

Comment on Løhre & Teigen (in press). "There is a 60% probability, but I am 70% certain: Communicative consequences of external and internal expressions of uncertainty." *Thinking & Reasoning*.

Craig R. Fox
UCLA Anderson School of Management & Department of Psychology

Gülden Ülkümen
University of Southern California

A number of philosophers and psychologists have observed that uncertainty may take different forms. Perhaps the best known psychological account is an essay by Kahneman & Tversky (1982) called *Variants of Uncertainty*, in which the authors distinguish *internal* uncertainty, which is attributed to one's mind (e.g., whether or not a trivia question was answered correctly), from *external* uncertainty, which is attributed to dispositions of causal systems in the world (e.g., whether or not the home team will win a football match). External uncertainty may further be characterized as either *singular* in which "probabilities are assessed by the propensities of the particular case at hand" (e.g., the relative strength of the teams and how they match up) or *distributional* in which "the case in question is seen as an instance of a class of similar cases, for which the relative frequencies of outcomes are known or can be estimated" (e.g., the proportion of times each team has prevailed over the other in the past; see Table 1, column 1 and 2).

In their essay Kahneman and Tversky (1982) make an incidental observation concerning how external versus internal uncertainty tend to be expressed in natural

language: “The attribution of uncertainty can sometimes be inferred from a simple linguistic test: Is it appropriate to describe the assessment of the uncertainty as ‘*the probability is ...*’ Or should one say *my probability is ... ?*” (p.151, italics in original). It is important to note that Kahneman and Tversky relied on reader intuitions and presented no empirical evidence of the relationship between language and their internal/external distinction. In this respect Løhre and Teigen (in press) fill an important gap in the literature.

In their paper Løhre and Teigen (in press) distinguish *internally focused expressions* such as “I am X% certain” from *externally focused expressions* such as “It is X% certain” or “there is an X% probability”. They present five studies suggesting that internally focused expressions “may be viewed as more variable and hence less to be trusted” and are more reflective of the speaker’s personal views so that the speaker is more accountable, whereas externally focused expressions appear to be “more objective and accordingly more reliable, but also less informative of the speaker’s views”(p.24). These authors draw generously on Kahneman and Tversky’s (1982) framework (notably their distinction between internal and external uncertainty) as well as empirical work on the language of uncertainty previously reported in unpublished manuscripts that we wrote with Bertram Malle (Fox & Malle, 1997, and Fox, Ülkümen & Malle, 2011; the latter paper has since appeared as Ülkümen, Fox & Malle, in press).¹ In this work we distinguish *confidence statements* such as “I am X% sure”, “I’m fairly confident”, or “I’m very certain” from *likelihood statements* such as “I think there’s an

¹ The unpublished studies of Fox & Malle (1997) were cited by Fox & Irwin (1998). Related studies by Fox, Ülkümen & Malle (2011) were cited by Fox & Ülkümen (2011).

X% chance”, “I’d say it is fairly likely” or “I think there’s a high probability”. We present a number of studies suggesting that confidence statements are associated with *epistemic* (knowable) uncertainty that is attributed to missing knowledge, skill, or information whereas likelihood statements are associated with *aleatory* (random) uncertainty that is attributed to chance or stochastic processes. We note in Fox and Ülkümen (2011) that epistemic (knowable) uncertainty maps roughly onto both Kahneman and Tversky’s (1982) internal uncertainty and external-singular uncertainty, whereas aleatory (random) uncertainty maps roughly onto Kahneman and Tversky’s external-distributional uncertainty (see Table 1, columns 3 and 4). This said, we developed an epistemic-aleatory rating scale (EARS; Fox, Tannenbaum, Ülkümen, Erner & Walters, 2015) for measuring perceptions of these dimensions. Sample items include [the target event] “is knowable in advance, given enough information” (epistemic uncertainty) and [the target event] “is something that has an element of randomness” (aleatory uncertainty), rated on a 7-point scale from “not at all” to “very much”.

