Evidentiality as a Causal Relation: A Case Study from Japanese *youda*

Christopher Davis
Yurie Hara

This paper explores the nature of indirect evidentiality on the basis of the Japanese evidential marker *youda*. We argue that the indirect evidentiality of *youda* can only be explained by reference to causal relations, rather than modal, probabilistic, or conditional dependencies.

Keywords: indirect evidentiality, causation, modality, naturalness rating study

1 Introduction

This paper gives an analysis of the Japanese evidential marker *youda*, illustrated in (1).

(1) Kinou   John-wa wain-o   takusan nonda youda.
     yesterday John-TOP wine-ACC many   drank YOUDA
     '(It seems that) John drank a lot of wine yesterday.'

The use of *youda* makes requirements on the nature of the evidence upon which the speaker bases his assertion, as witnessed by the contrasting felicity of (1) in the contexts in (2).

(2) a. #Witness: The speaker directly witnessed John drinking a lot.
     b. #General Knowledge: John likes wine very much.
     c.   Indirect Evidence: There are a lot of empty wine bottles in John's room.

The use of *youda* is infelicitous for assertions where the speaker has direct evidence (2a) or which are made on the basis of general background knowledge (2b). The use of *youda* seems to require that the assertion be made on the basis of indirect evidence (2c).

In this paper, we investigate how exactly *youda* marks a proposition as being based on 'indirect evidence'. We argue for two main conclusions: (i) *youda* does not mark any kind of epistemic commitment on the part of the speaker, and (ii) *youda* marks indirect evidence by indicating a causal relation between its propositional complement and a contextually salient evidence source. Before providing evidence for these two conclusions, we first give a brief overview of previous accounts of *youda* in section 2, focusing particularly on the account of McCready and Ogata (2007). Following Waldie (2012), we argue that evidentials in general encode a tripartite relationship between an agent a, an evidence source e, and target proposition p. We discuss the kind of relations that previous accounts posit between these three elements, before going on to discuss each one in detail, on the basis of both intuitionistic and experimental evidence. In section 3, we provide experimental support for the basic paradigm in (1). This paradigm establishes that *youda* requires a *specific* evidence source, rather than mere background knowledge on the part of the speaker. It furthermore establishes that the relationship between the evidence

source e and target proposition p is fundamentally *indirect*, in that the evidence source must be a situation/event distinct from that described by the target proposition. Section 4 provides evidence for the claim that *youda* does not require any epistemic commitments on the part of the agent toward the target proposition, and that *youda* thus has no epistemic modal component linking the agent a and the target proposition p. Section 5 provides evidence that the relation linking the evidence source and the target proposition is not based on a purely probabilistic or conditional dependency, contra the proposals of McCready and Ogata (2007) and Takubo (2009). While these accounts predict that a probabilistic correlation or a biconditional dependency between evidence source and target proposition are sufficient to license *youda*, we argue that in fact the relation is an asymmetric one based on causation, in which the target proposition describes a type of situation which is a possible cause for the evidence source. In section 6, we provide a semantics of *youda* that spells out a causal link between a contextual evidence source and the target proposition. Section 7 concludes.

2 Overview of Previous Accounts

Aoki (1986) argues that the use of *youda* indicates that there is "some visible, tangible or audible evidence collected through [the speaker's] own senses to make an inference" (Aoki 1986:231). According to this description, there are two restrictions on the evidence indicated by *youda*. First, there is a restriction on the way in which this evidence has been acquired: the speaker's own vision, touch, or audition. Second, the evidence provides the basis for an inference; the inference here is one from the evidence itself to the proposition encoded by the sentence to which *youda* attaches.

This two-part description finds a more formal characterization in McCready and Ogata (2007) (henceforth M&O), who give a Bayesian modal semantics for a number of Japanese evidentials, including *youda*. In this account, evidentials serve to link their propositional complement p to a contextual agent a via an evidence source e. The evidence source e serves as evidence for p just in case it changes the subjective probability (degree of belief) of a towards p, $P_a(p)$. Evidentials differ in (i) the *type* of evidence allowed (i.e. the way in which the evidence can be acquired by the agent), and (ii) the degree of belief in p resulting from the acquired evidence. For *youda*, this two-part semantics is sketched in (3).

(3)   *p-youda*, relativized to agent a, indicates that:
   a.   some information e, acquired in a manner compatible with the lexical restrictions of *youda*, has led a to raise the subjective probability of p.
   b. a takes p to be probably but not certainly true ($.5 < P_a(p) < 1$) after learning e.

This account is illustrated by the example in (4).

(4)   Context: Looking at a wet street.
         Ame-ga   futta youda.
         rain-NOM fell   YOUDA
         'It seems that it rained.'

In this example, *youda* attaches to a propositional complement meaning 'it rained'. According to M&O, the resulting utterance is interpreted as follows: (i) the information 'the streets are wet' has led the speaker to raise her subjective probability for the proposition 'it rained', (ii) the resulting subjective probability for 'it rained' is greater than .5 but less than 1, and (iii) the

speaker has accessed the information 'the streets are wet' in a manner compatible with the lexical restrictions peculiar to *youda* (i.e. 'visible, tangible, or audible evidence', following Aoki). Putting aside the details of formal implementation, the theory spells out what we think are three crucial components of any theory of evidentiality, shown graphically as follows:

evidential relation

p ⎯⎯⎯⎯⎯ e

epistemic relation   means of acquiring evidence

a
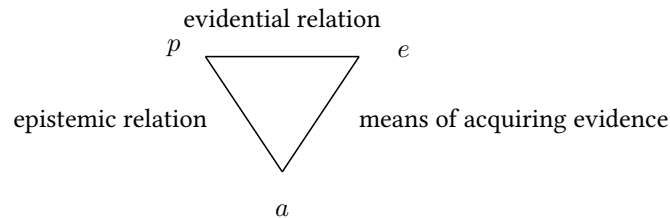
In this view, any evidential must be defined in terms of the relationships that hold between an agent a, a target proposition p, and an evidence source e. The tripartite relationship sketched here is in broad outlines the same as the view advanced by Waldie (2012), although Waldie's approach contains certain additional complications, including the use of an 'origo' rather than a simple individual to model what we term the agent, and a distinction between centered and uncentered propositions. A discussion of these differences is beyond the scope of this paper; we refer the reader to Waldie (2012) for detailed discussion and motivation for the origo-based version of the basic picture sketched here.

