Evidential meaning of English clause-embedding verbs

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Abstract

English clause-embedding verbs can be used in the evidential meaning (Simons, 2007; Murray, 2017), modulating the degree to which the speaker is committed to the truth of the proposition in the embedded clause. For example, an utterance like "I think the movie starts at 4" can signal that the speaker is uncertain whether the proposition *the movie starts at 4* is true, and would like to attenuate their claim. Previous research has provided detailed accounts of lexical and contextual features that give rise to evidential meanings — however, less is known about how widespread these uses are, whether they are part of the verb's lexical meaning, or emerge under certain pragmatic conditions. In this study, we addressed these questions by conducting two large-scale acceptability judgment experiments. In line with the observations in literature (Simons, 2007), we found that non-factive clause-embedding verbs are the most acceptable in evidential contexts. We also found, however, that even highly factive verbs can be acceptable as evidentials under favorable pragmatic conditions.

Keywords: clause-embedding verbs; evidentiality; Questions Under Discussion

Introduction

English clause-embedding verbs typically express the speaker's attitude toward the proposition in the embedded clause:

(1) John believes that smoking is bad for you.

(2) John knows that smoking is bad for you.

(3) John understands that smoking is bad for you.

The information conveyed by the sentences in (1)–(3) concerns John's mental states: his beliefs, knowledge, and facts about the world that he understands. Based on this information alone, our judgments about the truthfulness of the proposition in the embedded clauses would be limited. If John believes that smoking is bad, that does not say anything about whether smoking is actually bad. Hearing that John *knows* or *understands* that smoking is bad might increase our confidence that smoking is, in fact, bad (as the predicates *know* and *understand* usually apply to truthful prepositions[1]) — still, the main point of the sentences in (1)–(3) is not to communicate something about the dangers of smoking, but rather about John's mental attitudes towards smoking.

Additionally, clause-embedding verbs are frequently used in a different context, and in a different function. Consider the dialogue:

(4) Speaker A: Do you know if Laura is going to the party?
Speaker B: I think she's working late again.

On the surface, the utterance made by Speaker B is similar to (1)–(3): the main verb *think* embeds the clause *she's working late again* and semantically resembles *believe* and *know* — all three can describe mental states. But in this context, where the speaker's goal is to answer a question about Laura's whereabouts, their own mental state is not the central focus. Instead, the main clause *I think* modulates the degree to which the speaker is committed to the proposition expressed by the embedded clause. A natural interpretation of the sentence in (4) is that Speaker B feels somewhat confident that Laura is working late and would not be able to attend the party, but their evidence might be indirect (e.g. Speaker B was leaving the office and noticed that Laura was still working) and they want to signal that they are not fully committed to the proposition in the embedded clause (e.g. Laura could have been just wrapping up work before heading to the party).

In order to distinguish between the two types of uses discussed, we will refer to the uses of clause-embedding verbs that center mental states (like in examples (1)–(3)) as **mentalistic** or **attitude uses**. We will refer to the uses of clause-embedding verbs that are not the main point of the utterance (like in (4)) as **evidential uses**, and to the contexts that trigger the evidential interpretation of clause-embedding verbs as **evidential contexts**. While the term *evidential* is traditionally reserved for morphological evidentiality markers in typological literature (Aikhenvald, 2004; Murray, 2017), we follow Simons 2007 in using it more broadly to describe all uses of clause-embedding verbs which do not reference mental states and do not carry the main point of an utterance[2].

[1] Although previous research suggests that even verbs considered to be highly factive (like *know* and *understand*) show variability as to how truthful the prepositions they embed are likely to be, depending on context (Tonhauser, Beaver, & Degen, 2018).

