The reliability of testimony and perception: connecting epistemology and linguistic evidentiality

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Abstract

Epistemologists have argued that there are three basic sources of belief: perception, testimony and inference. These three belief sources correspond directly to the way in which many languages mark statements morphologically for sources of evidence for the statements (evidentiality). In this paper, we connect generalizations from the fields of epistemology and evidentiality. We also introduce a new method for investigating how reliable people find different types of evidence to be. A study based on this method indicates that speakers of English rank different sources of evidence according to the same criteria that govern the use of grammaticalized evidential marking.

Keywords: epistemology, evidentiality, language, testimony, perception

Introduction

This paper[1] investigates how people evaluate different sources of evidence. We connect insights from epistemology (philosophy) with evidence from grammaticalized evidentiality (linguistics) and a novel experimental study in order to shed some light on evidential sources.

Epistemology

Epistemologists have argued that we form our beliefs based on sources of evidence that can be broadly categorized as perception (what we have directly perceived), testimony (what we have heard or read), or inference (what we conclude based on other evidence). This tripartite distinction of evidence in epistemology is carefully discussed in Davies and Matheson (2012). Testimony is considered especially important epistemologically. Hume took testimony very seriously, for example: "[T]here is no species of reasoning more common, more useful, and more necessary to human life, than that which is derived from the testimony of men, and the reports of eye-witnesses and spectators" (Hume, 1748). Coady (1992) also argues that testimony plays an especially significant role,

and that it influences perception and inference. Davies and Matheson (2012) propose that the special status of testimony in epistemology may be due to the relative representational power of testimony. In other words, what we learn from testimony is greater in *scope* than what we learn from other sources of evidence.

Although testimony has perhaps been granted special status as a belief source in the philosophical literature, the directness and reliability of perception has also been acknowledged (McCready, 2015; Millar, 2011; Davies & Matheson, 2012), even though much focus has also been placed on *inaccurate perceptions*, such as illusions, hallucinations and dreams; see Hinton (1967); Martin (2002), and also Plato's *Theaetetus*.

The scholarship on epistemology is old, rich and large, and it raises many questions about how people perceive and internalize different kinds of evidence to form beliefs. We turn next to a natural language phenomenon that we believe can shed some light on one of the many issues that are discussed in epistemology: How do people naturally classify and evaluate different types of evidence?

Evidentiality

In about a quarter of the world's languages, every statement is overtly marked for the type of evidence that statement is based on (Aikhenvald, 2004). This marking is called *evidentiality marking*. Evidentiality marking is illustrated in (1-4) with examples from the Northwest Amazonian Language Tariana (Aikhenvald, 2003):

1. tʃinu niwahãka dina
   'The dog bit him (we have seen it).'

2. tʃinu niwahãmahka dina
   'The dog bit him (we have heard the noise).'

3. tʃinu niwahãsika dina
   'The dog bit him (he has a scar and I can make an inference).'

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[1] The authors of this paper contributed equally and are listed in purely alphabetical order.

4. tʃinu niwahã�pidaka dina
   'The dog bit him (someone told me).'

The word beginning with *niwahã-* is the verb. The form of the verbs (the verb ending) indicates past tense as well as the source of the evidence for the statement that the verb heads: *-ka* marks visual evidence, *-mahka* marks non-visual sensory evidence, *-sika* marks inferred evidence, and *-pidaka* marks reportative evidence (evidence based on testimony). Hinuq (Forker, 2014), Quechua (Faller, 2002a, 2002b), Tuyuca (Barnes, 1984) and Kashaya (Oswald, 1986) are other examples of languages with grammatical evidentials. The literature on evidentials is intricate and valuable, but so far relatively modest in scope. This is perhaps due to the fact that many of the languages that have grammaticalized evidentiality are relatively understudied compared to the large European languages, for example.

What can evidentiality marking tell us about how humans categorize types of evidence? It turns out there are strong cross-linguistic tendencies in how languages distinguish between different information sources (see Willett, 1988; Haan, 1999; Faller, 2002a; Aikhenvald, 2003, 2004; Matthewson, 2014, and many others). As illustrated in (1–4), Tariana distinguishes between visual evidence (perception), non-visual sensory evidence (perception), indirect evidence (inference), and reportative evidence (testimony). These are fairly typical evidential categories cross-linguistically, and they mirror the epistemological literature on sources of beliefs.