The purpose of this Comment is to clarify differences between Løhre and Teigen’s (in press) work and our own (Ülkümen, Fox & Malle, in press), and in so doing show how these accounts complement each other. We begin by noting that Løhre and Teigen’s key distinction between “internally focused expressions” and “externally focused expressions” appears to turn on the use of the first person active voice (“I am”) versus third person passive voice (“it is”) which appear to convey subjectivity versus objectivity and may suggest internal versus external uncertainty, respectively (see Table 1, columns 5 and 6). While Løhre and Teigen’s Studies 2 and 3 deliberately confound

objective versus subjective formulation with use of confidence versus likelihood terms (e.g., “I am X% certain” versus “there is an X% probability”), their Studies 1 and 5 hold the term “certain” constant and manipulate only subjective/objective formulation (e.g., “I am X% certain” versus “It is X% certain”). Meanwhile, Study 4 manipulates both voice and terms—though not in a fully crossed manner (“I am X% certain” versus “It is X% certain” versus “There is an X% probability”), obtaining similar results for the two third-person formulations. Nowhere do these authors show that “% certain” versus “% probability” terms influence attributions of internal versus external uncertainty independently of subjective (“I am”) versus objective (“there is”) formulations.

Our work, in contrast, focuses on the association between different linguistic terms and different representations of *subjective* uncertainty, and we therefore deliberately use a subjective formulation for all expressions (e.g., “I am 90% certain” versus “I’d say there is a 90% probability”). Løhre & Teigen (in press) appear to view this as a liability because they see likelihood statements (e.g., “there is a 90% probability”) as suggesting external uncertainty, so that our subjective (“I’d say”) formulation weakens this association because it may be interpreted as “a statement about one’s internal uncertainty about an external uncertainty” (p.5) and because they think that it is “not very realistic” that people always use such subjective qualifications of likelihood statements. We believe that this misses the point of our research because our aim was to examine the effect of confidence versus likelihood terms while holding subjectivity constant so as not to confound these variables.

In sum, we assert that subjective/objective formulation (as investigated by Løhre and Teigen, in press) and confidence/likelihood statements (as investigated by Ülkümen, Fox & Malle, in press) are logically independent dimensions of language that prompt attention to internal/external and epistemic/aleatory sources of uncertainty, respectively. To test this notion we devised a study (adapted from Ülkümen, Fox & Malle, in press, Study 4) in which we fully crossed voice (subjective versus objective formulation) with term (confidence versus likelihood expression) in composing stems of sentences, and then asked participants to complete those sentences so that they sounded natural. For instance, stems with *subjective* voice and *confidence* term began “I am fairly certain that...” which participants could complete with any event that came to mind. Our assumption was that participants would tend to complete sentences using events that reflect the nature of uncertainty primed by the particular linguistic stem. Thus, we next asked participants to rate their own sentence completions on whether they pertained to internal versus external uncertainty and epistemic (knowable) versus aleatory (random) uncertainty. We predicted that internal versus external sentence completions would be better predicted by voice (e.g., “I am...” versus “It is...”) than by term but that epistemic versus aleatory completions would be better predicted by term (e.g., “certain” versus “probability”) than by voice. In this way we expected to establish the independence of these two linguistic factors.

Method

We recruited 191 participants from Amazon’s MTurk platform (49% female,

average age = 33) to complete a 10-minute study in exchange for \$1. We presented participants with sentence stems and asked them to complete each stem "...so that the complete sentence sounds natural to you." Every participant completed two confidence ("certain") stems and two likelihood ("probability") stems. Half of the stems were phrased using subjective language ("I am fairly certain that", "I'd say there is a high probability that"), and half the stems were phrased using objective language ("It is fairly certain that", "There is a high probability that"). We randomized the order of presentation of the stems.

After the sentence completion task, we provided participants with the full sentences they had completed, and asked them to self-rate each sentence on: (1) a four-item version of the Epistemic-Aleatory Rating Scale (EARS; Fox, Tannenbaum, Ülkümen, Erner & Walters, 2016); (2) subjectivity/objectivity reflected by the sentence (1=my own subjective opinion, 7=objective facts, computation, and/or consensus); (3) whether the locus of uncertainty resides inside or outside the mind (1=is mostly inside my mind, 7=is mostly due to factors in the outside world); and (4) belief strength (1=definitely is false or will not occur, 7=definitely is true or will occur).² We randomized order in which participants completed the four stems, as well as the order in which they responded to the measures for each completion.

Results

² We also asked participants to rate the extent to which the uncertainty reflects singular versus distributional reasoning (1=single case, 7=class of events). This measure failed to turn up any significant results, which suggested to us that participants had difficulty interpreting this measure. In hindsight we recognize that this is a difficult construct to communicate to lay participants online in an understandable way. Thus, we omit this variable from the analysis described below.

We created a term dummy (0=confidence statement, 1=likelihood statement), and a voice dummy (0=subjective formulation, 1=objective formulation) to indicate the nature of each sentence stem. We analyzed the data at the level of completions, with four data points corresponding to each participant's responses to the four completions. We clustered standard errors by participant.

