

Modal Reasoning as a Species of Conditional Reasoning

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Plan

Strengthening

Context dependence

Conditional Modality

- A brief history

- Strict and variably strict theories of conditionals

Condition Dependence

- Two Trains

- Predictions on the standard and conditionals theories

Strong or weak permission?

Independence Inferences

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*Alice's car is in need of fuel and she is in need of a cigarette.
She pulls into a station and pulls out a match.*

Alice is not allowed to strike the match.



*Alice's car is in need of fuel and she is in need of a cigarette.
She pulls into a station and pulls out a match.*

Alice is not allowed to strike the match.

She is allowed to leave the petrol station and strike it.



*Alice's car is in need of fuel and she is in need of a cigarette.
She pulls into a station and pulls out a match.*

Alice is not allowed to strike the match.

She is allowed to leave the petrol station and strike it.

She is not allowed to leave the petrol station and go to another station and strike it.



*Alice's car is in need of fuel and she is in need of a cigarette.
She pulls into a station and pulls out a match.*

Alice is not allowed to strike the match.

She is allowed to leave the petrol station and strike it.

She is not allowed to leave the petrol station and go to another station and strike it.

She is allowed to leave the leave the petrol station, go to another station, dip the match in water and strike it.



If Alice stuck the match, the rules would be broken.



If Alice stuck the match, the rules would be broken.

If Alice left the station and struck the match, the rules wouldn't be broken.



If Alice stuck the match, the rules would be broken.

If Alice left the station and struck the match, the rules wouldn't be broken.

If Alice left the station, went to another station and struck the match, the rules would be broken.



If Alice stuck the match, the rules would be broken.

If Alice left the station and struck the match, the rules wouldn't be broken.

If Alice left the station, went to another station and struck the match, the rules would be broken.

If Alice left the station and went to another station and dipped the match in water and struck it, the rules wouldn't be broken.



Alice leaves the station, goes to another station, dips the match in water and strikes it.

- ⇒ Alice leaves the station, goes to another station and strikes the match.
- ⇒ Alice leaves the station and strikes the match.
- ⇒ Alice strikes the match.

Inheritance If A entails B and A is permitted, B is permitted too.

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Alice leaves the station and strikes the match.

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By contraposition,

Alice doesn't strike the match.

⇒ Alice doesn't leave the station and strike the match.

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By inheritance,

Alice is not allowed to strike the match.

⇒ Alice is not allowed to leave the station and strike the match.

It's Wednesday. A driver pulls over beside the sign.



PARKING ATTENDANT:

You're not allowed to park here.

But parking here on Sunday is allowed.

But parking here on Sunday during roadworks is not allowed.

But parking an emergency vehicle here on Sunday during roadworks is allowed.

It's Wednesday. A driver parks beside the sign.



PARKING ATTENDANT:

If you parked here, you'd be breaking the rules.

If you parked here on Sunday, you wouldn't be breaking the rules.

If you parked here on Sunday during roadworks, you'd be breaking the rules

If you parked an emergency vehicle here on Sunday during roadworks, you wouldn't be breaking the rules.

We seem to be dealing with two very similar phenomena:

1. Failures of inheritance

$$\Diamond(A \wedge B) \not\Rightarrow \Diamond A$$

2. Failure of antecedent strengthening

$$\text{if } A, \text{ would } C \not\Rightarrow \text{if } A \wedge B, \text{ would } C$$

Are these really two separate phenomena?

Similar behaviour among modals and conditionals

- (1) Alice is allowed to strike the match, provided she leaves the petrol station first.
- (2) If Alice struck the match, the rules would be met, provided she leaves the petrol station first.

Smodal sequences for epistemic modals

- (3) A: Where is Alice?
 B: She must be in her office.
 [We look into Alice's office and don't find her.]
 A: She must not be in her office.
 B: Well, she might be hiding under the desk.
 A: That's true, so she might be in her office
 after all.