The relation between a and e specifies the means by which the evidence has been acquired; among these are such modalities as visual, auditory, tactile, and so on. The details differ for each evidential morpheme, and according to M&O must essentially be listed on an item-by-item basis, without anything more of theoretical interest to be said. M&O provide some data pertaining to the means by which evidence can be acquired for different evidentials in Japanese, and we will have nothing more to say about it here; in what follows, we will talk about this dimension of *youda*'s meaning as the 'lexical requirements' of *youda*, referring the reader to M&O for further details.

The relationship between e and p expresses the exact sense in which e counts as evidence for the target proposition; we refer to this as the *evidential relation* encoded by the morpheme in question. As with the relation linking a and e, we can imagine a number of possible ways in which e and p could be linked, including by way of inference (the existence of e allows one to infer that p), identity (the proposition p itself describes the evidence source e), etc. We note that descriptive inventories of evidential morphemes tend to conflate this dimension, which is where terms such as 'inferential' or 'indirect' apply, with the prior one, which is where terms such as 'visual' or 'auditory' apply. For *youda*, Aoki describes the connection between e and p as one of 'inference', and in M&O's theory of *youda* and other Japanese evidentials, this relation is spelled out as one of Bayesian belief update; e constitutes evidence for p just in case learning e causes the agent to increase their subjective probability for p. The theory of Takubo (2009) provides an account of this relation based on abduction. In what follows, we will show that these views overgenerate in the case of *youda*, and that the relation holding between e and p is one based on causation.

The relationship between a and p is an epistemic one; it is here that restrictions can be placed on the epistemic attitude expressed toward the target proposition. In M&O's theory, *youda* requires a subjective probability greater than .5 but less than 1. In Izvorski's (1997) theory of indirect evidentiality, the commitment is a necessity modal, while in Matthewson et al.'s

(2006) theory of evidentials in St'át'imcets, there is simply an underdetermined (contextually determined) epistemic force. In all of these theories, however, evidentials have a fundamentally *epistemic modal* component, making some requirement on the epistemic commitments of *a* towards the target proposition *p*. We will argue in what follows that *youda* lacks any kind of epistemic requirements; the tendency for the use of *youda* to express epistemic commitments is a conversational implicature, and can be cancelled.

Before moving on to a detailed discussion of the evidential relation and (lack of) epistemic commitment encoded by *youda*, the next section reports the results of an experiment that verifies the basic distribution of *youda* as an indirect evidential.

3 *Youda* Requires Specific Indirect Evidence

This section reports the results of an experiment showing that *youda* requires a specific source of indirect evidence for the target proposition, rather than direct evidence or general background knowledge. A naturalness rating experiment was conducted in which native speakers of Japanese judged the naturalness of different combinations of contexts (Witness, Indirect Evidence, General Knowledge) and sentence-final evidential markers (bare assertion, *youda*, *darou*, *ndarou*).

Witness contexts describe situations where the speaker directly witnesses the event or situation described by the target proposition. Indirect Evidence contexts are ones in which the speaker has concrete evidence for the target proposition, but does not witness it directly. General Knowledge contexts are ones in which the speaker is making an inference from background knowledge, without having observed any particular piece of concrete evidence in the context. The choice of sentence final markers was made for the purposes of another study in which the evidential properties of these other markers were investigated. Intuitively, bare declaratives tend to indicate the presence of direct evidence, while *darou* tends to indicate the *absence* of any particular evidence. As has been described, *youda* seems to require specific indirect evidence. The inclusion of *ndarou* was made for the purposes of a separate study, and it is ignored in what follows. The predictions for the distribution of sentence type and context are as follows:

(5) a. Bare declaratives should be rated more natural in Witness contexts than in other contexts, and other sentence endings should be rated less natural than bare declaratives in this context.
     b. Sentences with *youda* should be rated more natural in Indirect Evidence contexts than in other contexts, and other sentence endings should be rated less natural than *youda* in this context.
     c. Sentences with *darou* should be rated more natural in General Knowledge contexts than in other contexts, and other sentence endings should be rated less natural than *darou* in this context.

3.1 Experiment I: Method

Stimuli The stimuli had two fully-crossed factors— three contexts (Witness, Indirect Evidence, and General Knowledge) and four sentence-endings (bare/∅, *youda*, *darou*, and *ndarou*), which resulted in 12 conditions. Each condition had 12 items, resulting in 144 target sentences (12 items × 12 conditions). 48 items from Experiments II and III were also included. The following are examples from one item set:

(6)　　Contexts:

    a.　Witness (Direct Evidence) Context: A wa kinoo Yamadakun ga udetatefuse o hyakkai yatteiruno o mita:
       'A saw Yamada doing 100 push-ups yesterday:'

    b.　Indirect Evidence Context: A wa kinoo Yamadakun ga kurushisoo na koe de hyakkai kazoeruno o kiita:
       'A heard Yamada counting up to 100 in an agonized voice:'

    c.　General Knowledge Context: A wa Yamada kun ga undoo zuki nano o sitteiru:
       'A knows that Yamada likes sports:'

(7)　　Target Sentence:

Yamada-kun-wa kinoo　　　udetatefuse-o hyakkai　　　　　yatta ∅ / youda / darou /
Mr.Yamada-TOP　yesterday push-ups-ACC one.hundred.times did　∅ / YOUDA / DAROU /
ndarou.

NDAROU

'Yamada did 100 push-ups yesterday.'

Procedure　The rating experiment was conducted in a quiet classroom at City University of Hong Kong. The stimuli were presented via a web-based online survey system, Qualtrics.[1] The first page of the test showed the instructions. In the main section, the participants were asked to read the context and target sentence, and then judge the naturalness of stimuli under the given context on a 7-point scale: 7 as very natural and 1 as very unnatural (provided in Japanese). The experiment was organized into 12 blocks separated by break signs. Each block contained 16 items. None of the stimuli were repeated and the order of the stimuli within each block was randomized by Qualtrics. No minimal pair sentences appeared next to each other.

Participants　Fourteen native speakers of Japanese participated in the rating experiment and received 80 Hong Kong dollars as compensation.

