X-marking

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Prolegomena
zu
einer jeden
künftigen Metaphysik
die
als Wissenschaft
wird auftreten können,
von
Immanuel Kant.
Riga,
bey Johann Friedrich Hartknoch.
1783.

Etymology [edit]

From the Ancient Greek neuter noun: προλεγόμενον (*prolegómenon*, “that which is said beforehand,”) [plural: προλεγόμενα (*prolegómena*), from the verb: προλέγω (*prolégō*, “I say before[hand]”)] referring to an introduction.

Pronunciation [edit]

- (*UK*) IPA(key): /ˌpɹəʊlɪˈgɒmɪnɒn/
- (*General American*) IPA(key): /ˌpɹoʊlɪˈgɑmənɑn/

Noun [edit]

prolegomenon (*plural* **prolegomena**)

1. (*usually in the plural*) A prefatory discussion; a formal essay or critical discussion serving to introduce and interpret an extended work.

Website

http://kvf.me/x

Week 1

Day 1 Modals, attitudes, and conditionals

Day 2 X-marked conditionals — beginnings

Day 3 X-marked conditionals — some theories

Day 4 X-marking beyond conditionals — intro

Week 2

Day 5 Aspect in X-marking [Sabine, Sergei]

Day 6 X-marked modals

Day 7 X-marked attitudes

Day 8 TBD

Day 1:
Modals, attitudes, and conditionals

The 5th dimension

- the three dimensions of space
- the fourth dimension: time
- the fifth dimension: possibility

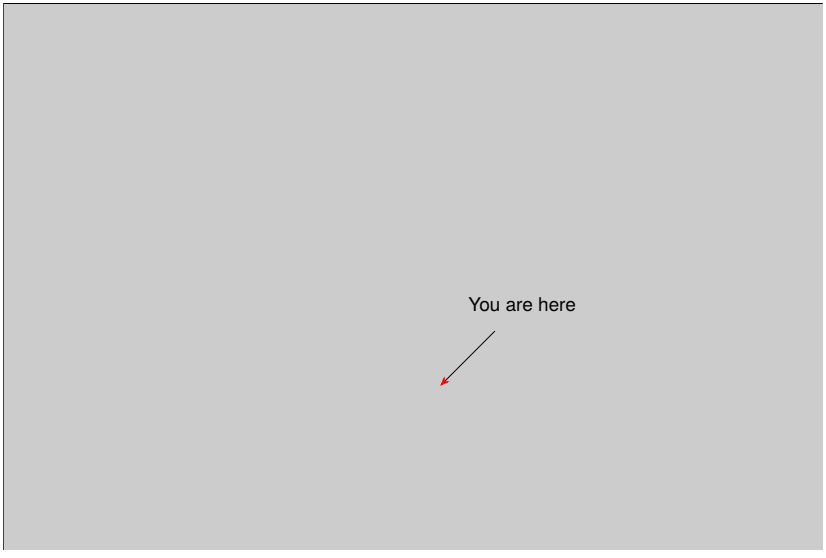
Space is big. You just won't believe how vastly, hugely, mind-bogglingly big it is. I mean, you may think it's a long way down the road to the chemist's, but that's just peanuts to space.

– Douglas Adams, The Hitchhiker's Guide to the Galaxy

The mind-boggling bigness of space is itself peanuts to the vastness of the realm of possibility. The tiniest variation in one tiny corner of the universe corresponds to a whole other possibility (or *possible world*).

There are ever so many ways that a world might be: and one of these many ways is the way that this world is.

– Lewis 1986, The Plurality of Worlds


You are here

Speech acts in the possible worlds view

- Propositions distinguish between regions of possibilities
- Questions ask where we are in the realm of possibility
- Imperatives try to get us to move to a particular region

The basic notion of possible worlds semantics is

$[\![\alpha]\!]^w$: the extension of an expression α at a possible world w

$[\![\text{is-in-Rethymno}]\!]^w$= the set of things in Rethymno in w

$[\![\text{Brianna}]\!]^w$ = Brianna

$[\![\text{Brianna is in Rethymno}]\!]^w = 1$ iff Brianna is in Rethymno in w

The proposition expressed by a sentence ϕ

$\lambda w.[\![\phi]\!]^w \approx$ the set of worlds where ϕ is true.

The proposition expressed by *Brianna is in Rethymno*:
the set of worlds where Brianna is in Rethymno.

When such a proposition is asserted, the speaker is urging us to accept that we are located in the particular region of the realm of possibilities where the proposition is true.

Shifting to other worlds

Intensional operators create propositions about the truth of their prejacent propositions at certain worlds.

But why bother?