Evidentiality marking often distinguishes between *direct* and *indirect* evidence: a direct evidential is either visual or otherwise sensory, whereas an indirect evidential is used for inference, report, or logical assumption (Aikhenvald, 2004). It is also possible to receive indirect visual information, as in example (3) above. Visual sensory evidence seems to have a special status: in the typology it is often distinguished from other types of sensory information (Willett, 1988; Aikhenvald, 2003; Speas, 2004).

It has been suggested that speakers mark the most reliable source of information if more than one type of evidence is available (see, e.g., Faller, 2002a). For example, if a speaker has seen something happen, but someone has also told them that it happened, then they use the perceptual/visual marker, as that is the most direct, reliable evidence. In cases of indirect visual evidence and reportative evidence, the speaker makes a judgement based on (a) how convincing the visual evidence is and (b) the general reliability (trustworthiness) of the person who gave the report.

Let us assume that conventions regarding grammaticalized evidentiality marking tells us something about how people rank sources of evidence upon which they form beliefs. We then arrive at the following conclusions:

5. Direct perceptual evidence outranks reportative evidence.

6. Direct perceptual evidence outranks indirect perceptual evidence.

7. Visual evidence outranks non-visual sensory evidence.

On our interpretation of Faller (2002a); Aikhenvald (2004) and others, grammatical marking of evidentiality can tell us something about how humans evaluate different types of evidence (see also, e.g., McCready, 2015). For example, morphological marking for direct visual evidence outranks morphological marking for indirect visual evidence because direct visual evidence is considered more reliable than indirect visual evidence. However, this conclusion does not follow directly from evidentiality marking. The conventions for how evidentiality markers are used could be based on some kind of historical accident of linguistic innovation and change. An argument against that is that there seem to be strong cross-linguistic tendencies, but this is perhaps not a strong argument since evidentiality morphology and languages that mark evidentiality remain relatively under-explored.

Experiment: Perception verbs and reportative verbs in English

Methods

We wanted to explore whether it was possible to find evidence for the generalizations in (5–7) in a language without grammaticalized evidentiality marking. We therefore performed an on-line survey where speakers were asked to judge how likely they thought it was that specific statements were true, given a single-sentence context.

The survey consisted of context-target sentence pairs and each context sentence contained one of the following: a reportative predicate (*say, tell*), a direct perception predicate (*see, hear*), or an indirect perception verb (*look like, sound like, smell like, taste like*).[2] For example, given the context *Beth saw John coming home*, how likely is it that *John came home* is true? Or, given the context *Sam said that John came home*, how likely is it that *John came home* is true? Or, given the context *It smells like there is cumin in the stew*, how likely is it that *There is cumin in the stew* is true? No examples included *that*-clause complements to *see* or *hear*, as those can denote indirect perception. For example, *Tom saw that the vase broke* can be used even when Tom did not actually witness the vase breaking. He might simply be seeing the broken vase. This reading is not possible with a sentence like *Tom saw the vase break*. Similarly, *Jenna heard that the vase broke* does not necessarily mean that *Jenna heard the vase break*. Jenna could instead have heard a report that the vase broke.

The use of *look, sound, taste* and *smell* as indirect perception verbs has been discussed by (Rogers, 1971, 1972, 1973; Asudeh & Toivonen, 2007, 2012) and others. Compare *Beth saw the pipe leaking water* to *It looks like the pipe is leaking water*. Both *see* and *look like* refer to visual perception. However, there is an important difference in meaning. The former sentence can be paraphrased as *Beth saw a pipe, and the pipe is leaking water*. The latter sentence is instead paraphrased as

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[2]The study does not include tactile perception.

There is some visual evidence that the pipe is leaking water. The evidence can be direct (i.e., the leaking pipe itself), but it can also be indirect; for example, a wet floor, or a moldy spot in the ceiling. See Asudeh and Toivonen (2012) for a semantic representation of indirect perception verbs.

