

# Causality and Evidentiality

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## Outline

- 1 Japanese Evidentiality
- 2 Davis & Hara (2014)
  - Cancellable Prejacent
  - Evidentiality via Causality
- 3 Causal Premise Semantics
  - Deriving evidentiality from causality
- 4 Conclusion

## Sentence-final Evidential Auxiliary

- (1) Ame-ga futta youda.  
rain-NOM fell EVID  
'It seems that it rained.'  
Message 1: "It rained."  
Message 2: "The speaker has **indirect evidence** for 'it rained'."

### Question 1

What are the statuses of Messages 1 & 2?

—At-issue entailment? Presupposition? Implicature? ...

### Question 2

What is indirect evidence?

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## Previous analyses

- Evidentiality as presupposition (Izvorski, 1997; Matthewson et al., 2006; McCready & Ogata, 2007)

- (2) Ame-ga futta youda.  
rain-NOM fell EVID  
'It seems that it rained.'  
At-issue commitment: "It might/must have rained."  
Presupposition: "The speaker has indirect evidence for 'it rained'."

## At-issues cannot be cancelled

### Bare assertion

- (3) #Ame-ga futta kedo, jitsu-wa futte nai.  
rain-NOM fell but, in.fact fall NEG  
# 'It rained, but in fact it didn't.'

### Canonical Modal

- (4) #Ame-ga futta darou kedo, jitsu-wa futte nai.  
rain-NOM fell probably but in.fact fall NEG  
# 'Probably it rained, but in fact it didn't.'

- The prejacent proposition  $p$  is a semantic commitment.

## Youda: cancellable implicature

- (5) Ame-ga futta youda kedo, jitsu-wa futte nai.  
rain-NOM fell EVID but in.fact fall NEG  
'It seems that it rained but in fact it didn't.'

- The prejacent  $p$  is a cancellable implicature.
- A similar argument is made for reportative evidentials (Faller, 2002; Murray, 2010; AnderBois, 2014)

## Youda: prejacent not committed



- (6) Gojira-ga abareta youda.  
Godzilla-nom raged EVID  
'It seems/looks as if Godzilla raged wildly.'  
'?It seems that Godzilla raged wildly.'



## Summary

- (7) Ame-ga futta youda.  
rain-NOM fell EVID  
'It seems that it rained.'

### Division of Labour

cancellable implicature It rained

semantic commitment The speaker has indirect evidence for 'it rained'

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## McCready and Ogata (2007)

- What is indirect evidence?

### McCready and Ogata's answer

Evidence for  $p$  is some information  $q$  that raises the agent's subjective probability of  $p$

## M&O: Probability account

- (8) a. (Looking at a wet street)  
 b. Ame-ga futta youda.  
 rain-NOM fell youda  
 'It seems that it rained.'

- ① The speaker learned the information:  
 'The streets are wet' (evidence  $q$ )
- ② The speaker raised her subjective probability  
 for the proposition:  
 'It rained' (prejacent  $p$ )
- ③ 'It rained-YOUDA' is felicitous. (Evid( $p$ ) OK)

## Unexpected asymmetry

- Wrong prediction if we switch the evidence  $q$  and the prejacent  $p$
- (9) a. (Looking at falling raindrops)  
 b. #Michi-ga nureteiru youda.  
 streets-NOM wet YOUDA  
 # 'It seems that the streets are wet.'

- ① The speaker learned the information:  
 'It is raining' (p)
- ② The speaker raised her subjective probability  
 for the proposition:  
 'The streets are wet' (q)
- ③ 'The streets are wet-YOUDA' is felicitous. (Evid( $q$ ) OK)  
 ↑ Wrong Prediction

## Takubo: conditional dependency

- What is indirect evidence?

### Takubo's (2009) answer

Evidence for  $p$  is a minor premise  $q$  in the abductive reasoning given a major premise  $p \rightarrow q$

- (10) Deductive reasoning
- |               |                   |
|---------------|-------------------|
| Major premise | $p \rightarrow q$ |
| Minor premise | $p$               |
| Conclusion    |                   |
|               | $q$               |
- (11) Abductive reasoning
- |               |                   |
|---------------|-------------------|
| Major premise | $p \rightarrow q$ |
| Minor premise | $q$               |
| Conclusion    |                   |
|               | $p$               |

## Abductive reasoning

- (12)
- |               |                                  |
|---------------|----------------------------------|
| Major premise | If it rains, the streets are wet |
| Minor premise | The streets are wet              |
| Conclusion    |                                  |
|               | It rains.                        |

Abductive Reasoning  $\rightarrow$  youda is attachable  $\Leftarrow$  Correct Prediction

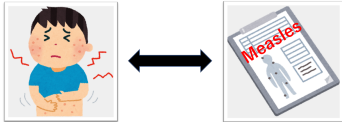
- (13) a. (Looking at a wet street)  
 b. Ame-ga futteru youda.  
 rain-NOM falling EVID  
 'It seems to be raining.'

