

# **X-marking**

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## 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](#)<sup>(key)</sup>: /ˌprələʊˈɡɒmɪnən/
- ([General American](#)) [IPA](#)<sup>(key)</sup>: /ˌprɪəʊlɪˈɡəmənən/

## 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>

# Topics

## Week 1

- Modals, attitudes, and conditionals
- X-marked conditionals
- X-marking beyond conditionals — intro

## Week 2

- **Monday July 25:** Aspect in X-marking [Sabine, Sergei]
- X-marked modals and attitudes in detail
- possibly: even more uses of X-marking

**Modality**

# 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

$\llbracket \alpha \rrbracket^w$ : the **extension** of an expression  $\alpha$  at a possible world  $w$

$\llbracket \text{is-in-Rethymno} \rrbracket^w = \text{the set of things in Rethymno in } w$

$\llbracket \text{Brianna} \rrbracket^w = \text{Brianna}$

$\llbracket \text{Brianna is in Rethymno} \rrbracket^w = 1 \text{ iff Brianna is in Rethymno in } w$

The **proposition** expressed by a sentence  $\phi$

$\lambda w. \llbracket \phi \rrbracket^w \approx$  the set of worlds where  $\phi$  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



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

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

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  $w$

$\phi$  the prejaacent proposition, a set of worlds where  $\phi$  is true

(6) It has to be raining.

$M$  universal quantification (subset relation)

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

$\phi$  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  $w$

$\phi$  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](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 prejacant

## 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 prejacet

The prejacet 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.