Why would we care about other possible worlds?

We don’t. They’re too ”far away”.

Other worlds matter as stand-ins for facts in this world:

- anchoring to some feature of this world
- projecting from there a restricted set of worlds to make a claim about

anchor in w —projection→ set of worlds talked about

Kinds of projection functions

- *epistemic*: worlds compatible with a body of evidence
- *doxastic*: worlds compatible with a belief system
- *deontic*: worlds compatible with a set of requirements
- *teleological*: worlds compatible with a goal
- *practical*: worlds compatible with a set of circumstances

Brianna might be in Rethymno

true in a world w iff Brianna is in Rethymno in some of the worlds compatible with the evidence in w

- anchor: the evidence at hand
- projection: all the worlds compatible with that evidence

$[\![\text{might}]\!]^w$ = $\lambda p.\exists w'$ compatible with the evidence in w : $w' \in p$

$[\![\text{must}]\!]^w$ = $\lambda p.\forall w'$ compatible with the evidence in w : $w' \in p$

Two dimensions of modal meaning:

- modal force (necessity … possibility)
- modal flavor (epistemic, deontic, …)

(1) It has to be raining.

(2) Visitors have to leave by six pm.

(3) You have to go to bed in ten minutes.

(4) I have to sneeze.

(5) To get home in time, you have to take a taxi.

The general schema: $M\ [f(w)]\ (\phi)$

M the quantificational relation between two sets of possible worlds

$f(w)$ a set of possible worlds assigned by flavor f to the evaluation world w

ϕ the prejacent proposition, a set of worlds where ϕ is true

(6) It has to be raining.

M universal quantification (subset relation)

$f(w)$ the set of worlds compatible with the evidence in w

ϕ the set of worlds where it is raining

$\rightsquigarrow$ the evidence in w entails that it is raining

(7) Iris can have one cookie after dinner.

M	existential quantification (compatibility relation)
$f(w)$	the set of worlds that satisfy the parent's wishes in w
ϕ	the set of worlds where Iris has one cookie after dinner

$\rightsquigarrow$ the parent's wishes in w allow Iris to have one cookie after dinner

Anchoring to the evaluation world:

- modals make a claim about the evaluation world via predicating the prejacent of a set of worlds determined by some feature of the evaluation world
- modal claims are contingent: whether they are true or not in the evaluation world depends on what the evaluation world is like and thus differs from world to world
- modal claims express propositions and thus are embeddable and iterable

From syntax to interpretation:

- how does the modal get a prejacent proposition to work on?
- where does the flavor $f(w)$ come from?

Lots of implementation options. But core insight is important.

Simple flavors:

- epistemic (worlds compatible with some body of evidence)
- deontic (worlds that satisfy some set of rules)

Complex flavors

(8) Howard forgot to return his library book.
He has to pay a $5 fine.

complex flavor: the evaluation world circumstances + what the rules are

essentially complex:

- not just the circumstances: Howard may be a scofflaw who never pays fines
- not just the rules: Howard would not have failed to return the book

(9) Howard has to pay a fine.

quantifies over worlds

- where the same things happened as in the evaluation world
- and that afterwards are as good as possible according to the rules

insight: flavors can be complex

implementation: lots of options

Famously, Kratzer relativized the semantics of modals to two parameters:

- modal base (core flavor)
- ordering source (comparing worlds in the modal base)

Three ways to implement mixed modal flavors

1. accessibility relation + (multiple) orderings
2. (multiple) premise sets
3. (multiple) subset selection functions

Recommendations for aficionados

- David Lewis. 1974. Semantic analyses for dyadic deontic logic. In Sören Stenlund et al. (eds.), *Logical theory and semantic analysis*, 1–14. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-010-2191-3_1
- David Lewis. 1981. Ordering semantics and premise semantics for counterfactuals. *Journal of Philosophical Logic* 10(2). 217–234. https://doi.org/10.1007/BF00248850

Modality in time

There are two issues about time:

- the temporal “location” of the anchor
- the temporal reference of the prejacent

The time of the anchor

Modals make a claim about an anchoring feature in the evaluation world:

- evidence
- goals
- requirements

And all of those change with time, so modals are time-dependent.

(10) There had to be a leak somewhere.

The time of the prejacent

The prejacent is a proposition and thus may also be time-dependent.

There are many interesting issues here: (non)-finiteness, absolute vs relative tense, aspectual relations.

Except for next Monday, we will largely set much of this aside.

(11) There had to have been a break-in.

Attitudes

Hintikka's idea: Attitude predicates have the same basic semantics as modals.

(12) Naby believes that Brianna is in Rethymno.