Deductive Reasoning  $\rightarrow$  youda is not attachable  $\Leftarrow$  Correct Prediction

- (14) a. (Looking at falling raindrops)  
 b. #Michi-ga nureteiru youda.  
 streets-NOM wet EVID  
 # 'It seems that the streets are wet.'

## Problem: Symmetric Conditional Dependency

You have red-brown spots on the skin.  $\leftrightarrow$  You have measles.



## Symmetric Conditional Dependency

You have measles.  $\rightarrow$  You have red-brown spots on the skin.

(15)

Major premise	If you have measles, you have you have red-brown spots on the skin.
Minor premise	Taro has red-brown spots on the skin
Conclusion	Taro has measles.

- abductive inference to 'Taro has measles.'
- *youda* is attachable  $\leftarrow$  Correct Prediction

(16)

(Looking at Taro's skin)  
Taro-wa hashika no youda.  
'Taro seems to have measles.'

## Symmetric Conditional Dependency

You have red-brown spots on the skin.  $\rightarrow$  You have measles.

(17)

Major premise	If you have red-brown spots on the skin, you have measles.
Minor premise	Taro has measles
Conclusion	Taro has red-brown spots on the skin.

- abductive inference to 'Taro has red-brown spots on his skin.'
- *youda* is attachable  $\leftarrow$  Wrong prediction

(18)

(Learning that Taro has "measles")  
#Taro-no hifu-ni akachairo-no shishin-ga aru youda.  
'Taro's skin seems to have red-brown spots.'

## Davis and Hara (2014): Asymmetric causation

- "What is indirect evidence?"

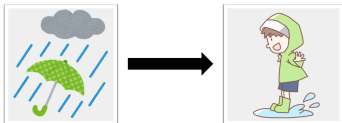
### Davis and Hara's answer

Evidence for  $p$  is some event/state  $q$  that is usually **caused** by  $p$ .

- ' $p$ -youda'  $\approx$  'I perceive  $q$  which is **caused** by  $p$ '  
See also Takubo (2007); Sawada (2006).

## Asymmetric Causal Relation 1

- Rain causes wet streets.
- Wet streets do NOT cause rain.



## Deriving the asymmetry 1



- (19)
- (Looking at a wet street)
  - Ame-ga futta youda.  
rain-NOM fell youda  
'It seems that it rained.'  
≈ I perceive some event  $q$  (=wet street)  
which is caused by  $p$  (=it rained).

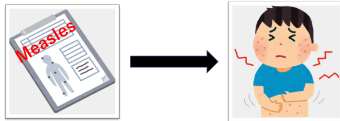
## Deriving the asymmetry 1



- (20)
- (Looking at falling raindrops)
  - #Michi-ga nureteiru youda.  
streets-NOM wet YOUDA  
'It seems that the streets are wet.'  
≈ I perceive some event  $q$  (=falling raindrops)  
which is caused by  $p$  (=wet streets)  
**FALSE!**

## Asymmetric Causal Relation 2

- Measles causes red-brown spots.
- Red-brown spots do NOT cause measles.



## Deriving the Asymmetry 2



- (21) (Looking at Taro's skin)  
Taro-wa hashika no youda.  
'Taro seems to have measles.'  
 $\approx$  I perceive some state  $q$  (red-brown spots)  
which is caused by  $p$  (=measles)

## Deriving the Asymmetry 2



- (22) (Learning that Taro has "measles")  
#Taro-no hifu-ni akachairo-no shishshin-ga aru youda.  
'It seems that Taro has red-brown spots on his skin.'  
 $\approx$  I perceive some state  $q$  (=measles)  
which is caused by  $p$  (=red-brown spots)  
**FALSE!**

## Summary

### Davis & Hara's interpretation of evidentials

$\text{Evid}(p)$  is true at  $w$  iff  $\exists q$  such that the speaker perceives a state  $q$  at  $w$  and  $p$  causes  $q$ .

### Goal

Formalize the causal component.

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## Formalize the causal component

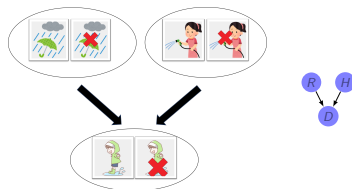
- (23) Davis & Hara's interpretation of evidentials  
 $\text{Evid}(p)$  is true at  $w$  iff  $\exists q$  such that the speaker perceives  $q$  at  $w$  and  $p$  causes  $q$ .