Statistics　To analyze the results, a general linear mixed model (Baayen 2008, Baayen et al. 2008, Bates 2005) was run using the lme4 package (Bates et al. 2011) implemented in R (R Development Core Team 2011). Contexts and sentence-endings were the fixed factors. Speakers and items were the random factors. The *p*-values were calculated by the Markov chain Monte Carlo method using the LanguageR package (Baayen 2009).

3.2 Results

Figure 1 shows the average naturalness ratings in each condition for sentences with each of three endings. The discussion above leads to the prediction that the use of *youda* is more natural in the Indirect Evidence context than in either the General Knowledge or Witness contexts. This prediction was confirmed; *youda* utterances were rated most natural in Indirect Evidence contexts (compared with Witness: $t = -12.37$, $p < 0.001$; with General Knowledge: $t = -9.20$,

---

[1]The output for this paper was generated using Qualtrics software, Version 52412 of the Qualtrics Research Suite. ©2014 Qualtrics. Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of Qualtrics, Provo, UT, USA. http://www.qualtrics.com

Figure 1
Rating of bare, *youda*, and *darou* sentences by context
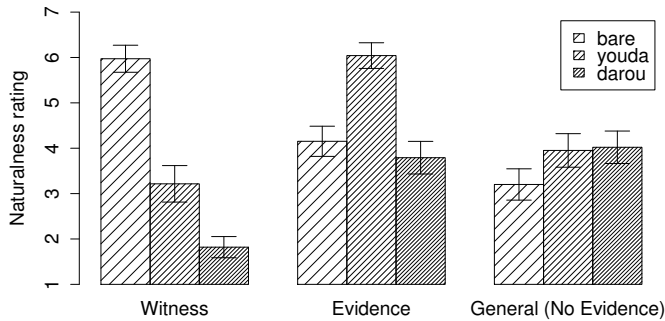
$p < 0.001$).[2]

Discussion   The experimental results described above establish that *youda* marks the proposition in its scope as being based on concrete but indirect evidence. The concreteness of the evidence source is shown by the fact that *youda* is infelicitous in contexts where the evidence is based on general background knowledge. The indirectness is established by the infelicity of *youda* in contexts where the speaker has directly witnessed the situation/event described by the target proposition. These results provide a solid empirical footing for the pre-theoretical description of *youda* as an indirect evidential. In the following sections, we explore the kind of indirect evidentiality encoded by *youda* in more detail; the next section shows that, contra M&O, it makes no epistemic requirements on the agent toward the target proposition.

4 Epistemic Commitment

4.1 Epistemic Commitment is Cancellable

According to M&O, *youda* imposes a minimal degree of commitment toward its propositional complement; putting aside the exact degree required (this is conceivably contextually variable), the theory gives to evidentials an epistemic component, predicting that utterance of *p-youda* will entail *might*(*p*). A commitment to *might*(*p*) in turn contradicts a commitment to ¬*p*, as illustrated by the following example. Notice that in English, the sequence becomes acceptable if the epistemic modal 'might' is replaced by the evidential-like 'seems like' construction:

(8)   a.   #It might be raining but in fact it isn't.
         b.   It seems like it's raining but in fact it isn't.

An utterance of *p-youda* is thus predicted to be incompatible with a subsequent utterance of ¬*p*, if in fact *p-youda* requires a minimal epistemic commitment to *p*. This is not, however, the case, as illustrated by the acceptability of the following example:

---

[2]Witness contexts made bare utterances most natural (compared with Indirect Evidence: $t = -8.448$, $p < 0.001$; with General Knowledge: $t = -13.548$, $p < 0.001$). General Knowledge contexts made *darou* utterances most natural (compared with Witness: $t = -11.130$, $p < 0.001$; with Indirect Evidence: $t = -0.849$, $p = 0.397$).

(9)   Context: There are a lot of empty wine bottles in John's room.
        Kinou   John-wa wain-o   takusan nonda youda kedo, jitsu-wa   nondeinai.
        yesterday John-TOP wine-ACC many   drank YOUDA but   really-TOP has.not.drank
        'It looks like John drank a lot of wine yesterday, but in fact he didn't drink any.'

Here, the speaker is saying that while it *appears* (based on the evidence of the empty bottles)
that John drank a lot of wine the previous night, John did not in fact drink, appearances notwith-
standing. The felicity of this sequence can be contrasted with other elements which can pre-
theoretically be described as either evidential or modal markers. For example, the particle *darou*,
which according to Hara (2006) generates a minimal epistemic commitment on the part of the
speaker, is not felicitous with a subsequent denial of its propositional complement:

(10)   Context: John often drinks wine.
        #Kinou   John-wa wain-o   takusan nonda darou kedo, jitsu-wa   nondeinai.
         yesterday John-TOP wine-ACC many   drank DAROU but   really-TOP has.not.drank
         'John probably drank a lot of wine yesterday, but in fact he didn't drink any.'

Infelicity is also seen with other elements that contribute an epistemic requirement on their
propositional complements, such as *kamosirenai* 'might' (11) and *hazu* 'should' (with an epis-
temic interpretation) (12):

(11)   ??Kinou   John-wa wain-o   takusan nonda kamosirenai kedo, jitsu-wa   nondeinai.
        yesterday John-TOP wine-ACC many   drank might   but   really-TOP has.not.drunk
        'John might have drunk a lot of wine yesterday, but in fact he didn't drink any.'

(12)   ??Kinou   John-wa wain-o   takusan nonda hazu   da kedo, jitsu-wa   nondeinai.
        yesterday John-TOP wine-ACC many   drank should COP but   really-TOP has.not.drunk
        'John should have drunk a lot of wine yesterday, but in fact he didn't drink any.'

    The above intuitions were verified by an experiment run alongside the previously described
Experiment I. We now provide the results of that experiment.

4.2 Experiment II: Method

Stimuli The stimuli had three conditions depending on the sentence-ending: bare/∅, *youda*, and
darou. Each condition had 12 items, resulting in 36 target sentences (12 items × 3 conditions).
144 items from Experiments I and III were also included. An example item is given below:

(13)   Yamadakun-wa kinoo   udetatefuse-o hyakkai   yatta (∅/youda/darou) kedo,
        Mr.Yamada-TOP yesterday push.up-ACC   one.hundred did   (∅/YOUDA/DAROU) but
        jitsu-wa   yatte-nai.
        truth-TOP did-NEG
        'Mr. Yamada did 100 push ups yesterday (∅/*youda*/*darou*), but in fact he didn't.'