[2] On this definition, evidential uses of clause-embedding verbs concern primarily the degree of speaker's certainty, rather than the source of the information in the embedded clause. However, the two notions are not necessarily inconsistent: Matthewson 2012 has suggested that even in languages with morphological evidentiality markers, evidentials can contribute epistemic modal semantics, and epistemic modals can contribute evidential semantics (see also Matthewson 2020 for discussion)

Not all clause-embedding verbs are acceptable in evidential contexts. For example, it might be less acceptable if Speaker B's response in (4) was *I **understand** she's working late again* and even more odd if it was *I **regret** that she's working late again*. What makes *think* and *believe* sound more acceptable than *understand* and *regret* in an evidential context?

Previous investigations of evidential uses of clause-embedding verbs (Rooryck, 2001a, 2001b; Simons, 2007) have proposed that a number of lexical features — such as factivity and the acceptability of a verb with sentence lifting (Ross, 1973) — are connected to evidentiality. However, this connection is supported by a small number of frequent verbs, and might not generalize if we consider the entirety of the lexicon (White & Rawlins, 2018).

In this paper, we present a large-scale study of the evidential uses of clause-embedding verbs to investigate how widespread evidential uses are, whether evidentiality is a lexically encoded feature of English verbs, and how context modulates the availability of evidential uses.

What makes clause-embedding verbs evidentials?

Since little is known about whether evidential meanings are generally available across various clause-embedding verbs, we consider three options: (1) evidentiality is a lexical feature inherent to the semantics of some (but possibly not all) clause-embedding verbs, (2) evidential readings are widely available given the right context, and (3) the availability of an evidential reading is determined by a combination of lexical and contextual features. In order to explore these three possibilities, we review the specific features that can potentially predict the availability of evidential uses, and state hypotheses about them.

Lexical factors

Factivity. A clause-embedding verb is factive if it entails the content of the embedded clause. For example, *Karl regrets that he worked until late again last night* can only be true when *Karl worked until late again last night* is also true. Factive verbs are typically odd in evidential reports (Simons, 2007): their meaning implies that the speaker is strongly committed to the content of the complement clause, which clashes with the pragmatic goal of expressing the speaker's uncertainty about the truth of the embedded clause.

For example, if Speaker B used the verbs *understand* or *discover* instead of *think* in (4), it would entail that the complement *she's working late again* must be true. The content of the complement clause in this case is said to be "projective", because the speaker would still be committed to its truth when uttering (5), where *discover* is embedded under entailment-cancelling negation (Karttunen, 1971; Tonhauser et al., 2018).

(5) Speaker B: I *didn't discover* that she's working late again.

In both positive and negative forms, the main point of the utterance is the discovery that the speaker made — while the content of the embedded clause is presupposed — but this is not what Speaker A is asking about.

Based on these observations, we state **Hypothesis 1:** *Factive verbs are not acceptable in evidential contexts*.

Slifting. When a clause-embedding verb is used as an evidential, it can be used parenthetically in a so-called sentence lifting (Ross, 1973) — or slifting — construction:

(6) John is working late again, I think.

In (6), using *I think* as a parenthetical is licensed because the sentence is not literally about the speaker's thoughts. The main point of the utterance concerns John's working habits and is expressed by the embedded clause; the additional information, such as the degree of the speaker's certainty about John's schedule, can be moved to the parenthetical. Slifting is less acceptable when the main point is expressed by the slifted main clause:

(7) Smoking is bad for you, John believes.

This observation can be generalized in the following way: slifting characterizes verbs that can embed clauses that are themselves the main point of the utterance. We should then expect there to be a correlation between how acceptable a clause-embedding verb is under slifting and how acceptable it is in evidential contexts. We state this as the following hypothesis:

Hypothesis 2: *Verbs that are acceptable under slifting are also acceptable in evidential contexts*.

Frequency. Rooryck (2001a,b) observes that one of the characteristic features of verbs used in the evidential meaning is that they become semantically impoverished (or semantically bleached). The process of semantic bleaching, in turn, is known to be a sign of grammaticalization (Bybee, Perkins, & Pagliuca, 1994). Thompson and Mulac (1991) argue, for instance, that the constructions *I think* and *I hear* have been grammaticalized as epistemic phrases, which function as epistemic adverbs. If semantic bleaching is a synchronically active process that makes evidential uses of clause-embedding verbs available, it should target high-frequency verbs first.

