(Un)certainty in language and cognition: Eyewitness reports vs. statistical probability

Elsi Kaiser, Deborah Ho & Claire Post, University of Southern California
emkaiser@usc.edu

Eyewitness evidence is privileged over statistical information in legal verdicts (*Wells Effect*): People are more likely to judge a suspect guilty based on eyewitness testimony than statistical evidence (e.g. DNA tests), even if people's estimates of the numerical likelihood of the suspect's actions are comparable (e.g. Wells'92, Niedermeier et al'99). This suggests that when the state-of-affairs is not certain, eyewitness reports have a privileged cognitive status relative to statistical information. What is less well-understood is whether and how this distinction is reflected linguistically. This relates to questions about the relation of language and thought, and how cognitive representations of (un)certainty are reflected in language.

Language has many tools for signaling (un)certainty, including adverbials (e.g. *possibly*, *definitely*) and verbal statements (e.g. *I am convinced/doubt,* Theil'02, Brun/Teigen'98, Juanchich etal'19). Prior work looked at how these relate to numerical probabilities, but it is not known whether eyewitness reports play a privileged role in guiding their use, compared to statistical information (cf. Willet'88 on evidentials). If yes, this suggests certainty markers cannot be defined on a unidimensional numerical probability scale (challenging many current approaches) and that the cognitive asymmetry in the Wells Effect should be incorporated into theories of language. To test this, we compared eyewitness vs. statistical evidence.

Experiment. Participants (216 native US-English speakers) read 8 paragraphs; each was followed by a critical sentence on the same screen. The paragraphs (ex.1) provided (a) statistical information only (*red sentence* included, **OnlyStatsEvid**), (b) eyewitness information only (blue sentence included, **OnlyEyeEvid**), (c) both kinds of information (**ConflictingStatsEye,** *red*+blue sentences included), or (d) neither (**NoEvid;** neither *red* nor blue sentence included). The eyewitness report conflicts with statistical information. The probabilities associated with them are equal (e.g. 80% vs. 20% in (1)).

In the critical sentence, we tested 8 certainty markers (Table 1). We manipulated whether this sentence mentions an event supported by the eyewitness (e.g. *the cup was made by 2-To-Go*) or by statistical information (*by Fast Kup*). When only one evidence type is provided (Only{Stats/Eye}Evidence), the other version is a *control* (*refers to a situation unsupported by evidence*). In Conflicting StatsEye, the two versions allow us to compare ratings for eyewitness vs. statistically-supported statements. In NoEvidence, neither version is supported by evidence. **Task**: Participants rated their level of agreement with the critical sentence (1= strongly disagree, 6=strongly agree), on the basis of the preceding paragraph.

Our **results** indicate that eyewitness information is privileged in the use of linguistic certainty markers, but, is weakened by conflicting statistical information. First, when eyewitness evidence points to an event (**OnlyEyeEvid,** Fig.1), all sentences describing that event, regardless of certainty marker, receive higher agreement ratings than controls (lmer, emmeans, all p's<.01, except for *possible* p=0.04). When statistical information points to an event (**OnlyStatsEvid,** Fig.2), sentences describing that event with lower-certainty markers (*possibly/possible/probably/believe*) receive higher ratings than controls (p's<.002). However, sentences with higher-certainty markers (*clear/convince/definitely*) do not differ from controls (except for *clearly,* p<.001): When *only statistical information* is provided, participants are unwilling to accept high-certainty markers: they rate high-certainty marker sentences as low as high-certainty markers modifying unsubstantiated claims (controls).