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Two theories of conditionals

Variably strict

e.g. Stalnaker 1968, Lewis 1973, Kratzer 1981a

Lewis: ‘if A , would C ’ says every **closest A -world** is a C world

$$f(A, w) \subseteq C$$

Invalidate antecedent strengthening

Strict

e.g. Lewis 1912, von Fintel 2001, Gillies 2007

von Fintel: ‘if A , would C ’ says every **A -world in the modal horizon** is a C -world

$$mh \cap A \subseteq C$$

Validate antecedent strengthening

How the modal horizon responds to conditional antecedents

- ▶ Entertainability presupposition:
‘if A , C ’ presupposes that the modal horizon contain an A -world.
- ▶ When it is empty, the modal horizon updates in response to conditional information, such as similarity.
- ▶ For von Fintel, when we hear a conditional ‘if A , would C ’, we add to the modal horizon the worlds that are as close to the actual world as every A -world

$$mh^\phi(w) = mh(w) \cup \{w' : w' \leq_w w'' \text{ for every } A\text{-world } w''\}$$

(von Fintel 2001, p. 138)

Conditional versus non-conditional update

Both variably strict and strict theories agree:

- ▶ The interpretation of conditionals is sensitive to meaning components (such as similarity, intervention, ...) that are **not** contributed by the general resources of context dependence

Conditional versus non-conditional update

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- ▶ The interpretation of conditionals is sensitive to meaning components (such as similarity, intervention, ...) that are **not** contributed by the general resources of context dependence
- ▶ They involve a *conditional*, rather than a purely *contextual* update of the set of relevant worlds

A theory no one accepts

Strict conditional with a **non-conditional** update

When we interpret a conditional antecedent, the modal horizon updates via general mechanisms of context dependence.

The update operation does not involve any specifically ‘conditional’ components, such as similarity.

A central problem

(4) If you struck this match, it would light.

When we interpret (4), which worlds should we add to the modal horizon?

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Surely, ones where the match is still dry, all else is equal, ...

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(4) If you struck this match, it would light.

When we interpret (4), which worlds should we add to the modal horizon?

Surely, ones where the match is still dry, all else is equal, ...

Which worlds we add is sensitive to the conditional selection function

Williamson on failures of inheritance

Example from Williamson (2020)

No dancing in the library!

- (5) It is permissible for Alexandria to dance.

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No dancing in the library!

- (5) It is permissible for Alexandria to dance.
- (6) It is permissible for Alexandria to leave the library and dance.



Context dependence

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- (6) It is permissible for Alexandria to leave the library and dance.

such examples pose no threat to the validity of [Inheritance]. For that means only that if the premise is true as uttered in a given context, the conclusions are true as uttered in the *same* context. When we originally considered [(5)], we held Alexandria's location in the library fixed—it was not being questioned. When we went on to consider [(6)], we no longer held her location in the library fixed, for it was explicitly at issue.

(Williamson 2020, p. 104)

Do modals use a conditional update?

Permission statements can change which worlds are contextually relevant.

Given a permission statement, **which** worlds become relevant?

Does the choice of worlds involve the same mechanism we use to select worlds given a conditional antecedent?

- (5) It is permissible for Alexandria to dance.
- (6) It is permissible for Alexandria to leave the library and dance.

Once we have accepted [(6)], it is natural for us to change our answer to the original question ‘Is it permissible for Alexandria to dance?’, saying ‘Yes’, though perhaps adding by way of explanation ‘but first she must leave the library’. [...] Situations in which she left the library were implicitly excluded as **irrelevant** in the original context, but not in the later context. In any context in which [(6)] is true, [(5)] is also true. Standard semantic accounts of modals allow for just such context-sensitivity: the *relevant* possible worlds or situations are those in the contextually determined *modal base*, to use Kratzer’s terminology.

(Williamson 2020, p. 104)

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The Diversity Condition

$\Box A$ and $\Diamond A$ presuppose that the modal base contain a world where A is true and a world where A is false. (Condoravdi 2002)

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- (5) It is permissible for Alexandria to dance.
- (6) It is permissible for Alexandria to leave the library and dance.

(6) presupposes that the modal base contains a world where Alexandria leaves the library and dances.

$\Diamond(A \wedge B)$, after accommodating its presuppositions, entails $\Diamond A$.