### Proposal: interpretation of evidentials (formal)

$\text{Evid}(p)$  is true at  $f_c, g, w$  iff  $\exists q$  such that the speaker perceives  $q$  at  $w$  and  $\text{Must}_p(q)$  is true at  $f_c, g, w$ .

- Kaufmann's (2013) causal premise semantics
- Kratzer-style (Kratzer, 2005) premise sets are ranked.

## A causal network



## Causal modal base $f_c(w)$



$f_c(w)$  consists of **causally relevant truths** at  $w$ .

**causally relevant propositions**  $\Pi^U$ : the set of all cells of all partitions in  $U$ .

- Example:  $\Pi^U = \{r, \bar{r}, h, \bar{h}, d, \bar{d}\}$ .

**causally relevant truths at  $w$**   $\Pi_w^U = \{p \in \Pi^U \mid p \text{ is true at } w\}$

- Example:  $\Pi_w^U = \{\bar{r}, h, \bar{d}\}$

## Causal premise backgrounds

- (24)  $f_c(w) := \{X \subseteq \Pi_w \mid X \text{ is closed under ancestors in } \Pi_w\}$   
 (Kaufmann, 2013, 1153)

Example:



- $\Pi_w = \{\bar{r}, h, \bar{d}\}$
- $f_c(w) = \{\emptyset, \{\bar{r}\}, \{h\}, \{\bar{r}, h\}, \{\bar{r}, h, \bar{d}\}\}$
- $\{h, \bar{d}\}, \{\bar{r}, \bar{d}\}, \{\bar{d}\}$  are NOT closed under ancestors

### Ordering source $g$

constrained by the *Causal Markov condition* relative to a causal structure  $\mathcal{C}$ .



## Hypothetical Update

- (25) interpretation of evidentials (formal)  
 $\text{Evid}(p)$  is true at  $\mathbf{f}, \mathbf{g}, w$  iff  $\exists q$  such that the speaker perceives  $q$  at  $w$  and  $\text{Must}_p(q)$  is true at  $\mathbf{f}, \mathbf{g}, w$ .

- $\text{Must}_p(q)$ : If  $p$  is true,  $q$  must be true.
- Built on the general interpretation of **conditionals**.

### Hypothetical update

For all  $w$ :  $\mathbf{f}[p](w) := \{\{p\}\} * \mathbf{f}(w)$ . (Kaufmann, 2013, 1148)

### (26) Example

- $\mathbf{f}_c(w) = \{\emptyset, \{\bar{r}\}, \{h\}, \{\bar{r}, h\}, \{\bar{r}, h, \bar{d}\}\}$
- $\text{Prem}(\mathbf{f}_c[r](w)) = \{\{r\}\} * \{\emptyset, \{\bar{r}\}, \{h\}, \{\bar{r}, h\}, \{\bar{r}, h, \bar{d}\}\}$   
 $= \{\{\{r\}, \emptyset\}, \{\{r\}, \{h\}\}\}$   
 $= \{r., r.h\}$

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## No commitment to $p$

- (27) Ame-ga futta youda kedo, jitsu-wa futte-nai.  
 rain-NOM fell EVID but fact-TOP fall-NEG  
 'It seems that it rained, but in fact it didn't.'

$\text{Evid}(r)$  is true at  $\mathbf{f}_c, \mathbf{g}, w$   
 iff Sp perceives  $\bar{d}$  at  $w$  and  $\text{Must}_r(\bar{d})$  is true at  $\mathbf{f}_c, \mathbf{g}, w$ .



- $\Pi_w = \{\bar{r}, h, \bar{d}\}$
- $\mathbf{f}_c(w) = \{\emptyset, \{\bar{r}\}, \{h\}, \{\bar{r}, h\}, \{\bar{r}, h, \bar{d}\}\}$
- $\text{Prem}(\mathbf{f}_c[r](w)) = \{r., r.h\}$
- $\mathbf{g}(w) = \{\emptyset, \{\bar{h}\}, \{r \rightarrow \bar{d}\}, \{h \rightarrow \bar{d}\}\}$
- $\max \text{Prem}((\mathbf{f}_c[r] * \mathbf{g})(w))$   
 $= \{r.h.(r \rightarrow \bar{d}), r.h.(h \rightarrow \bar{d})\}$

$\text{Must}_r(\bar{d})$  is true at  $\mathbf{f}_c, \mathbf{g}, w \Rightarrow \text{Evid}(r)$  is true at  $\mathbf{f}_c, \mathbf{g}, w$ ,  
 even though  $r$  is not true at  $w$ .