The stimuli were divided into four separate surveys so that each survey contained two stimulus pairs with *see, hear, say,* and *tell*. The surveys also contained four stimulus pairs each with *look like, sound like, smell like* and *taste like*. However, these verbs were of two types: two examples per verb and survey had an expletive subject *it* and two had a "copy-raised" subject (see, e.g, Rogers, 1971 and Asudeh & Toivonen, 2012 for copy-raising). An expletive example would be *It looks like the movie has started* and a copy-raising example would be *Grant looks like he's been crying*. So there were two examples per verb and survey if we consider *it looks like* and *(subject) looks like* to be different. When deciding on what words to use with the different verbs, we considered two factors: (1) We tried to pick sentences that sounded natural. For example, for the complement of *smell*, we tried to pick something with a distinctive smell, such as *It smells like the roast is ready.* (2) We wanted different combinations of words across surveys. For example, if Survey A contained *It looks like Grant has been crying*, then Survey B would not contain the same example, but instead *Nathan heard Grant crying*. We hoped that this design would minimize effects that might be due to specific word choices, while still allowing comparison of sentences that are minimally different. There is a tension between considerations (1) and (2). For example, it is natural for a stew to taste salty, but not to smell, look or sound salty. It therefore would not make sense to combine "salty stew" with *taste* in one questionnaire and *smell* in another, although it would in principle be desirable to compare stimuli that differ only in verb of perception. Each survey contained 24 target stimuli (sentence pairs) in total. In addition, each survey contained 50 filler sentence pairs.

The data were collected electronically using SurveyMonkey (www.surveymonkey.com). Participants were recruited by email lists and social media. Participation was voluntary and anonymous. The participants received no compensation. The participants were given the following instructions: "Assume that the first sentence is true, and judge the likelihood of the second sentence using a 5 point scale (where 1 = "I have no idea" and 5 = "It is true"). Here's an example pair of sentences: *Sam is coughing. Sam is sick.* You will rate how likely you think it is that "Sam is sick" (given that "Sam is coughing" is true), using the scale from 1 to 5. The scale is explained in a bit more detail here: 1. I have no idea whether the second sentence is true. 2. It is somewhat likely that the second sentence is true. 3. The second sentence is probably true. 4. The second sentence is almost certainly true. 5. The second statement is true."

A total of 203 participants completed the questionnaire. As the only demographic question included in the survey, we asked participants to identify whether or not they were native speakers of English. Of the 203 participants, 142 self-identified as native speakers of English and 61 as non-native speakers. We have so far only analyzed the native speakers but we look forward to comparing these results with the results of the non-native speakers.

Results

We ran separate paired t-tests to test if the judgments from the English survey study were consistent with the generalizations from grammaticalized evidentiality listed in (5–7).

Direct perception verbs and reportative verbs The likelihood judgements of examples where the source of evidence was given as direct perception (*see, hear*) were compared to the likelihood judgments of examples where the source of evidence was given as a report (*say, tell*). For example, given *Annie heard Cassie open the door* or *Annie said that Cassie opened the door*, how likely is it that *Cassie opened the door* is true? The participants gave significantly higher judgements when the source of evidence was given as direct perception than when it was given as an oral report. The results are shown in Figure 1. There is a significant difference in the
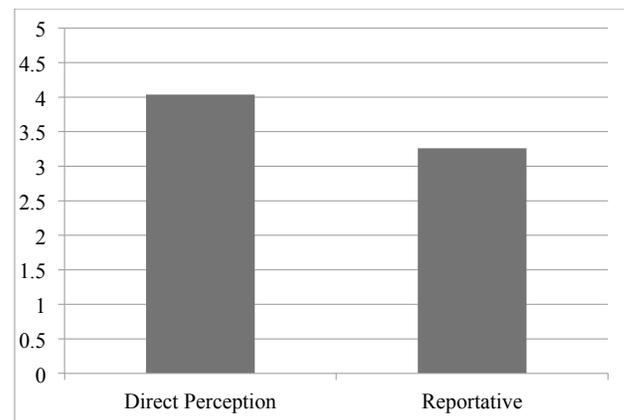

Figure 1: Direct perception vs. reports

scores for perception verb examples (M=4.05, SD=0.72) and reportative verb examples (M=3.26, SD=0.91); t(138)=1.66, p<.001. This result is consistent with the cross-linguistic generalization about evidentiality marking: direct perception is considered more reliable than reported evidence.