In each item, a sentence with one of the three endings is combined with a negation of that
sentence. Given the intuitions above, we predict that such sequences will be rated more natural
for sentences ending in *youda* than either bare declaratives or those ending in *darou*.
    The procedure, participants and statistics were the same as Experiment I.

Figure 2
Rating of bare, *youda*, and *darou* sentences with subsequent cancellation
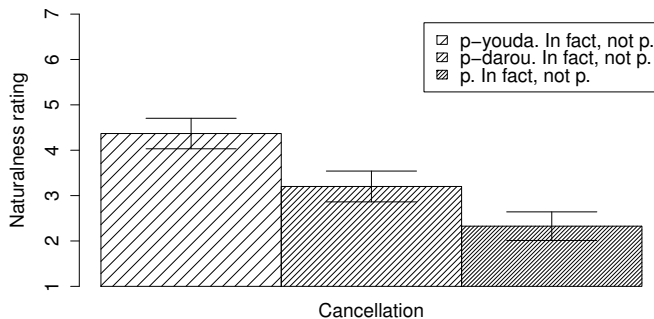
4.3 Results

Figure 2 shows the average naturalness ratings in each condition. The cancellation of *youda*-sentence was judged the most natural (compared with *darou*: $t = -6.285$, $p < 0.001$; with the bare assertion: $t = -11.117$, $p < 0.001$).

4.4 Discussion

The felicity of *p-youda* & $\neg p$ sequences suggests that *youda* is not an epistemic modal of any kind, whether a classical possibility modal, a probabilistic minimal-commitment modal, or even an epistemic modal that is unspecified for quantificational force, as in Matthewson et al.'s (2006) theory of evidentials in St'át'imcets. Although Matthewson et al. (2006) argue that evidentials in St'át'imcets do not encode quantificational force, they are nevertheless shown to be incompatible with contexts in which it is known that their propositional complement is false:

(14)   Context: You had done some work for a company and they said they put your pay,
         $200, in your bank account. But actually, they didn't pay you at all.
         *um'-en-tsal-itás   ku7   i   án'was-a xetspqíqen'kst táola, t'u7 aoz kw
         give-DIR-1SG.OBJ-3PL.ERG REPORT DET.PL two-DET hundred   dollar but NEG DET
         s-7um'-en-tsál-itas   ku   stam'
         NOM-give-DIR-1S.OBJ-3P.ERG DET what
         'They gave me $200 [I was told], but they didn't give me anything.' (Matthewson et al.
         2006:20)

This difference suggests that *youda* does not encode epistemic modality of any kind, whether couched in a traditional Kratzerian (1991) framework (Izvorski 1997, Matthewson et al. 2006, a.o.) or a probabilistic framework (McCready and Ogata 2007). The logic here follows that of Faller (2002), who shows that the Cuzco Quechua reportative evidential *-si* can mark propositions known by the speaker to be false. Faller argues on the basis of this fact that use of the Cuzco Quechua reportative evidential entails no epistemic commitment on the part of the speaker toward the proposition expressed; it is instead "presented" to the listener. Murray (2010) presents similar arguments for the Cheyenne reportative evidential; following Faller, she uses deniability facts like those discussed here for *youda* to argue against an epistemic modal analysis of

reportative evidentials in Cheyenne.

Matthewson (2012) has recently called into question this line of argument, putting forth the strong thesis that *all* evidentials are epistemic modals, even those whose deniability behavior has been taken to argue against such an analysis. Matthewson's argument is based primarily on the apparently non-modal St'át'imcets evidential *lákw7a*, which like *youda* is can be used felicitously with a proposition that is subsequently denied. Matthewson follows the approach of Kratzer (2012), according to which the truth-conditions of an epistemic modal are dependent on a conversational background, which can be realistic or informational. Given that it is only modals with a realistic conversational background that commit speakers to the truth of their propositional complements, evidentials allowing for deniability, such as *youda*, can still be given an epistemic modal semantics, with the caveat that they allow for an informational conversational background. The point is taken; the evidence cited above at most shows that it is *possible* that *youda* is not an epistemic modal. As we show below, *youda* requires that a non-trivial relation hold between the evidence source and the target proposition. When the semantics of this relationship is spelled out explicitly, we can account for the other features of *youda*'s meaning without appealing to an additional epistemic modal component. We thus conclude that no such meaning component is necessary in describing the semantics of *youda*.

5 An Asymmetric Evidential Relation

5.1 An Asymmetry

Having established that *youda* makes no requirements on the beliefs of the agent toward the target proposition, we now turn to the connection between the target proposition p and the evidence source e. According to M&O, this connection is based on Bayesian belief revision, with a piece of information e serving as evidence for the target proposition p just in case learning e causes an increase in the subjective probability assigned to p. This was illustrated with the example in (4), repeated below:

(15)   Context: Looking at a wet street.
        Ame-ga   futta youda.
        rain-NOM fell   YOUDA
        'It seems that it rained.'

According to M&O, the information that the street is wet serves as evidence for the proposition that it rained just in case learning this fact increases the subjective probability that it rained.

In the following example, we have switched the target proposition and evidence source:

(16)   Context: Looking at falling raindrops.
        #Michi-ga   nureteiru youda.
         streets-NOM wet   YOUDA
         'It seems that the streets are wet.'

The resulting utterance is predicted to be felicitous under M&O's account, given that the speaker has witnessed it raining in a manner compatible with the lexical restrictions of *youda*, and that its having rained is sufficient evidence to bump up the probability that the streets are wet. The reasoning is spelled out as follows: (i) the information 'it is raining' has led the speaker to raise her subjective probability for the proposition 'the streets are wet', (ii) the resulting subjective

probability for 'the streets are wet' is greater than .5 but less than 1, and (iii) the speaker has accessed the information 'it is raining' in a manner compatible with the lexical restrictions peculiar to *youda*. The sentence is, however, infelicitous. The infelicity here reflects a general fact about *youda*: the target proposition and evidence source cannot generally be switched, even in contexts where the original target proposition can be understood as forming evidence (in the sense of M&O) for the original evidence source. We argue that this asymmetry is due to the fact that *youda* encodes an asymmetric *causal relation* between the target proposition and the evidence source; the asymmetry of this causal relation explains why switching the target proposition and evidence source results in infelicity. In the following section, we present the results of an experiment conducted to verify the intuition that *youda* links evidence source to the target proposition by means of an asymmetric causal relation.