Belief strength. We regressed rated belief strength on the term dummy, the voice dummy, and their interaction. This analysis revealed a marginally significant main effect of term dummy ($B = -.188, p = .083$), suggesting that the rated belief strength tended to be higher for confidence ("fairly certain") stems than likelihood ("high probability") stems. There were no other significant effects. Because of this finding we control for rated belief strength in the analyses reported below.

Composite EARS score. We calculated a composite EARS score by reverse coding items on the aleatory subscale and averaging them with items on the epistemic subscale. Thus, higher scores indicate greater perceived epistemicness (knowability) and/or less perceived aleatoriness (randomness).³ The scale was highly reliable ($\alpha = .78$). Means and standard deviations are listed in Table 2A.

We regressed composite EARS score on the term dummy, voice dummy, their interaction, as well as self-rated belief strength. As predicted and consistent with the results of Ülkümen, Fox & Malle (in press), the effect of term dummy was negative and significant ($B = -.503, p = .041$), indicating that confidence stems were completed with

³ Results of a factor analysis found the scale in this study to load on a single dimension (Eigenvalue = 2.39, explaining 60% of the variance). Thus, in the present application we code the EARS as a single scale of knowability versus randomness. In other applications it loads on two independent dimensions (see Fox et al., 2016).

events that were rated as more epistemic and less aleatory than likelihood stems. Meanwhile, the main effect of voice dummy was not significant ($B = .034, p = .880$). Interestingly, the interaction between term and voice dummies was marginally significant ($B = -.608, p = .062$), suggesting that objective confidence stems (“It is fairly certain that...”) were completed with events that were rated as more epistemic and less aleatory ($M = 2.08$) than the remaining three kinds of stems (average $M = 1.29$). Not surprisingly, there was a significant positive association between belief strength and EARS score ($B = 1.11, p < .001$), indicating that completions that were rated as more plausible were also rated as more epistemic (knowable) and less aleatory (random).

Subjectivity/objectivity. As a manipulation check, we regressed ratings of objectivity on the voice dummy. This analysis confirmed that when participants completed objective stem formulations, they later rated these completed sentences as more objective (and less subjective); ($B = .573, p < .001$).

Internal/external locus of uncertainty. Finally, we regressed the locus of uncertainty measure on the term dummy, voice dummy, their interaction, as well as self-rated belief strength. Means and standard deviations of this measure are presented in Table 2B. As predicted and consistent with Løhre and Teigen (in press), the effect of voice dummy was positive and significant ($B = .516, p = .009$), indicating that participants completed objective stem formulations with events that they subsequently rated as entailing more external uncertainty and less internal uncertainty. Meanwhile, the main effect of term dummy was not significant ($B = -.186, p = .366$), nor was the interaction between the two dummies ($B = -.329, p = .264$). Interestingly, the effect of

belief strength was also significant ($B = .207, p = .009$), indicating that completions that were rated as more plausible were also seen as more external.

Discussion

In their paper Løhre and Teigen (in press) assert that they manipulate internal versus external focus in their studies “partly by the use of personal pronoun, or voice (*it is certain vs. I am certain*), and partly by manipulating voice and terms simultaneously (there is a *X% probability vs. I am X% sure*).” They go on to claim:

“This is a contrast to previous studies by Fox and colleagues where the implied source of uncertainty was manipulated by changing the term while keeping the voice constant (e.g., ‘I am 60% sure’ vs. ‘I think there is a 60% probability’).

Although we support the idea that some terms are more likely to be associated with external uncertainty and distributional reasoning, while other terms are more associated with internal uncertainty and singular reasoning, our studies show that the voice is perhaps more important. The same (internally focused according to Fox and colleagues) term, certain, is interpreted in a fashion congruent with an external or internal attribution of uncertainty depending on the voice in which it is given.” (pp. 21-22)

In our view neither linguistic dimension is “more important”; they are merely associated with different dimensions of uncertainty. A proper empirical test of the claim that voice is “more important” than term necessitates orthogonally manipulating the two factors in order to compare their unique effects on specific variants of uncertainty, a test that is

conspicuously absent from Løhre and Teigen (in press). Thus, in the study reported in this Comment we manipulate term and voice independently and obtain a double dissociation. Confidence versus likelihood terms (“fairly certain” versus “high probability”) prompt completions that participants rate as relatively epistemic versus aleatory, respectively, whereas objective versus subjective voice (e.g., “It is” versus “I am”) has no such effect. Meanwhile, objective versus subjective voices prompt completions that are seen as relatively external versus internal, respectively, whereas confidence versus likelihood terms had no such effect.