- Naby's belief state in the evaluation world (whatever it is) determines a set of worlds
- these are the worlds that are "compatible with" the belief state
- nothing is going on in these worlds that contradicts what the belief state thinks the world is like

x believes that p
= $\forall w' \in \textsc{dox}(x, w) : \ w' \in p$

where $\textsc{dox}(x, w)$ is the set of worlds compatible with x's belief state in w

- Like modals, attitudes are anchored to the evaluation world
- Unlike modals, the set of worlds they take us to is (i) lexically constrained and (ii) depends on the subject of the attitude

The quantificational force of modals

- almost universally universal
- but see Slovenian *dopuščati*, Russian *dopuskat'* (Močnik 2019)

Conditionals

(13) If Rosa left before 6am, she got there in time.

- epistemic flavor
- worlds compatible with the evidence + where Rosa left before 6am
- all of those worlds are worlds where she got there in time

Just like modals:

- quantificational force (universal)
- modal flavor (epistemic)
- anchoring to evaluation world

plus: restriction to worlds where the antecedent is true

Obvious idea: *if* is a modal operator

if $[f(w)]\ (p)\ (q)$

- the antecedent p
- the modal flavor function $f(w)$
- the consequent q

true iff $\forall w' \in p \cap f(w) :\ q(w') = 1.$

The interaction of modals and conditionals

(14) If she's in front of a big fortress, Brianna might be in Rethymno.

(15) If he returned the book late, Howard has to pay a fine.

The Restrictor Theory

Kratzer 1986:

> *the history of the conditional is the story of a syntactic mistake. There is no two-place if …then connective in the logical forms of natural languages. If-clauses are devices for restricting the domains of various operators.*

Kratzer's Thesis

If-clauses are devices for restricting the domains of various operators.

(16) If we're on Route 62, we must be in Clinton.

must [f(w) ∩ p] (we be in Clinton)

The only thing the *if*-clause is doing is restricting the flavor argument of *must*. There's no additional modal operator contributed by *if*.

(17) If we're on Route 62, we are in Clinton.

If *if* is a device for restricting the domains of operators, where is the operator being restricted here?

Kratzer: covert modals

Alternatives to the restrictor theory

- Anthony S. Gillies. 2010. Iffiness. *Semantics and Pragmatics* 3(4). 1–42. https://doi.org/10.3765/sp.3.4
- Ivano Ciardelli. 2022. The restrictor view, without covert modals. *Linguistics and Philosophy* 45(2). 293–320. https://doi.org/10.1007/s10988-021-09332-z
- Kai von Fintel & Robert Pasternak. 2022. Attitudes, aboutness, and indirect restriction. http://mit.edu/fintel/fintel-pasternak-2022-AttitudesAboutness.pdf

Tomorrow: X-marking

(O) If Leila is here, there is gazpacho.

(X) If Leila was here, there would be gazpacho.

Continuing the family enterprise

- Kai von Fintel. 1998. The presupposition of subjunctive conditionals. In Uli Sauerland & Orin Percus (eds.), *The interpretive tract* (MIT Working Papers in Linguistics 25), 29–44. Cambridge, MA: MITWPL. http://mit.edu/fintel/fintel-1998-subjunctive.pdf
- Sabine Iatridou. 2000. The grammatical ingredients of counterfactuality. *Linguistic Inquiry* 31(2). 231–270. https://doi.org/10.1162/002438900554352
- Kai von Fintel & Sabine Iatridou. 2008. How to say *ought* in Foreign: The composition of weak necessity modals. In Jacqueline Guéron & Jacqueline Lecarme (eds.), *Time and Modality* (Studies in Natural Language and Linguistic Theory 75), 115–141. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-1-4020-8354-9_6

Some recent work

- Kai von Fintel & Sabine Iatridou. 2022. Prolegomena to a theory of X-marking.
- Kjell Johan Sæbœ. 2021. Non-actualistic mood in Czech, Russian, German, and Norwegian.
- Marcelo Ferreira. 2022. A square of necessities: X-marking weak and strong necessity modals.

All available on the website: https://kvf.me/x

An apposite quote

Irene Heim in an email to a student on April 15, 2016:

> *“I have been thinking about aspects of this topic for about 25 years and have recently reached an all-time high of profound confusion.”*

Three levels of confusion:

1. Apprentice (get a sense for the data, understand the basic questions, descriptive adequacy)
2. Professional (understand the data, explanatory adequacy, grasp open questions)
3. Guru (have inklings of how things really work, profound confusion)

Question orthodoxy

- anchoring to events?
- situation or truth-maker semantics?
- rethink attitude verbs and complementation?
- rethink restrictor theory?
- get rid of possible worlds?