Direct perception and indirect perception Next, the likelihood judgements of examples where the source of evidence was given as direct perception (*see, hear*) were compared to the likelihood judgments of examples where the source of evidence was given as indirect perception *look like, sound like, taste like, smell like*. Here is a direct perception example: if *Sam saw Cassie open the door is true*, how likely is it that *Cassie opened the door* is true? As already mentioned above, the indirect perception sentences were given either with an expletive subject *It looked like Cassie opened the door*, or with a copy-raising example *Cassie looked like she opened*

the door. Again, given such a sentence, participants were asked to judge how likely they found it that *Cassie opened the door* was true. The results are shown in Figure 2.
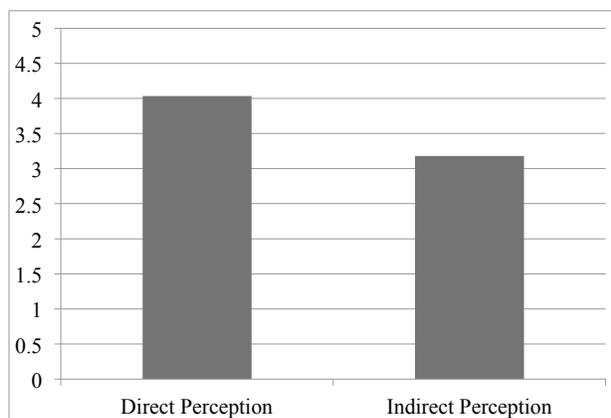

Figure 2: Direct perceptual evidence vs. indirect perceptual evidence

There is a significant difference in the scores for direct perception verb examples (M=4.05, SD=0.72) and indirect perception verb examples (M=3.18, SD=0.66); t(138)=14.30, p<.001. This tendency again echoes the findings from the research on cross-linguistic evidentiality: direct perceptual evidence is considered more reliable than indirect perceptual evidence.

Visual perception and non-visual perception The likelihood judgments where the evidence was either visual perception or non-visual perception were also compared. The direct perception verbs and indirect perception verbs were analyzed separately. In the indirect perception class, the *look like* examples were compared to the *sound like, taste like* and *smell like* examples. The results are given in Figure 3.
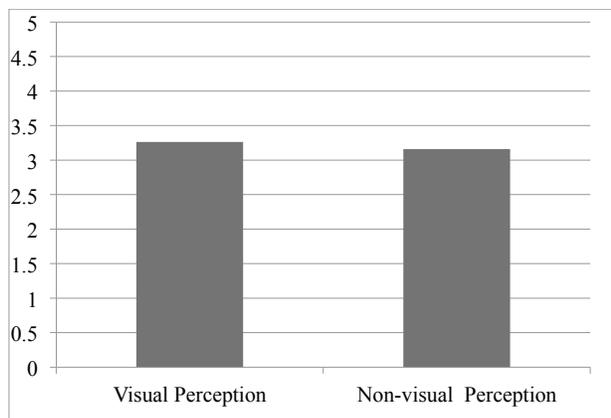

Figure 3: Visual perception vs. non-visual perception (indirect)

There was a significant difference in the scores for visual perception verb examples (M=3.26, SD=0.75) and non-visual sensory verb examples (M=3.16, SD=0.66); t(139)=1.66, p=.02. This again mirrors the pattern found in grammatical evidentials (although the effect here appears to be small).

For direct perception, only visual and auditory perception verbs (*see, hear*) were included in the study. No examples involving direct gustatory or olfactory sensory perception were included in the survey. In other words, no examples of the form *Sue tasted honey in the tea* or *Sue smelled soap in the bathroom* were included. The only non-visual direct perception verb included in the analyses here is thus *hear*. The likelihood judgements of visual *see* and non-visual *hear* direct perception examples are given in Figure 4.
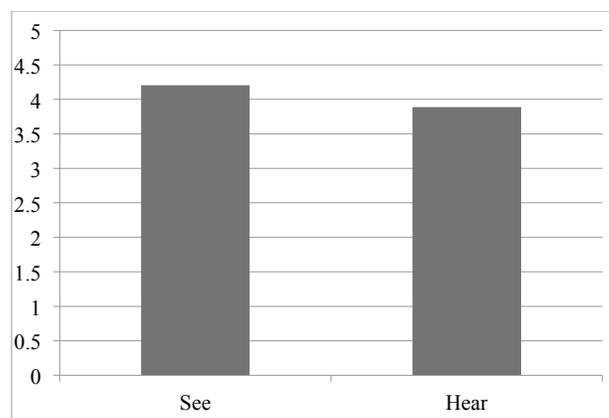