Inheritance is **Strawson-valid**
(in the terminology of von Fintel 1999)

Criticism of the Diversity Condition

Examples from Majdič (2024):

- (7) In 1 hour, 60 minutes will have passed.
- (8) Context: Al won an Olympic medal last year.
 - a. Al: I have already won one Olympic medal. And I hope to win one more this year.
 - b. Bo: In any case, at the end of your life you will have won at least one Olympic medal. So that's already very impressive.

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Modal Entertainability (the Diversity Condition's better half)

$\Box A$ and $\Diamond A$ presuppose that the modal base contain a world where A is true.

Modal Entertainability

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- ▶ When we interpret (5), the modal base contains **no** worlds where Alexandria leaves the library.

Modal Entertainability

$\Box A$ and $\Diamond A$ presuppose that the modal base contain a world where A is true.

(5) It is permissible for Alexandria to dance.

- ▶ When we interpret (5), the modal base contains **no** worlds where Alexandria leaves the library.

(6) It is permissible for Alexandria to leave the library and dance.

- ▶ When we interpret (6), the modal base **does contain** worlds where Alexandria leaves the library.

A problem: Smodal sequences

Alice is not allowed to strike the match.

She is allowed to leave the petrol station and strike it.

She is not allowed to leave the petrol station and go to another station and strike it.

She is allowed to leave the leave the petrol station, go to another station, dip the match in water and strike it.



A problem: Smodal sequences

- (9) Alice is not allowed to strike the match.
- (10) She is allowed to leave the petrol station and strike it.

A problem: Smodal sequences

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Entertainability requires:

on hearing (10), add to the modal base **some** worlds where Alice leaves the petrol station and strikes the match.

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Is the match still dry in those worlds?

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What about worlds where it is wet? What's wrong with them?

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Is the match still dry in those worlds?

What about worlds where it is wet? What's wrong with them?

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An natural answer:

do not admit gratuitous departures from actuality.

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May I open the window?



May I open the window?

Is there at least one allowed case where I open the window?



May I open the window?

Would it be ok if I opened
the window?

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Leibniz (1670)

Leibniz's *Elements of Natural Law*:

What is permitted is

“what is possible for a good person to do”

What is obligatory is

“what is necessary for a good person to do”

Leibniz (1670)

Leibniz's *Elements of Natural Law*:

What is permitted is

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What is obligatory is

“what is necessary for a good person to do”

Hilpinen (2017, pp. 159–60) suggests paraphrasing Leibniz's thought here using conditionals:

One is permitted to do something just in case

if they do it, possibly, they are a good person

One is obligated to do something just in case

if they do not do it, necessarily, they are not a good person.

Anderson (1956, 1958a,b)

Let S denote “Thing wrong”, or ‘Sanction’

A is obligatory means $\Box(\neg A \supset S)$

A is forbidden means that $\neg A$ is obligatory $\Box(A \supset S)$

A is permitted means that A is not forbidden $\Diamond(A \wedge \neg S)$

“to say that p is obligatory is to say that failure of p leads to a state-of-affairs P which is ‘bad’ ”

(Anderson 1958a, p. 103)

“it is *analytic* of the notion of obligation that if an obligation is not fulfilled, then something has gone wrong”

(Anderson 1967, pp. 346–47)

This analysis of obligation is also proposed by Kanger (1957)

von Wright (1968)

Let I denote “immunity to punishment”

It ought to be the case that A means

A is a necessary condition of I

$\Box(I \supset A)$, equivalent to $\Box(\neg A \supset \neg I)$

It may be the case that A means

A is a sufficient condition of I

$\Box(A \supset I)$

This is known as ‘strong permission’

A problem with strong permission

We lose duality:

- (11) a. You must submit the essay on time.
 b. You are not allowed to submit the essay late.

- (12) a. Everyone has to stop at a red light.
 b. No one is allowed to go through a red light.