5.2 *Experiment III: Method*

Stimuli The stimuli had two conditions, *p-youda* and *q-youda* for each causal relation CAUSE(p, q), which holds just in case p can be taken as being part of a causal explanation for q. Each condition had 12 items, resulting in 24 target sentences (12 items $\times$ 2 conditions). 144 items from Experiments I and II were also included.

(17) a. *p-youda* Context: A wa kinoo Yamada kun ga kurushisoo na koe de hyakkai ka-zoeruno o kiita:
        'A heard Yamada counting up to 100 in a struggling voice:'

    b. Yamada-kun-wa kinoo   udetatefuse-o hyakkai   yatta youda.
        Mr.Yamada-TOP yesterday push.up-ACC one.hundred.times did YOUDA
        'Yamada did 100 push ups yesterday *youda*.'

(18) a. *q-youda* (Reverse) Context: Yamada kun wa kinoo udetatefuse o hyakkai yatta.
        'Yamada did one hundred push ups yesterday.'

    b. kinoo   tonari-no heya-no Yamadakun-ga kurusisouna koe-de hyakkai
        yesterday next-GEN room-GEN Mr.Yamada-NOM struggling   voice-in one.hundred
        made kazoeta youda.
        up.to count   YOUDA
   'Yamada counted up to 100 in a struggling voice next door yesterday *youda*.'

Each of the above sentences involves a relationship between two propositions, p = 'Yamada did 100 push ups yesterday' and q = 'Yamada counted up to one hundred in a struggling voice next door yesterday.' Intuitively, p serves as part of a causal explanation for q, but not vice-versa; Yamada can be said to have counted to 100 because he did 100 push ups, but cannot be said to have done 100 push-ups because he counted to 100. The proposition p is thus naturally understood as part of an asymmetrical causal explanation for q, but not vice versa. We hypothesize that *youda* must mark p in such relationships, and thus that *p-youda* will be rated more natural than *q-youda*.

     The procedure, participants and statistics were the same as Experiments I and II.

5.3 *Results*

Figure 3 shows the average naturalness ratings in each condition. Given CAUSE(p, q), *p-youda* sentences were judged more natural than *q-youda* sentences ($t = -11.77, p < 0.001$).

Figure 3
Ratings of *p*(cause-event)-*youda* and *q*(effect-event)-*youda* sentences
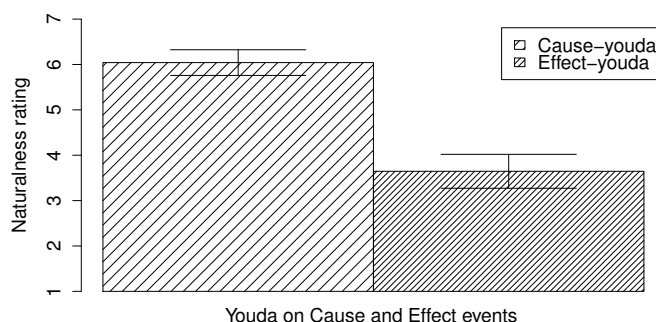
5.4 Discussion

The results of Experiment III confirm that the relation between the prejacent proposition *p* and the evidence information *q* is asymmetric. Given a causal relation where *p* causes *q*, *youda* can be attached to a proposition *p* which is inferred from an evidence source described by *q*; in the reverse situation, naturalness drops significantly. According to M&O, however, the relation between the prejacent proposition *p* and the evidence information *q* is in principle symmetric, given that learning *p* leads to an increased probability for *q* and vice-versa. The asymmetry observed here is left unexplained.

This problem is not limited to theories based on Bayesian probabilities. It also holds for theories that model a dependency using more traditional logical tools, for example, the conditional relations employed by Takubo (2009). According to Takubo (2009), *youda* can be attached to a sentence denoting the conclusion *p* when there is a piece of information *q* that abductively derives *p* from the background knowledge $p \rightarrow q$. For instance, in (15), we have a major premise 'If it rains, the streets are wet' as background knowledge. The new information 'the streets are wet' counts as abductive evidence for the propositional complement of the *youda*-utterance in (15).

(19)　　Abductive reasoning
　　　　Major premise　　If it rains, the streets are wet.
　　　　Minor premise　　The streets are wet.
　　　　Conclusion　　　It rains.

In (16), given the same major premise 'If it rains, the streets are wet', the prejacent proposition 'The streets are wet' is a conclusion derived by deductive reasoning, not abduction, and hence *youda* cannot be attached.

Although we think Takubo's insight on the directionality of the inference is on the right track, the modeling of this asymmetry in terms of logical abduction is not strong enough to predict the correct distribution of *youda*-sentences. Consider the following biconditional, which could reasonably be part of a speaker's background knowledge.

(20)　　You have red-brown spots on the skin ↔ You have measles

Given the bidirectionality of (20), there are two conditional statements which are part of our background knowledge. One is that if you have measles, you have red-brown spots on the skin. If the speaker *a* perceives that Taro has red-brown spots on the skin, *a* can abductively derive a conclusion that Taro has measles:

(21) | Major premise | If one has measles, then one has red-brown spots on the skin. |
        | Minor premise | Taro has red-brown spots on the skin. |
        | Conclusion | Taro has measles. |

Thus, Takubo's analysis correctly predicts that *youda* can be attached to the abductive conclusion:

(22)   Context: Looking at Taro's skin.
        Taro-wa   hashika no   youda.
        Taro-TOP measles COP YOUDA
        'Taro seems to have measles.'

In contrast, the other direction of the biconditional is problematic for Takubo's analysis. The background assumption in (20) licenses the abductive inference in (23):

(23) | Major premise | If one has red-brown spots on the skin, then one has measles. |
        | Minor premise | Taro has measles. |
        | Conclusion | Taro has red-brown spots on the skin. |

Thus, according to Takubo's analysis, if the speaker perceives a situation where Taro has measles, she could abductively conclude that Taro has red-brown spots. In turn, *youda* should be able to attach to this conclusion. However, this is the wrong prediction:

(24)   Context: Looking at Taro's medical certificate saying 'measles'
        #Taro-wa akachairo-no   shisshin-ga aru   youda.
        Taro-TOP red-brown-GEN spots-NOM exist YOUDA
        'Taro seems to have red-brown spots.'

