Eliciting Sets of Acceptable Gambles — The CWI World Cup Competition

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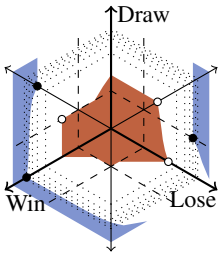
We present an interface for eliciting sets of acceptable gambles on a three-outcome possibility space, discuss an experiment conducted for testing this interface, and present the results of this experiment.

Elicitation When uncertainties are elicited from experts, they are typically quantified as probabilities. Eliciting probabilities directly from domain experts as precise numbers is often problematic due to a lack of familiarity with probability theory and the absence of a concrete context. Moreover, even some of the most ardent 'precise' probabilists agree that imprecise-probabilistic techniques are better suited to deal with the results of an elicitation procedure (O'Hagan & Oakley 2004, Sec. 3.3). Sets of acceptable gambles form a representation for imprecise probabilities that is close to human behavior and eliciting them directly may improve the quality of the resulting uncertainty model.

Interface As a first step towards testing this hypothesis, we designed an interface for eliciting sets of acceptable gambles on three-outcome possibility spaces. We started from a two-dimensional representation of the three-dimensional space of gambles that was inspired by the flexibility afforded under the coherence axioms: We used the set of gambles with minimal value -1. This set of gambles was projected onto the plane and a logarithmic transformation was applied to obtain a representation with a sufficiently wide range of gamble values. To implement this representation, we needed to apply a discretization and had to develop a set of techniques for efficiently calculating the natural extension of an assessment in the context of a web browser, our chosen implementation environment.



Experiment We organized a betting competition for the 2014 FIFA World Cup. For each match, sets of acceptable gambles were elicited from participants; using the assessments so obtained, we computed a bet between them, i.e., a gamble was assigned to each participant. We were inspired by (Walley 1991, App. I), who ran an experiment for eliciting lower and upper probabilities concerning the outcome of matches of the 1982 FIFA World Cup.

Whereas (Walley 1991, App. I) used pairwise fair bets between the participants to score them, we designed a new algorithm for generating a single fair bet between all the participants in the betting pool. The algorithm's objective was to maximize lower expected payoff over all participants, while keeping the sum of the payoffs equal to zero.

Results Participant feedback indicated that reducing the complexity of the task and the interface would ease the elicitation procedure. The experiment's results underlined that imprecision is an essential aspect of real-life uncertainty modeling: most assessments made were imprecise. An interesting observation: the few participants who used complete, 'precise' models almost exclusively all had greater global losses than winnings.

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