A problem with strong permission

We lose duality:

- (11) a. You must submit the essay on time.
 $A \Box \rightarrow \neg I$
- b. You are not allowed to submit the essay late.
 $\neg(A \Diamond \rightarrow I)$ ✓ $\neg(A \Box \rightarrow I)$ ✗
-
- (12) a. Everyone has to stop at a red light.
 $\forall x(Ax \Box \rightarrow \neg I)$
- b. No one is allowed to go through a red light.
 $\neg \exists x(Ax \Diamond \rightarrow I)$ ✓ $\neg \exists x(Ax \Box \rightarrow I)$ ✗

This is a reason to prefer Anderson's weak notion of permission over von Wright and Hilpinen's strong notion

Let I denote “immunity to punishment”

Hilpinen (1982) suggested replacing the strict conditional $\Box(A \supset C)$ with the variably strict conditional, à la Stalnaker (1968) and Lewis (1973).¹

¹Nute (1985) suggested another kind of conditional.

Let I denote “immunity to punishment”

Hilpinen (1982) suggested replacing the strict conditional $\Box(A \supset C)$ with the variably strict conditional, à la Stalnaker (1968) and Lewis (1973).¹

Let f be a conditional selection function, taking a sentence and a world and returning a set of worlds where the sentence is true.

$A \Diamond \rightarrow C$ is true iff C is true at some A -world selected by f
 $A \Box \rightarrow C$ is true iff C is true at every A -world selected by f

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$A \Diamond \rightarrow C$ is true iff C is true at some A -world selected by f
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A is permitted expresses $A \Diamond \rightarrow I$

A is obligatory expresses $\neg A \Box \rightarrow \neg I$

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Strict theories

(Lewis 1912, von Fintel 2001, Gillies 2007)

If A, would C means

every **A-relevant** case
where *A* is true, *C* is true.

Variably strict theories

(Stalnaker 1968, Lewis 1973, Kratzer 1981a)

If A, would C means

every **relevant** case
where *A* is true, *C* is true.

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Two trains approach an intersection in a dense forest at full speed.

One is travelling North to South, the other East to West.

If both continue they will crash into one another.





Network Configuration		Status
A goes	B goes	Forbidden
A goes	B stops	Permitted
A stops	B goes	Permitted
A stops	B stops	Permitted

Table: The deontic status of each configuration of the train network.

Am I permitted to continue
through the intersection?

Am I permitted to stop?



Am I permitted to
continue through the
intersection?

Am I permitted to stop?



Am I permitted to continue
through the intersection?

Am I permitted to stop?

Am I permitted to
continue through the
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Network Configuration	Deontic status
Train A goes, train B goes	Forbidden
Train A goes, train B stops	Permitted
Train A stops, train B goes	Permitted
Train A stops, train B stops	Permitted

Am I permitted to continue through the intersection?

Yes.

Am I permitted to stop?

Yes.

Am I permitted to continue through the intersection?

Yes.

Am I permitted to stop?

Yes.



Network Configuration	Deontic status
Train A goes, train B goes	Forbidden
Train A goes, train B stops	Permitted
Train A stops, train B goes	Permitted
Train A stops, train B stops	Permitted



You are permitted to continue
through the intersection.

You are permitted to stop.



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EPISTEMIC STATE

A goes B goes
A stops B goes
A goes B stops
A stops B stops

accessible worlds

A goes B goes
A stops B goes
A goes B stops
A stops B stops

Contains some
good world?



EPISTEMIC STATE

A goes B goes
A stops B goes
A goes B stops
A stops B stops

if A goes...

A goes B goes

A goes B stops

Contains some
good world?



??

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Strong or weak permission?

Strong permission

If A happens, **necessarily** (i.e. in **every** case we consider), there is no violation. (von Wright 1968, Hilpinen 1982)

Weak permission

If A happens, possibly (i.e. in **some** case we consider), there is no violation. (Anderson 1956)

Angelica has many allergies: she is allergic to soy, gluten, shellfish, lactose, and nuts.

Is she allowed to eat food?

Angelica has many allergies: she is allergic to soy, gluten, shellfish, lactose, and nuts.

Is she allowed to eat food?

If she ate food, would things be ok?

Alice and Bob are colleagues in Quebec. They know both French and English. Bill 96 requires them to speak French at work. They choose to continue to speak English at work.



Does Bill 96 allow Alice and Bob to talk to each other at work?

Alice and Bob are colleagues in Quebec. They know both French and English. Bill 96 requires them to speak French at work. They choose to continue to speak English at work.



Does Bill 96 allow Alice and Bob to talk to each other at work?