In our work (e.g., Ülkümen, Fox & Malle, in press), we have chosen to investigate the relationship between language and perceptions of epistemic versus aleatory uncertainty, whereas Løhre and Teigen (in press) have chosen to study the relationship between language and internal versus external attributions of uncertainty. While we have observed that these frameworks are related (internal uncertainty is generally epistemic whereas external uncertainty may be either epistemic or aleatory; see Table 1), this does not indicate that ratings on these two dimensions (EARS and internal/external) will necessarily covary in a particular experiment. We note that sentence completions in our experiment tended heavily toward more external events (70% of completions were rated at or above the mid-point of that scale), which does not distinguish between epistemic and aleatory uncertainty.

While we have treated the impact of linguistic term and voice as largely independent, we hasten to add that these dimensions may interact in some contexts. Moreover, we can imagine that the use of precise numerical rather than qualitative

expressions may also influence associations with variants of uncertainty. Thus, the expression, “There is an 87% chance that...”, which combines objective voice, likelihood term, and precise quantification may be perceived as especially external and distributional (or aleatory) compared to the expression “I am pretty sure that...” which combines subjective voice, confidence term, and vague qualification. Further research is needed to more carefully map out the relationships between these distinct variations in language and cognitive representations of uncertainty.

References

- Fox, C. R., & Irwin, J. R. (1998). The role of context in the communication of uncertain beliefs. *Basic and Applied Social Psychology, 20*(1), 57-70.
- Fox, C. R., & Malle, B. F. (1997). On the communication of uncertainty: Two modes of linguistic expression. Unpublished manuscript.
- Fox, C. R., Tannenbaum, D., Ülkümen, G., Erner, C. & Walters, D. (2016). Credit, blame, luck and attributions of uncertainty: Validating an Epistemic-Aleatory Rating Scale (EARS), Manuscript in preparation.
- Fox, C. R., & Ülkümen, G. (2011). Distinguishing two dimensions of uncertainty. In W. Brun, G. Keren, G. Kirkebøen & H. Montgomery (Eds.), *Perspectives on Thinking, Judging, and Decision Making* (pp. 21-35). Oslo: Universitetsforlaget.
- Fox, C. R., Ülkümen, G., & Malle, B. F. (2011). On the dual nature of uncertainty: Cues from natural language. Unpublished manuscript later appearing as Ülkümen, Fox & Malle (in press).
- Kahneman, D., & Tversky, A. (1982). Variants of uncertainty. *Cognition, 11*, 143-57.

Løhre, E. & Teigen, K. H. (in press). There is a 60% probability, but I am 70% certain:

Communicative consequences of external and internal expressions of uncertainty.

Thinking & Reasoning, forthcoming.

Ülkümen, G., Fox, C. R., & Malle, B. F. (in press), "Two dimensions of subjective

uncertainty: Clues from natural language," *Journal of Experimental Psychology:*

General.

Table 1. Variants of Uncertainty and Sample Putative Linguistic Associations. Note: Headings indicate key references, and rows indicate forms of uncertainty that roughly correspond across frameworks.

Kahneman & Tversky (1982)		Ülkümen, Fox & Malle (in press)		Løhre & Teigen (2015)	
<i>Internal</i>	"my probability is X"	<i>Epistemic</i>	"I am X% certain"	<i>Subjective</i>	"I am X% certain"
<i>External--Singular</i>	"the probability is X"	<i>Epistemic</i>	"I am X% certain"	<i>Objective</i>	"It is X% certain" "There is an X% probability"
<i>External--Distributional</i>	"the probability is X"	<i>Aleatory</i>	"I'd say there's an X% probability"	<i>Objective</i>	"It is X% certain" "There is an X% probability"

Table 2A EARS (Epistemicness – Aleatoriness) Means (and Standard Deviations).

	Subjective Voice	Objective Voice
Confidence Term	1.34 (2.76)	2.08 (2.76)
Likelihood Term	1.16 (2.66)	1.37 (2.74)

Table 2B Locus of Uncertainty (1= mostly inside my mind, 7 = is mostly due to factors in the outside world) Means (and Standard Deviations).

	Subjective Voice	Objective Voice
Confidence Term	4.31 (2.19)	5.17 (2.06)
Likelihood Term	4.40 (2.06)	4.95 (1.97)