Hypothesis 3: *Highly frequent clause-embedding verbs are more acceptable in evidential contexts than less frequent verbs*.

Contextual factors

Question Under Discussion (QUD). As discussed in the introduction, context largely determines whether a particular clause-embedding verb is used in its mentalistic or evidential meaning. Specifically, this depends on the Question Under Discussion (QUD) (Simons, Tonhauser, Beaver, & Roberts, 2010; Roberts, 2012) — the issue currently being raised by the conversation. Consider the sentence:

(8) I remember you need a suit jacket to enter that restaurant.

It is possible to construe contexts where *remember* is used either mentalistically or evidentially. In one context, speakers could be discussing fancy restaurants that they have been to and sharing their impressions of the food, the level of service, etc. If Speaker A asks Speaker B "What do you remember about the restaurant at the Ritz in Paris?", Speaker B could utter (8) literally to talk about their memory of visiting that restaurant. In a different, scenario, however, a group of friends could be discussing a place to get dinner after work. When Speaker A asks "Should we go to the restaurant at the Ritz?", Speaker B could utter (8) evidentially — not to introduce a new topic of their memories about the restaurant, but to suggest evidence that the restaurant might not be a good choice for a casual dinner.

We have discussed the possibility that any clause-embedding verb can be used evidentially, given the right context. To address this possibility, we state **Hypothesis 4:** *All clause-embedding verbs can be used to answer Questions Under Discussion that are not about mental states*.

Common ground. Clause-embedding verbs vary as to how committed the speaker is to the content of the main clause. Factive verbs, in general, demonstrate a higher degree of such commitment. However, there is some variability to how factive a verb can be — e.g., it has been proposed that certain verbs should be considered *semi-factive* (Kiparsky & Kiparsky, 1970; Karttunen, 1971; Simons, 2007; Abusch, 2010). Even for the same factive verb, the degree to which we can infer the truth of the embedded clause varies depending on the context. For example, compare the following evidential contexts, both featuring the factive verb *understand*:

(9) Jane has just come back to her office from a walk outside — it was a warm, sunny day after a long spell of rain. Jane's co-workers are talking about the weather, so she says: "I understand it's nice out."

(10) Jane's colleague Laura is very responsible and usually goes to meetings, while Bill is unreliable and finds them boring. Jane and her co-workers are discussing whether Laura or Bill will attend a meeting, and Jane says: "I understand Laura is going to attend the meeting."

In (9), Jane has had direct experience with the weather outside — her colleague who was indoors, on the other side, does not know what the weather is like. Since this context has already established that Jane is **knowledgeable** about the proposition in the embedded clause, highlighting her high degree of commitment to the complement clause by using *understand* evidentially might sound odd.

In (10), although Jane is familiar with Laura and Bill's work ethic, she has not heard directly from either Laura or Bill whether they would attend the meeting. That is, Jane is **ignorant** about the truthfulness of the proposition in the embedded clause. She can, however, make a fair guess based on her experience working with them — in this context, the evidential use of *understand* sounds more natural, as Jane is likely very certain, but not absolutely sure about who will attend the meeting.

Hypothesis 5: *Evidential uses of factive verbs are only acceptable when the speaker is ignorant about the truthfulness of the proposition in the embedded clause*.

Experiment 1

We tested the hypotheses stated in the previous section by conducting a large-scale acceptability judgment task, in which we asked participants to rate the acceptability of 208 clause-embedding English verbs extracted from the open-source MegaVeridicality dataset (White & Rawlins, 2018) in evidential contexts.

Participants

260 native speakers of American English were recruited via Amazon Mechanical Turk. They were paid $1.50 for participating in the experiment.

Materials

In order to accommodate the hypothesized pragmatic constraints on the evidential meanings of clause-embedding verbs, we asked participants to rate the acceptability of sentences containing clause-embedding verbs *given some context*. The context was manipulated to elicit the QUD that would target the verb's evidential reading.