If Alice and Bob talked to each other at work, would Bill 96 be satisfied?

There are two switches, A and B. Each switch can be either up or down. The rules specify that A must be up and that B may be in any position.

Are the positions of the switches allowed to agree?

There are two switches, A and B. Each switch can be either up or down. The rules specify that A must be up and that B may be in any position.

Are the positions of the switches allowed to agree?

If the switches agreed, would the rules be met?

John's doctor has permitted him to smoke at most seven cigarettes per day.

Does John have permission to smoke more than six cigarettes per day?

John's doctor has permitted him to smoke at most seven cigarettes per day.

Does John have permission to smoke more than six cigarettes per day?

If John smoked more than six cigarettes, would he be following his doctors orders?

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Menéndez-Benito (2005) and Booth (2022):

Alice and Bob are siblings in an orphanage. They are not allowed to be separated.

(13) You may adopt Alice or Bob.

Independence inferences

Menéndez-Benito (2005) and Booth (2022):

Alice and Bob are siblings in an orphanage. They are not allowed to be separated.

(13) You may adopt Alice or Bob.

(14) If you adopt Alice or Bob, the rules will be met.

You may take all or none of the cards in the discard pile.

(15) You may take any cards in the discard pile.

Independence inferences

Menéndez-Benito (2005) and Booth (2022):

Alice and Bob are siblings in an orphanage. They are not allowed to be separated.

(13) You may adopt Alice or Bob.

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(16) If you take any cards in the discard pile, the rules will be met.

Summary

In contrast to the standard theory of modality, the conditional theory provides

- ▶ a unified account of failure of inheritance and failures of antecedent strengthening
- ▶ a more satisfying account of the train case
- ▶ a straightforward account of independence inferences



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An employee is required to work Monday to Friday. Their boss then tells them that they may take Friday off. Much changes in response. The requirement to work Friday morning disappears. So does the requirement to work every morning this week. But much else stays the same. They are still required to work Monday to Thursday. Murder is still forbidden. They are still permitted to take the weekend off. And so on.

The Similarity Analysis. The newly permissible worlds should be selected to resemble (as closely as possible) the worlds that were permissible before.

(1979, p. 28)

Professor Procrastinate

A graduate student asks Smith for comments on a paper he is planning to read at a job interview. If Smith accepts the task and comments on the paper, the student would make substantial improvements on it, have a highly successful interview, and receive an offer for a three-year position. If Smith accepts the task but fails to comment on the paper in time, the student will make no revisions, have a dismal interview, and receive no job offer. If Smith does not accept the task, the student will elicit comments from another faculty member, make less helpful revisions in the paper, have a moderately successful interview, and receive a one-year job offer letter.

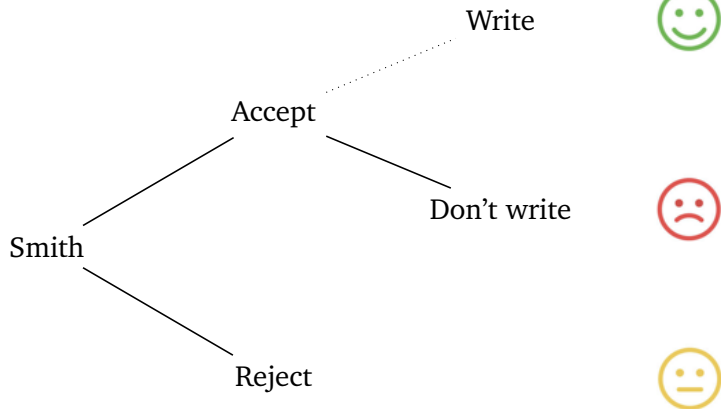
(Smith 1978, p. 185)