## Causal Asymmetry: Cause-YOUDA OK

- (28) a. (Looking at wet streets)  
 b. Ame-ga futta youda.  
 rain-NOM fell EVID  
 'It seems that it rained.'

$\text{Evid}(r)$  is true at  $\mathbf{f}_c, \mathbf{g}, v$   
 iff Sp perceives  $\bar{d}$  at  $v$  and  $\text{Must}_r(\bar{d})$  is true at  $\mathbf{f}_c, \mathbf{g}, v$ .



- $\Pi_v = \{r, \bar{h}, \bar{d}\}$
- $\mathbf{f}_c(v) = \{\emptyset, \{r\}, \{\bar{h}\}, \{r, \bar{h}\}, \{r, \bar{h}, \bar{d}\}\}$
- $\text{Prem}(\mathbf{f}_c[r](v)) = \{r., r.r, r.\bar{h}, r.r.\bar{h}, r.r.\bar{h}.\bar{d}\}$
- $\mathbf{g}(v) = \{\emptyset, \{\bar{h}\}, \{r \rightarrow \bar{d}\}, \{h \rightarrow \bar{d}\}\}$
- $\max \text{Prem}((\mathbf{f}_c[r] * \mathbf{g})(v)) = \{r.\bar{h}.(r \rightarrow \bar{d}), r.\bar{h}.(h \rightarrow \bar{d}), r.r.\bar{h}.\bar{d}.(r \rightarrow \bar{d}), r.r.\bar{h}.\bar{d}.(h \rightarrow \bar{d})\}$

$\text{Must}_r(\bar{d})$  is true at  $\mathbf{f}_c, \mathbf{g}, v \Rightarrow \text{Evid}(r)$  is true at  $\mathbf{f}_c, \mathbf{g}, v$

## Causal Asymmetry: Effect-YOUDA BAD

- (29) a. (Looking at falling raindrops)  
b. #Michi-ga nureteiru youda.  
street-NOM wet EVID  
'#It seems that the streets are wet.'

Evid( $\vec{d}$ ) is true at  $\mathbf{f}_c, \mathbf{g}, v$  iff Sp perceives  $r$  at  $v$  and  $\text{Must}_{\vec{d}}(r)$  is true at  $\mathbf{f}_c, \mathbf{g}, v$



- $\Pi_v = \{r, \bar{h}, \vec{d}\}$
- $\mathbf{f}_c(v) = \{\emptyset, \{r\}, \{\bar{h}\}, \{r, \bar{h}\}, \{r, \bar{h}, \vec{d}\}\}$
- $\text{Prem}(\mathbf{f}_c[\vec{d}](v)) = \{\vec{d}, \vec{d}.r, \vec{d}.\bar{h}, \vec{d}.rh\}$
- $\mathbf{g}(v) = \{\emptyset, \{\bar{h}\}, \{r \rightarrow \vec{d}\}, \{h \rightarrow \vec{d}\}\}$
- $\max \text{Prem}((\mathbf{f}_c[\vec{d}] * \mathbf{g})(v))$   
 $\supseteq \{\vec{d}.\bar{h}.(r \rightarrow \vec{d}), \vec{d}.\bar{h}.(h \rightarrow \vec{d})\}$

$\text{Must}_{\vec{d}}(r)$  is **NOT** true at  $\mathbf{f}_c, \mathbf{g}, v \Rightarrow \text{Evid}(\vec{d})$  is **NOT** true at  $\mathbf{f}_c, \mathbf{g}, v$

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## Concluding remarks

### Davis & Hara's (2014) interpretation of evidentials

Evid( $p$ ) is true at  $w$  iff  $\exists q$  such that the speaker perceives a state  $q$  at  $w$  and  $p$  causes  $q$ .

- Meaning statuses  
cancellable implicature prejacent  $p$   
semantic commitment indirect evidentiality
- Indirect evidence is the effect state of the cause-effect dependency
- Formalized the causal component using Kaufmann's causal premise semantics

### Interpretation of evidentials (formal)

Evid( $p$ ) is true at  $\mathbf{f}_c, \mathbf{g}, w$  iff  $\exists q$  such that the speaker perceives  $q$  at  $w$  and  $\text{Must}_p(q)$  is true at  $\mathbf{f}_c, \mathbf{g}, w$ .

- Correct predictions
  - uttering  $p$ -youda only commits the speaker to  $\text{Must}_p(q)$  but not to the prejacent  $p$ ,
  - successfully derive the asymmetry between the prejacent  $p$  and the evidence source  $q$ .
- Causality
  - indispensable to interpretation of evidentiality
  - independently needed for interpretation of counterfactuals

## Acknowledgement

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