The crucial difference between (22) and (24) is that the conditional relation $p \rightarrow q$ employed for the inference in (22) is based on a causal relation. Thus, causality seems to be indispensable in defining the indirect evidentiality of *youda*. On the basis of this observation, we propose that for the purposes of using *youda* a piece of information q can be regarded as indirect evidence for p just in case q situations/events are caused by p situations/events, CAUSE(p, q).

6 Proposal: Indirect Evidence via Causal Connection

6.1 A Causal Semantics of youda

The evidence adduced in the previous sections shows that *youda* does not seem to demand the kind of epistemic commitment on the part of the speaker that would be expected according to analyses based on epistemic modality (including those based on probabilistic belief commitment). Moreover, the connection between the evidence source e and the target proposition p is asymmetrical in a way that is left unexplained by theories of evidence based on probabilistic or conditional dependencies between propositions.

In this section we propose a semantics of *youda* that links the evidence source and target

proposition via an asymmetric relation of causation. The idea is that the target proposition p can be taken under normal circumstances as a plausible cause for the perceived evidence source e. What *youda* does is first to state the existence of an evidence source e, knowledge of which has to have been acquired by the agent a in a way compatible with the lexical restrictions of *youda* (visual, auditory, tactile, etc). It then says that there is some property q of the evidence source which stands in a causal relation with p, such that p events cause q events. These ideas are spelled out in the following denotation:

(25)   Let s be the semantic type of events/situations:

    a. $[\![\text{youda}]\!]^a = \lambda p_{\langle s,t \rangle} \lambda e_s.\ \text{PERCEIVE}(a,e)\ \&\ \exists q\,[q(e)\ \&\ \text{CAUSE}(p,q)]$

    b. $\text{PERCEIVE}(a,e)$ is true iff
            a perceived e in a manner compatible with the lexical restrictions of *youda*.

    c. $\text{CAUSE}(p,q)$ is true iff for some c in p and some e in q, c causes e.   (modified from Lewis 1973:558)

The particular conditions required by $\text{PERCEIVE}(a,e)$ are ignored in what follows. We focus our attention on $\text{CAUSE}(p,q)$, which is the means by which *youda* indicates the existence of evidence for the target proposition p. The relation is defined between propositions (properties of events/situations) and requires that some p events/situations cause some q events/situations.[3] Causation as such is thus a relation that holds between particular events/situations; the CAUSE relation holds between propositions p and q, and makes an existentially quantified claim about the sets of situations characterized by p and q. The assertion of p-*youda* does not entail that there exists a particular p event c which causes the particular q event e that is perceived by agent a; it only requires that some p events are in a causal relation with some q events.

    The above denotation includes no statement of an epistemic attitude on the part of the agent a towards p. Moreover, there is no encoding of 'evidence' as such. Instead, these features of interpretation (that the perceived event counts as evidence for p, and that the agent has some resulting epistemic commitment toward p) are left as implicatures deriving from the causal relation that *youda* encodes. That is, *youda* acts as an indirect evidential by indicating a causal connection between the evidence source and the target proposition. In cases where a is understood as the speaker, the assertion that a perceived some situation of a kind that is normally caused by p situations/events generally licenses a conclusion that the speaker thinks there is some evidence for p, and has a corresponding commitment to its truth.

    We now show how this semantics applies to some of the examples considered so far, and how it can explain the facts observed earlier in the paper.

6.2 Cancellable Commitment

We first apply the above semantics to (4), repeated in (26).

(26)   Context: Looking at a wet street.
        Ame-ga   futteru youda.
        rain-NOM falling   YOUDA
        'It seems to be raining.'

---

[3]We assume the view of situations outlined in Kratzer (1989); Davidsonian events and Kratzerian situations are not distinguished, and are given the primitive type s in our model.

In this and the following examples, the agent *a* is resolved to the speaker. The target proposition *p* = 'it is raining', and the evidence source *e* is the wet street observed by the speaker; *e* thus has the salient property *q*, where *q* = 'the streets are wet'. The use of *youda* requires that CAUSE(p, q) is true, meaning that situations in which the streets are wet are caused by events/situations in which it is raining. Since this is true, the sentence as a whole can be judged true (given that the wet streets were observed by the speaker in a way compatible with the lexical restrictions of *youda*).

As a pragmatic implicature, the speaker is understood to be providing evidence for the proposition that it rained, and also to be committed to the likelihood or possibility of it actually raining. But as observed earlier, this commitment seems to be cancellable, meaning that it should not be included as an entailment or presupposition of the sentence:

(27)   Ame-ga   futteru youda kedo, jitsu-wa   futteinai.
        rain-NOM falling YOUDA but   truth-TOP not.falling
        'It seems to be raining, but it's not.'

Although such cancellations were shown in Experiment II to be judged significantly more natural than ones involving bare declaratives or declaratives marked with *darou*, the average rating (around 4.5 out of 7) indicates that speakers still feel that such cancellations are less than perfect. We think this is similar to other cases in which a conversational implicature is cancelled:

(28)   ?Some people came to the party, and in fact everyone came.

We note that the slight infelicity resulting from the cancellation of *youda* sentences disappears in examples like the following, in which *youda* is replaced by *youni mieru*, a sentence ending built from an adverbial form of *youda* plus *mieru*, meaning 'to appear':

(29)   Ame-ga   futteru youni mieru kedo, jitsu-wa   futteinai.
        rain-NOM falling YOUDA appear but   truth-TOP not.falling
        'It looks like it's raining, but it's not.'

We suspect that these two forms, *youda* and *youni mieru*, compete with each other pragmatically. Since the more marked form *youni mieru* tends to indicate a lack of commitment to the truth of *p*, the less marked form comes to indicate some commitment to its truth.

6.3 Causal Asymmetry

As seen in the following example, *youda* is unacceptable if we reverse the propositions *p* = 'it is raining' and *q* = 'the streets are wet' from the above example:

(30)   Context: Looking at falling raindrops.
        #Michi-ga   nureteiru youda.
         streets-NOM wet   YOUDA
         'It seems that the streets are wet.'