We further manipulated the degree to which the speaker was committed to the truth of the proposition in the embedded clause. Based on the observations about the role of common ground and speaker knowledge in answering the evidential QUD, we varied the speaker's knowledge about the proposition expressed in the embedded clause.

The examples below illustrate the contexts used to trigger the evidential meaning of the verb *think*:

(11) **knowledge condition**

a. Sophie is going grocery shopping, so she has just checked the fridge to see what she needs to buy. She's noticed that she is out of milk. Before Sophie leaves, her roommate asks her: "Is there milk in the fridge?"

b. Sophie replies: "I **think** there isn't any."

(12) **ignorance condition**

a. Bob and his friend Alice want to try coffee at a new cafe that just opened, but a friend of Bob's warned him that their coffee is quite expensive, starting at $5 per cup. Alice is asking Bob: "How's the coffee at the new place?"

b. Bob replies: "I **think** it's expensive."

First, we designed the context (a) and target items (b) as question-answer pairs in order to make the QUD explicit.

We created 8 scenarios similar to the ones in (11)–(12). Each verb was used in only one of the 8 scenarios, resulting in 26 verbs per scenario and 208 trial items overall. The trial items were divided into 26 randomized lists using TurkTools (Erlewine & Kotek, 2016) with 8 scenarios in each list. Each list was rated by 10 participants, resulting in 10 acceptability judgments per verb.

Procedure

In the beginning of the survey, participants were given the definition of a natural sounding English sentence and examples of natural sounding English sentences, as well as odd or ungrammatical English sentences. Then participants were familiarized with the task by reading passages which were similar to test the items and viewing their acceptability ratings. Acceptability ratings were accompanied by explanations for why a particular rating was chosen. Participants read the question–answer pairs similar to those in (11) and (12) and then were asked to rate how natural the answers sounded on a scale from 1 (very unnatural) to 7 (very natural).

Predictions

In order to test Hypotheses 1–3 and 5, we made the following predictions:

(13)
a. The more factive a verb is, the less acceptable it will be in an evidential context (**Hypothesis 1**).
b. The more acceptable a verb is under slifting, the more acceptable it will be in an evidential context (**Hypothesis 2**).
c. More frequent verbs would be more acceptable in evidential contexts (**Hypothesis 3**).
d. Less factive verbs will be acceptable in both knowledge and ignorance conditions, while more factive verbs will only be acceptable in the ignorance condition (**Hypothesis 5**).

If, contrary to our predictions, the availability of evidential uses is not limited to non-factive verbs that are acceptable under slifting, that would would lend evidence to **Hypothesis 4**, which states all clause-embedding verbs have evidential uses in evidential contexts.

Results

We fit a mixed-effects linear regression model with the acceptability score as the dependent variable and fixed effects of factivity, slifting, item frequency, and the knowledge state of the speaker, as well as an interaction term for factivity, slifting and frequency. Factivity and slifting scores were obtained from the MegaVeridicality dataset (White & Rawlins, 2018), and log frequencies were extracted from the Corpus of Contemporary American English (COCA) (Davies, 2008). The model also included random intercepts for participants and stimuli.

We found a main effect of factivity ($\beta = -5.47, SE = 1.804, t = -3.03, p = 0.002$), frequency ($\beta = 1.19, SE = 0.27, t = 4.39, p < 0.01$) and the knowledge state of the speaker ($\beta = 0.35, SE = 0.07, t = 4.66, p < 0.01$), but not of slifting ($\beta = 0.35, SE = 0.35, t = 0.98, p = 0.33$). We also found an interaction between factivity and frequency ($\beta = -1.2, SE = 0.332, t = -3.62, p < 0.01$), but not between factivity and slifting ($\beta = -0.12, SE = 0.46, t = -0.25, p = 0.8$), slifting and frequency ($\beta = -0.02, SE = 0.07, t = -0.28, p = 0.78$), or factivity, slifting and frequency ($\beta = 0.07, SE = 0.09, t = 0.78, p = 0.43$).