Professor Procrastinate

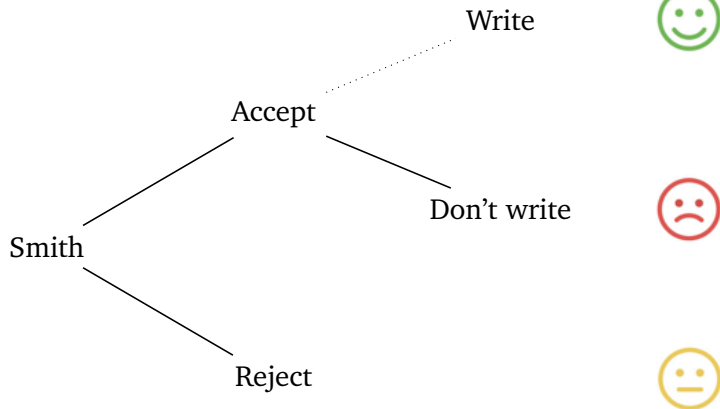
[...] let us suppose that if Smith accepted the task, he would actually fail to comment on the paper in time – perhaps he would misunderstand what the deadline is, or perhaps he would become so bogged down in administrative work that he wouldn't get around to it.

(Smith 1978, p. 185)

Professor Procrastinate

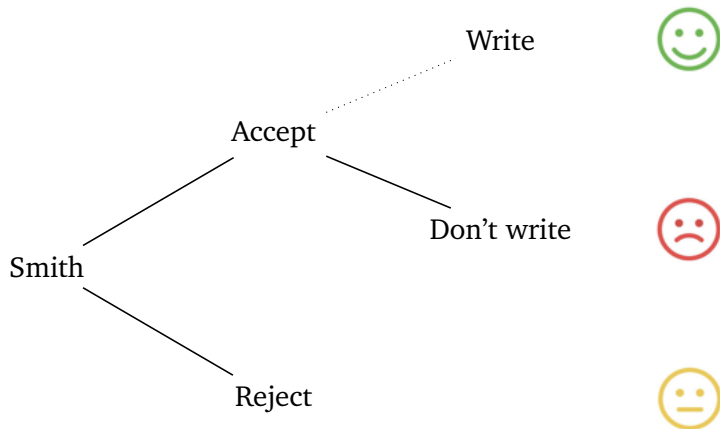


Professor Procrastinate



(17) Smith should reject the offer to review the paper.

Professor Procrastinate



- (17) Smith should reject the offer to review the paper.
- (18) Smith should accept the offer and follow through with reviewing it.

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Counterfactual-Style Revisions in the Semantics of Deontic Modals

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Arregui's (2011) Wedding Party

Your friend, the bride, has asked you to sit with her three brothers in law: John, Jack and Jim. They are very shy and she wants to make sure somebody friendly has dinner with them. [The more brothers you sit with, the better.] As it turns out, two of the brothers (John and Jack) sit at one table and Jim sits at another. You sit with John and Jack.



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(19) You should be sitting with Jim.

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- (19) You should be sitting with Jim.
- (20) You should be sitting with John, Jack and Jim.

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(21) If you were sitting with Jim, things would be better.

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- (21) If you were sitting with Jim, things would be better.
- (22) If you were sitting with John, Jack and Jim, things would be better.

- (23) If Alexandria danced, she'd be breaking the rules.
- (24) If Alexandria left the library and danced, she wouldn't be breaking the rules.

If A, would C means:

every relevant world where *A* is true, *C* is true
(von Fintel 2001, Gillies 2007)

Entertainability for conditionals

If A, would C presupposes that there are some relevant worlds where *A* is true.

(24) presupposes that there are some relevant worlds where Alexandria leaves the library and dances

Revising the circumstances?

On Kratzer's view, deontic modals are *circumstantial*: they are interpreted in view of the relevant circumstances.

“the kind of facts we take into account for circumstantial modality are a rather slippery matter” (Kratzer 1981b, p. 53)

A reply to Smodal sequences: we revise the circumstances to give the prejacent a chance of being true.

Suppose Suzy and Bob work in a ski resort in the Swiss Alps. Suzy is the safety officer and Bob is a bartender. If there is an avalanche, the resort rulebook states that the safety officer is required to stay, but bartenders may go home.

One day, there is an avalanche. As it happens, the snowfall blocks any route Bob could take to leave. He is unable to leave. It is nonetheless true that, as far as the resort rulebook is concerned, only Suzy is required to stay. Suzy is required to stay but Bob is not.

The Problem

We can revise the circumstances to make it possible for Bob to leave by removing the avalanche, but then Suzy is no longer required to stay.