In this example, the speaker witnesses rain, and infers wet streets. Although this is acceptable as a general kind of reasoning, use of *youda* for the proposition 'the streets are wet' is infelicitous. This follows directly from our account, since use of *youda* in this example would indicate that wet streets cause rain. More generally, given that causation is asymmetric, we predict that the

evidence proposition and target proposition cannot be switched on a felicitous *youda* sentence to produce another felicitous *youda* sentence. The evidential relation encoded by *youda*, based on causation, is intrinsically asymmetrical.

6.4 Embeddability

Our proposal makes the semantic contribution of *youda* a truth-conditional, assertional part of the resulting sentence, rather than a presupposition or a conventional implicature. Although it is beyond the scope of this paper to discuss the compositional semantics of *youda* in embedded contexts, the following examples show that *youda* can be semantically embedded under past tense (31), negation (32), and in the antecedent of conditionals (33), facts that fall out naturally under an account in which the semantic content of *youda* is a truth-conditional component of the at-issue assertion.

(31)   Embedding under past tense:
        Ame-ga   furu youda-tta.
        rain-NOM fall   YOUDA-PAST
        'It seemed that it was going to rain.'

(32)   Embedding under negation (see McCready and Ogata 2007, Hara 2006):
        Ame-ga   furu youja-nakat-ta.
        rain-NOM fall   YOUDA-NEG-PAST
        'It didn't seem that it was going to rain.'

(33)   Embedding in the antecedent of a conditional (see McCready and Ogata 2007):
        Ame-ga   futta youda-tta-ra,   hana-ni   mizu-wa   yara-nai.
        rain-NOM fell   YOUDA-PAST-if, flower-DAT water-TOP give-NEG
        'If it seems that it has rained, I won't water the flowers.'

6.5 Evidence via Causation

In much of the previous literature on evidentiality, the notion of indirect evidentiality has been left unanalyzed, as pointed out by McCready (2010). McCready and Ogata (2007) provide a concrete analysis of indirect evidentiality based on Bayesian probabilities; as has been shown, this account cannot explain the asymmetry of the evidential relation encoded by *youda*. In this paper, we have claimed that the notion of asymmetric causation is indispensable in characterizing at least one kind of evidentiality: a piece of information e is regarded as evidence for the proposition p just in case the agent a perceives the situation e, which has a property q, and q situations are caused by p situations. What then is a causal relation? In this paper, we leave causation as a primitive, though we note in passing that causal relations have often been considered a formative feature of natural language semantics.

One of the most influential analyses of causation is Lewis's (1973) counterfactual theory:

(34)   Where c and e are two distinct possible events, e causally depends on c if and only if, if
        c were to occur, e would occur; and if c were not to occur, e would not occur.   (from
        Menzies 2014)

For instance, the lighting of a match causally depends on someone's striking it if and only if, if she struck the match, it would light; and if she did not strike the match, it would not light.

Kaufmann (2013) reverses Lewis's (1973) idea, deriving the interpretation of counterfactuals from causality.

There are also philosophical and linguistic discussions on what count as causal relata, that is, what kinds of semantic objects can be the arguments of causal relations. Some argue that causal relata are *events* (Davidson 1967, Lewis 1973). Others argue that they are *facts* (Bennett 1988, Mellor 1980), and there are a large number of other proposals besides (see Hara et al. 2013 for an overview of different approaches). Under the events-as-causal-relata approach, causation is understood as a relation between concrete objects located in space and time. It is beyond the scope of this paper to develop an analysis of causation itself; we note only that recent work such as that of Kaufmann (2013) suggests treating causation as a cognitive primitive, and building other linguistic notions, such as counterfactuality, on the basis of it. We think this is the right approach for the kind of evidentiality encoded by *youda*.

There are other phenomena in the grammar of Japanese suggesting a close link between evidentiality and causation. Tenny (2006), for example, argues that the Japanese causal connective *node* bears an evidential meaning. One of the characteristics of Japanese evidential morphemes is to lift the person constraint of predicates of direct experience:

(35)   a.   *Taroo-wa kanasii/uresii/samui.
                Taro-TOP sad/glad/cold
                'Taro is sad/glad/cold.'   (adapted from Shibatani 1990:384)
         b.   Taroo-wa kanasii/uresii/samui youda.
                Taro-TOP sad/glad/cold   YOUDA
                'Taro seems sad.'   (adapted from Shibatani 1990:384)

Tenny (2006) shows that sentence final auxiliaries are not the only category which has this property; the effect is also ameliorated by the causal connectives *kara/node*. Take the following pair of examples. In (36a), where the adjunct clause is headed by the temporal *toki*, the predicate *samui* 'cold' can only be interpreted non-thematically, 'it was cold'. That is, the third person *kare* cannot be the experiencer. In (36b), on the other hand, both non-thematic and thematic interpretations are possible.

(36)   a.   Kare-wa samukatta toki,   dambou-o ireta.
                he-TOP   cold.PAST when, heater.ACC put.on-PAST
                'When it was cold, he put on the heat.'
                *'When he felt cold, he put on the heat.'   (Shinko Tamura, p.c. to 2006)
         b.   Kare-wa samukatta node,   dambou-o ireta.
                He-TOP   cold.PAST because, heater-ACC put.on.PAST
                'Because it was cold, he put on the heat.'
                'Because he felt cold, he put on the heat.'   (Shinko Tamura, p.c. to 2006)

As discussed by Hara (2008), the crucial semantic difference between the temporal and causal adjuncts seen in (36) is that sentences with a temporal adjunct express quantification over event properties, while sentences with a causal adjunct express a relation between closed propositions (see also Johnston 1994). Unlike temporal quantification, a causal relation is established when a cognitive agent perceives a particular event described in the complement sentence and causally connects the event to another event. In this sense, the causal connective plays a

role as an evidential marker.

7 Conclusion

We have investigated the nature of indirect evidentiality on the basis of the Japanese evidential marker *youda*. We frame our analysis in terms of three components: an agent *a*, a target proposition *p*, and an evidence source *e*, and three relations among them. The means of acquiring evidence, that is, the relation between *a* and *e*, is lexically specified by *youda*, although we left the details of this meaning dimension aside in this paper. We proposed that *youda* expresses *a*'s epistemic commitment to *p* as a cancellable implicature. A modalized statement like *might*(*p*) encodes the agent's epistemic commitment to *p*, which is not cancellable, that is, *might*(*p*) & ¬*p* is a contradiction. A treatment of *youda* as a species of epistemic modal would semantically encode the agent's epistemic commitment to *p*, making subsequent denial of *p* infelicitous; the results of Experiment II show that this is a wrong prediction.

