

A pairwise contrast model of intuitive probabilistic inference

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One of the most robust findings in subjective probability research is “subadditivity”—people judge the likelihood of some compound event occurring (e.g., a Chicago team wins the World Series) as less than the sum of the likelihoods given to its constituent parts (White Sox win + Cubs win).

Recently, Windschitl and Chambers (2004) presented evidence for a “dud-alternative effect”: adding an especially weak alternative increases confidence in the focal alternative. For example, their participants rated the probability of winning a raffle lower if only one other competitor held 14 tickets than if three other competitors held 14, 1 and 2 tickets, respectively. This is neither consistent with subadditivity nor with the regularity principle (adding a new alternative cannot increase the probability of any of the original alternatives). The authors sketch a theory of pairwise comparisons between the focal alternative and competitors, but never developed a formal model with testable predictions. Windschitl and Wells (1988) also tested a simple model in which the probability judgment was based entirely on comparing the focal alternative to the strongest competitor.

We propose a two-parameter model of probability judgment which predicts when dud-alternative effects will be found and generates normative judgments as a special case. The first parameter determines the degree to which comparisons with weak competitors dilutes the comparison with the strongest competitor. The second parameter determines the disproportionate weight to the strongest competitor.

We test our model in two studies adapted from Windschitl & Chamber (2004). Participants in Study 1 rated their confidence in winning a series of raffles. For each trial, participants viewed the number of tickets they and each competitor held. Participants saw a combination of baseline and “dud” raffles. “Dud” raffles were generated by adding from one to three “dud” competitors to a “non-dud” competitor in the baseline raffle. Though there was no time limit, participants were asked to proceed as quickly as possible. Study 2 gave half of the participants a limit of 5 seconds per trial.

We fit the data using both our two-parameter model and a two-parameter support theory model (Brenner & Koehler, 1999). In general, our model outperforms support theory. Participants who made their judgments under time pressure exhibited more dud effects (i.e. participants thought they had a higher chance to win the dud raffle than its baseline raffle). As a result, our model even further outperforms support theory for data from the time pressure condition.