Discussion

Consistent with our predictions, we found that highly factive clause-embedded verbs were less acceptable in evidential contexts. This was particularly true for the most frequent verbs in our dataset. We also found that participants rated items in the ignorance condition higher than in the knowledge condition — contrary to our prediction that non-factive verbs would be rated equally highly in both knowledge and ignorance conditions.

Two potential issues should be addressed. First, a number of highly factive verbs (*realize*, *understand*, *remember*) received high acceptability ratings (Figure 1).

The second issue is that participants might have inferred that the answers in the ignorance condition were to an *implied* question. For example, in (12a) the utterance "I think it's expensive" could have been construed as a response to the implied question "Should we have coffee at the new place?", rather than the direct question "How's the coffee at the new place?". The difference is that under the implied QUD, the non-evidential (i.e., mentalistic or attitude) meaning of the clause-embedded verb becomes available: it is pragmatically acceptable for the speaker to communicate their knowledge of a fact that is relevant for deciding where to have coffee. One possibility, then, is that factive verbs received a higher rating in those contexts where an implied question could be inferred.

Experiment 2

We conducted a follow-up acceptability judgment study to address the potential issues we discussed in Experiment 1 and to test finer predictions about the interpretation of clause-embedding verbs across various contexts. In this experiment, we focused on several of the most highly rated verbs from Experiment 1: 3 factive (*know*, *realize*, *understand*) and 3 non-factive verbs (*believe*, *imagine*, *think*).

Participants

We recruited 200 native speakers of American English via Amazon Mechanical Turk. They were paid $0.50 for participating in the experiment.

Materials

We created question-answer pairs similar to those in Experiment 1, but with two new manipulations. First, in order to sharpen the difference between knowledgeable and ignorant

