction.

Fall 2009: Theoretical foundations. I will spend this quarter at Northwestern University, working on the questions of ontology and representation outlined in Section 2.1. I will consult with colleagues on a trip to the University of Amsterdam and through electronic media, but otherwise this part of the project does not require prolonged visits elsewhere. Northwestern is an ideal place to carry out this work because it offers

easy access to colleagues and libraries at Northwestern and the University of Chicago.

Winter 2010: Modal-temporal resource sharing. I will spend most of this period at Palo Alto Research Center (PARC), where I will work with Cleo Condoravdi (PARC and Stanford University). Dr. Condoravdi and I have a long history of collaborations on papers, co-teaching and co-organizing workshops at major international summer schools, and co-editing a special issue of the *Journal of Semantics* on “Modality and Temporality.” During this visit, we will work on a paper on special “modal” interpretations of temporal expressions in modal contexts, with a special (though not exclusive) focus on data from English, Modern Greek, and Japanese. The main goal is to produce a journal article on this topic during the visit. In addition, we will pursue ongoing collaborations on related topics in the semantics of conditionals, modality, and temporality. All parts of this work will benefit not only from Dr. Condoravdi’s expertise, but also from the wider community of researchers in formal semantics at PARC and at Stanford’s first-rate Linguistics Department (ranked second nationwide by the NRC) and related departments.

Spring 2010: Cross-linguistic studies. Most of this period will be spent at Kyoto University, Japan. Since my residence there as a postdoctoral fellow in 2001-2002, I have paid regular short-term visits to carry out joint research with scholars there, discuss my other related work, teach intensive tutorials (three days on “Modality” in 2005; two days on “Dynamic Semantics” in 2008), co-organize international conferences and workshops, and co-edit a special issue of the *Journal of Semantics* on “Modality and Temporality.” One scholar from the area, Setsuko Arita (Osaka Shoin), a leading expert on conditionals in Japan, spent her sabbatical year visiting Northwestern University in 2006-2007. During my visit, I will work on two papers. One, with Prof. Takubo, will further explore the modal interpretation of Japanese temporal expressions, including the ones discussed in Section 2.3, but also related ones. The other, with Prof. Arita, is a Japanese/English contrastive study of the use and interpretation of tenses in conditionals. This extends my work on English (Kaufmann, 2005a, and Section 2.2 above) and Prof. Arita’s prior work on Japanese conditionals. At Kyoto University I will have the benefit of easy access to a vibrant community of researchers in semantics, as well as an excellent library, text corpora and a large pool of native speakers for data collection.

Summer 2010: Wrap-up and write-up. In the final quarter of the grant, back at Northwestern, I will finish the papers that grew out of each of the phases of the project, submit them to major journals, and pursue new collaborative projects that may have resulted from my visits to Palo Alto and Kyoto.

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- On the temporal interpretation of Japanese temporal clauses. *Journal of East Asian Linguistics*. With Misa Miyachi (University of Chicago).
- Language and ideology in Congress. *American Political Science Review*. With Daniel Diermeier, Jean-François Godbout, and Bei Yu (Northwestern University).

In preparation

- Kaufmann, Stefan and Setsuko Arita. Conditional uses of the connective *tara*: Temporal and modal dimensions. Ms., Northwestern University / Osaka Shoin.
- Kaufmann, Stefan and Yukinori Takubo. Modal implicatures of temporal connectives: Japanese expressions of temporal precedence. Ms., Northwestern University / Kyoto University.

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- Kaufmann, Stefan. 2009. On the projection of expressive presuppositions. To be presented at the Workshop on Expressives and other kinds of non-truth-conditional meaning, held at the 31. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft (31st Annual Meeting of the German Society for Linguistics), University of Osnabrück, Germany.
- Sagi, Eyal, Brady Clark, and Stefan Kaufmann. Tracing semantic change with Latent Semantic Analysis. To be presented at the Annual Meeting of the Linguistic Society of America (LSA), San Francisco, CA.
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- Special issue on Modality and Evidentiality, *Journal of Semantics* Vol. 25, Nr. 3 (August, 2008). With Takao Gunji (Kobe Shoin) and Yukinori Takubo (Kyoto University).
- Special issue on Modality and Temporality. *Journal of Semantics*, Vol. 22, Nr. 2 (May, 2005) and 3 (August, 2005). With Cleo Condoravdi (PARC and Stanford University).