Finally, we claim that the evidential relation between *p* and *e* is asymmetric and based on a causal relation holding between *p* and some salient property *q* that characterizes *e*. Given the inherent asymmetry of causation, this account correctly predicts the observation confirmed in Experiment III that one cannot switch the target proposition and evidence proposition of a *youda* sentence felicitously. This asymmetry is not predicted by the account of McCready and Ogata (2007), in which the evidential relation for *youda* and other evidentials is defined in terms of Bayesian probabilities, since they are in principle symmetrical, being based only on the effect that learning one piece of information has on the subjective probabilities assigned to another proposition. We also showed that the abduction-based account of Takubo (2009) is not strong enough, due to the fact that dependencies between propositions in this account are based on conditional statements, and hence in principle symmetric, since bi-conditional generalizations can be part of our background knowledge.

In summary, we have argued that the indirect evidentiality of *youda* can only be explained by reference to asymmetric causal relations, rather than epistemic, probabilistic, or conditional dependencies. A piece of information *e* is regarded as indirect evidence for the prejacent proposition *p* just in case the agent *a* perceives *e*, which has a property *q*, and *q* situations are often caused by *p* situations. Since *youda*-utterances merely assert the existence of a potential causal relation between the perceived situation and the prejacent proposition, the speaker is not epistemically committed to *p* itself; the evidential and epistemic components of *youda* are derived as implicatures from a core semantics based on causation.

References

Aoki, Haruo. 1986. Evidentials in Japanese. In *Evidentiality: The linguistic coding of epistemology*, ed. Wallace Chafe and Johanna Nichols. Norwood, New Jersey: Ablex Publishing Corporation.

Baayen, Harald R. 2008. *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge: Cambridge University Press.

Baayen, Harald R. 2009. LanguageR. R package.

Baayen, Harald R., Doug J. Davidson, and Douglas M. Bates. 2008. Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language* 59:390–412.

Bates, Douglas. 2005. Fitting linear mixed models in R. *R News* 5:27–30.

Bates, Douglas, Martin Maechler, and Ben Bolker. 2011. lme4: Linear mixed-effects models using S4 classes. R package.

Bennett, Jonathan F. 1988. *Events and their names*. Clarendon.

Davidson, Donald. 1967. Causal relations. *Journal of Philosophy* 64:691–703.

Faller, Martina. 2002. Semantics and Pragmatics of Evidentials in Cuzco Quechua. Doctoral Dissertation, Stanford University.

Hara, Yurie. 2006. Japanese discourse items at interfaces. Doctoral Dissertation, University of Delaware, Newark, DE.

Hara, Yurie. 2008. Evidentiality of discourse items and *because*-clauses. *Journal of Semantics* 25:229–268.

Hara, Yurie, Youngju Kim, Hiromu Sakai, and Sanae Tamura. 2013. Projections of events and propositions in Japanese: A case study of *koto*-nominalized clauses in causal relations. *Lingua* 133:262–288.

Izvorski, Roumyana. 1997. The present perfect as an epistemic modal. In *The Proceedings of SALT 7*, 222–239.

Johnston, Michael. 1994. The syntax and semantics of adverbial adjuncts. Doctoral Dissertation, UCSC.

Kaufmann, Stefan. 2013. Causal premise semantics. *Cognitive Science* 37:1136–1170.

Kratzer, Angelika. 1989. An investigation of the lumps of thought. *Linguistics and Philosophy* 12:609–653.

Kratzer, Angelika. 1991. Modality. In *Semantics: An international handbook of contemporary research*, ed. Arnim von Stechow and Dieter Wunderlich, 639–650. Berlin: de Gruyter.

Kratzer, Angelika. 2012. *Modals and conditionals: New and revised perspectives*, chapter 2: The Notional Category of Modality. Oxford University Press.

Lewis, David. 1973. Causation. *The Journal of Philosophy* 70:556–567.

Matthewson, Lisa. 2012. Evidence about evidentials: Where fieldwork meets theory. In *Empirical approaches to linguistic theory: Studies of meaning and structure*, ed. Britta Stolterfoht and Sam Featherston, 85–114. Berlin: De Gruyter.

Matthewson, Lisa, Hotze Rullmann, and Henry Davis. 2006. Evidentials are epistemic modals in St'át'imcets. In *The Forty-first International Conference on Salish and Neighbouring Languages*, ed. Masaru Kiyota, James L. Thompson, and Noriko Yamane-Tanaka, University of British Columbia Working Papers in Linguistics 18, 221–263.

McCready, Eric. 2010. Evidence from evidentials. In *University of British Columbia Working Papers in Linguistics*, ed. Tyler Peterson and Uli Sauerland, volume 28, 105–127.

McCready, Eric, and Norry Ogata. 2007. Evidentiality, modality and probability. *Linguistics and Philosophy* 30:35–63.

Mellor, D. H. 1980. On things and causes in spacetime. *The British Journal for the Philosophy of Science* 31:282–288.

Menzies, Peter. 2014. Counterfactual theories of causation. In *The Stanford encyclopedia of philosophy*, ed. Edward N. Zalta. Spring 2014 edition. URL http://plato.stanford.edu/archives/spr2014/entries/causation-counterfactual/.

Murray, Sarah. 2010. Evidentiality and the structure of speech acts. Doctoral Dissertation, Rutgers.

R Development Core Team. 2011. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/, ISBN 3-900051-07-0.

Shibatani, Masayoshi. 1990. *The languages of Japan*. Cambridge.

Takubo, Y. 2009. Conditional modality: Two types of modal auxiliaries in Japanese. In *Japanese modality: Exploring its scope and interpretation*, ed. B. Pizziconi and M. Kizu. Palgrave Macmillan.

Tenny, Carol. 2006. Evidentiality, Experiencers, and the Syntax of Sentience in Japanese. *Journal of East Asian Linguistics* 15:245–288.

Waldie, Ryan. 2012. Evidentiality in Nuu-chah-nulth. Doctoral Dissertation, The University of British Columbia.

(Davis)   *(Hara)*
University of the Ryukyus   *City University of Hong Kong*
cmdavis@ll.u-ryukyu.ac.jp   *y.hara@cityu.edu.hk*