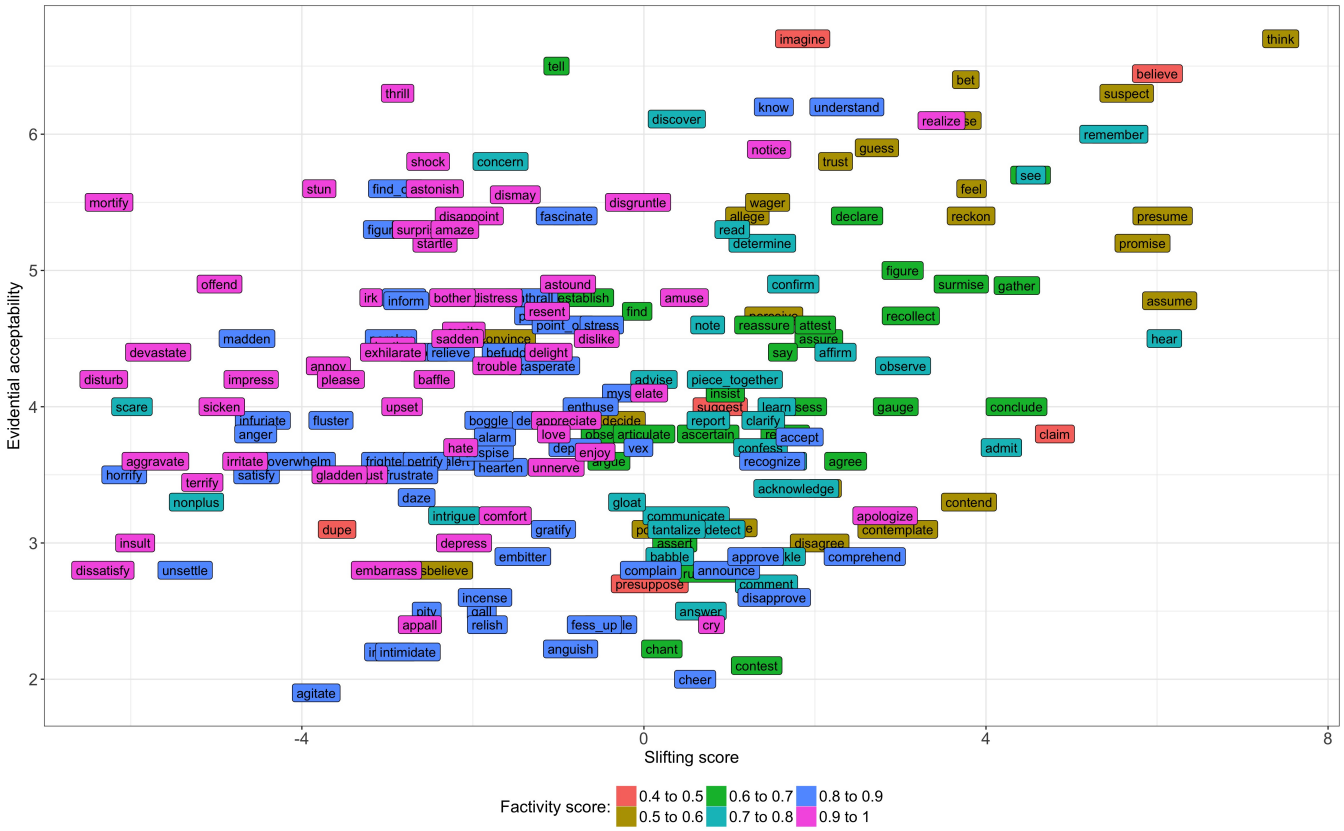

Figure 1: Acceptability of clause-embedding verbs in evidential contexts.

speaker states, we manipulated whether the context was **verification** or **opinion**: in verification contexts, speakers were answering questions about something that was objectively true or false (e.g. whether there is an event happening), and in opinion contexts, they were explicitly asked for a subjective opinion (e.g. whether a class is worth taking, a recipe is good, etc). Second, we manipulated the answers to be either *direct* responses to the question, or responses to an *implied* question the speaker might have inferred.

(14) **verification-direct**

a. Julie is sick, so she can't come to the spring fair festival at her college. Her friend Nancy is there, and Julie is sad she couldn't join. Julie called Nancy and asked: "Are there a lot of people at the fair?"

b. Nancy replied: "I think there aren't that many."

(15) **verification-implied**

a. Julie is sick, so she can't come to the spring fair festival at her college. Her friend Nancy is there, and Julie is sad she couldn't join. Julie called Nancy and asked: "Are there a lot of people at the fair?"

b. Nancy replied: "I think you aren't missing out on much."

(16) **opinion-direct**

a. Beth wants to sew a dress, and she's shopping for fabric. Her friend Allison also makes her own clothes. Beth asked her friend Allison: "Do you like rayon?"

b. Allison replied: "I think it's nice."

(17) **opinion-implied**

a. Beth wants to sew a dress, and she's shopping for fabric. Her friend Allison also makes her own clothes. Beth asked her friend Allison: "Do you like rayon?"

b. Allison replied: "I think you should use it."

We designed 6 verification contexts and 6 opinion context, each varying between a direct and an implied QUD, which yielded a total of 24 contexts.

Procedure

The procedure was the same as in Experiment 1.

Predictions

Based on the results of Experiment 1, we make the following predictions:

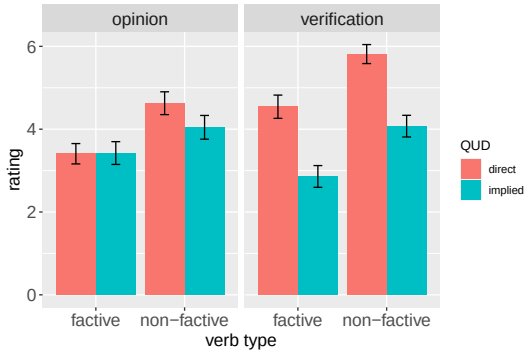

Figure 2: Experiment 2 results. Error bars indicate 95% confidence intervals.