If statistics point to one event and the eyewitness to another (**ConflictingStatsEye,** Fig.3), sentences about the 2 situations are rated alike, regardless of marker: If statistics and eyewitness conflict, eyewitness reports lose their special status. High-certainty *I'm convinced* is an exception and gets higher ratings when it matches the eyewitness (p<.008). If no evidence is given (**NoEvid,** Fig.4), ratings for sentences about the 2 events don't differ.
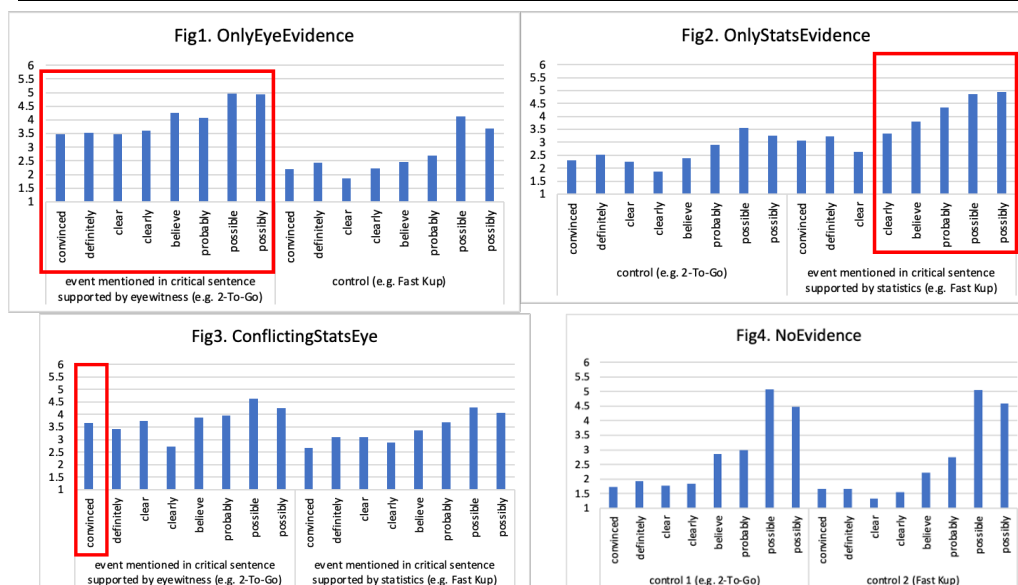
In sum, people's willingness to accept linguistic certainty markers reveals that eyewitness evidence has a special status in language comprehension. But if information sources conflict, high-certainty markers become less acceptable for eyewitness-based statements, indicating that it is not impervious to effects of statistical information.

(1) Example evidence paragraph (Color, underlining, italics not shown in experiment. 8 paragraphs, with 8 distinct scenarios, were tested; this is one example.)

Mrs. Wells suffered serious burns when the disposable cup containing her coffee from the Yum Roastery Cafe suddenly collapsed as she was holding it. The Yum Roastery Cafe only uses disposable cups by two companies; the Fast Kup company and the 2-To-Go company. Both companies use the same raw materials and the same kinds of machines. Neither company puts any branding on its cups. [[*Eighty percent of the disposable cups used by Yum Roastery are manufactured by Fast Kup, whereas 20 percent of the cups are manufactured by 2-To-Go.*]] [[The barista who served Mrs. Wells said he is 80 percent certain that he grabbed a cup from the box containing 2-To-Go disposable cups when he made Mrs. Wells' coffee.]] Because the two companies' cups look alike and because Mrs. Well's cup got soaked, it's impossible to tell from the remnants of the cup itself who made it.

Table 1**:** Example w/ certainty markers, selections informed by prior work e.g. Theil'20)

Approx. certainty level	Linguistic certainty marker	Example critical sentence
higher certainty	I am convinced	I am convinced beyond a doubt that Mrs. Wells was burned because a cup made by **{Fast Kup/2-To-Go}** malfunctioned.
	definitely	Mrs. Wells was burned because a cup definitely made by **{Fast Kup/2-To-Go}** malfunctioned.
	clear	There is clear and convincing evidence that Mrs. Wells was burned because a cup made by **{Fast Kup/2-To-Go}** malfunctioned.
	clearly	Mrs. Wells was burned because a cup clearly made by **{Fast Kup/2-To-Go}** malfunctioned.
mid/lower certainty	I believe	I believe that Mrs. Wells was burned because a cup made by **{Fast Kup/2-To-Go}** malfunctioned.
	probably	Mrs. Wells was burned because a cup probably made by **{Fast Kup/2-To-Go}** malfunctioned.
lower certainty	it's possible	It is possible that Mrs. Wells was burned because a cup made by **{Fast Kup/2-To-Go}** malfunctioned.
	possibly	Mrs. Wells was burned because a cup possibly made by **{Fast Kup/2-To-Go}** malfunctioned.

Fig1. OnlyEyeEvidence

Fig2. OnlyStatsEvidence

Fig3. ConflictingStatsEye

Fig4. NoEvidence

Figs1-4: Agreement ratings for critical sentences. Red boxes indicate significant ($p<.05$) differences from controls/ from other side of the graph.