Figure 4: Visual perception vs. non-visual perception (direct)

The difference between visual and non-visual perception was greater in direct perception verbs (Figure 4) than in indirect perception verbs (Figure 3). The difference in scores between the *see* examples (M=4.20; SD=0.83) and the *hear* examples (M=3.89; SD=0.81) was highly significant t(138)=5.25, p<.001.

Discussion

Our research questions concerned the validity of different types of evidence. We conducted four analyses based on the survey data. Participants were given sentences which encode perceptual (direct and indirect) and reportative sources of evidence. The first analysis compared direct perception verbs to reportative verbs, and found that participants ranked direct perception as more reliable. The second analysis compared direct perceptual evidence to indirect perceptual evidence, and found that participants ranked direct perceptual evidence as more reliable. The third and the fourth analysis compared visual sensory perception to non-visual sensory perception, and found that participants ranked visual perception as more reliable. All results were significant.

We are focusing here on the distinctions between the denotations of the verbs. Of course, the stimuli are all presented

to the participants as written texts, which is in itself a form of testimony. Also, in reading the stimulus sentences, the participants also perceive the words on the computer screen. This means that all stimuli are, in a sense, both testimonial and perceptual. We set these issues aside, as they are constant across all the items.

Comparing the different classes of verbs considered here, it is worth noting that only *see* and *hear*, the direct perception verbs, entail their complement. This is not the case for the indirect perception verbs, nor is it true for the reportative verbs. For example, *John saw Mary open the door* entails *Mary opened the door*, but *It looked like Mary opened the door* does not, and neither does *John said that Mary opened the door*. In fact, *see* and *hear* not only entail their complement, they also presuppose it (see Karttunen, 1973 for a discussion of verbs according to their presuppositional properties). For example, saying *no, that's false* to *John saw Mary open the door* only challenges John's seeing, but it tacitly accepts Mary's having opened the door (the same is true for *John didn't see Mary open the door*; see, e.g., Beaver, 2001). The judgements reported in this study thus directly connect reliability of evidence with the study of presupposition and entailment in semantics and pragmatics.

Conclusion

Evidentiality marking is sometimes described as "the grammar of knowledge" (Aikhenvald, 2014), or naturally occurring epistemology (Chafe & Nichols, 1986). Grammaticalized evidential marking mirrors the classes of evidence (or "sources of belief") that philosophers have argued for. For example, Tariana marks perceptual evidence (divided into visual and non-visual sensory evidence), inference and reported evidence (testimony), as illustrated in (1–4). Despite the obvious parallels between the categories discussed in epistemology and evidentiality markers, Aikhenvald (2014) warns that there is not necessarily a straightforward relationship between between grammatical evidentiality, on the one hand, and truth, the validity of a statement, and the speaker's responsibility, on the other. Evidentiality is grammaticalized differently across languages, and the mapping to non-linguistic concepts such as evidence and truth is intricate and subtle. However, McCready (2015) suggests that it might be mutually beneficial for epistemologists and linguists specializing in evidentiality to collaborate, and we agree.

Findings from the fields of epistemology and evidentiality suggest several generalizations on how people rank evidence in terms of reliability: Direct perceptual evidence outranks evidence based on reports, and also evidence based on indirect perception. In addition, visual evidence outranks non-visual perceptual evidence.

We wanted to learn whether it was possible to find further support for these generalizations in a population that does not speak a language with grammaticalized evidentiality. We therefore devised a simple method intended to gauge how people judge different sources according to reliability.

The survey directly asks for likelihood judgments: *How likely is it that X is true?* However, the design indirectly allows access to judgements of the reliability of different types of evidence, since participants are asked to give judgements in the context of a given statement, for example *Linda said X* or *Linda saw X*. We assume that different judgements of likelihood of X reflect judgements of reliability of the context.

Our survey directly supports the generalizations derived from philosophy and linguistics. In essence, direct visual evidence is deemed to be more reliable than other types of evidence.

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