(18) a. In verification contexts, non-factive verbs, which take on purely evidential meanings, will be rated higher than factive verbs.

b. In opinion contexts, both non-factive and factive verbs will be licensed, but the latter will be more acceptable with implied QUDs.

Results

There were main effects of context ($\beta = 1.12, SE = 0.18, t = 6.05, p < 0.01$) and verb type ($\beta = 1.2, SE = 0.17, t = 6.9, p < 0.01$), but not of QUD ($\beta = -0.0004, SE = 0.18, t = -0.003, p = 0.1$). We also found an interaction between context and QUD ($\beta = -1.66, SE = 0.28, t = -5.99, p < 0.01$), as well as between verb type and QUD ($\beta = -0.57, SE = 0.25, t = -2.28, p = 0.02$). The interactions between context and verb type ($\beta = 0.08, SE = 0.25, t = 0.3, p = 0.75$), and between context, verb type and QUD ($\beta = 0.49, SE = 0.36, t = 1.34, p = 0.18$) were not significant.

Discussion

In verification contexts, non-factive verbs were rated higher than factives in response to both implied and direct QUDs. This confirms our previous finding that less factive verbs are more acceptable in evidential contexts. In opinion contexts, non-factive verbs were rated higher as well, but the effect was smaller than in verification contexts (see Figure 2). Further, the interaction between context and QUD shows that in verification contexts, direct QUDs were preferred for both factive and non-factive verbs. This suggests that in verification contexts, the evidential meaning of a clause-embedded verb is more salient than the mentalistic/attitude meaning, so the QUDs which target the evidential meaning are preferred.

Conclusion and general discussion

Some clause-embedding English verbs have evidential meanings (Rooryck, 2001a, 2001b; Simons, 2007): for example, uttering "I think the movie starts at 4" as an answer to *What time does the movie start?* or *What time shall we leave?* would make a point that is primarily about movie start times, rather than about the speaker's mental state. The contribution of the main clause *I think* in this example is to attenuate the speaker's claim in the embedded clause, as it signals they are not completely confident about it.

Previous research has detailed the contextual and lexical features that characterize evidential uses of English clause-embedding verbs — however, these studies have focused on a small subset of verbs that are known to have these uses (Rooryck, 2001a, 2001b; Simons, 2007). It remained unknown how widespread these uses are, whether they are part of the verb's lexical meaning, or emerge under certain pragmatic conditions.

We conducted a large-scale acceptability judgment study to address these questions. As was reported previously in literature (Simons, 2007), factive verbs were less acceptable in evidential contexts overall. We also found that the verbs that received the highest acceptability ratings were among the most frequent in our dataset. This points to the possibility that evidential meanings of those verbs are being lexicalized, as in the case of epistemic phrases *I hear* and *I think* (Thompson & Mulac, 1991).

Contrary to earlier discussions of evidentiality in literature, we also found that some highly factive verbs like *discover* and *realize* received high acceptability ratings in evidential contexts. This suggests that the acceptability of a clause-embedding verbs verb in an evidential meaning is *connected* to, but not *strictly guided* by its lexical features, and context plays a significant role as well.

In Experiment 2, we tested more fine-grained predictions about how subtle differences in context and QUD can affect the acceptability of a clause-embedding verb. We found that verification contexts, which give rise to truly evidential meanings, favor non-factive verbs overall, but this preference depends on the specific QUD: participants rated factives in answers to direct QUDs higher than non-factives in answers to implied QUDs. In opinion contexts, which we predicted would allow mentalistic or semi-mentalistic uses of clause-embedding verbs, non-factive verbs were still rated higher than factives, but this difference was smaller than in verification contexts.

Taken together, the results of these two experiments suggest that a combination of lexical and pragmatic features contribute to the acceptability of a clause-embedding verb in evidential contexts. Generally, evidential uses are more acceptable for non-factive verbs — and for a subset of highly frequent verbs, evidential meanings might be lexicalized. Under favorable pragmatic conditions, however, some factive clause-embedding verbs can be used evidentially as well.

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