Cognitive Reconstruction in Hindsight: A Model and an Experiment

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Hindsight bias refers to the tendency for people with knowledge and event outcome to recall their original judgment about the event as closer to the outcome than it actually was. No attempt to explain hindsight bias has resulted in a precise model that specifies the cognitive (or motivational) mechanism. Our CRAFT model (Cognitive Reconstruction After Feedback with Take the Best) does.

We apply CRAFT to the typical hindsight bias task in which an original judgment has to be made at time 1, feedback about the correct answer is given at time 2, and the original judgment has to be recalled at time 3.

Time 1: Steps of the Algorithm

We account for the original judgment at time 1 with the basic PMM algorithm (PMM theory; see Gigerenzer, Hoffrage, & Kleinbölting, 1991). A PMM is an inductive device that uses limited knowledge to make fast inferences in tasks in which a choice must be made between two objects *a* and *b* (e.g., two food items) on a quantitative target variable (e.g., amount of cholesterol). The knowledge consists of cues (that are correlated with the target variable) as well as the values of *a* and *b* (e.g., 2g and 1g saturated fat per ounce, respectively) on each cue.

In a two-alternative choice in which one has to decide which of two food items has more cholesterol, the basic algorithm in the PMM framework, the "Take The Best" (TTB) algorithm, retrieves the items' relation on the most valid cue from memory. The cue is said to discriminate between the two alternatives if its value for *a* differs from that for *b*. If the best cue discriminates, the search stops; otherwise, the algorithm repeats the procedure with the next-best cue until a cue that discriminates is found. Finally, the item with the higher cue value on the discriminating cue is chosen.

Time 3: Cognitive Reconstruction

What happens when one's original judgment at time 3 must be recalled after receiving feedback (about *a* and *b*'s values on the target variable) at time 2? It is assumed that if the original judgment cannot be retrieved at time 3, it will be generated by reconstructing the knowledge on which the judgment at time 1 was based. During this process, the TTB algorithm will be applied again.

Our crucial assumption concerning reconstruction is that it is not completely veridical but rather is shifted toward feedback. The reason is that feedback is a cue strong enough to shift recalled cue relations between objects in the direction consistent with feedback. The impact of feedback is particularly strong when a cue did not discriminate at time 1 because of an unknown cue value.

Aside from systematic (feedback dependent) shifts in cue relations, there also occur random (feedback independent) shifts. Random shifts, which reflect an error component whose importance Erev, Wallsten, and Budescu (1994) and others have demonstrated in modeling human confidence judgments. Random shifts can account for the finding that choices are sometimes reconstructed in a way inconsistent with feedback.

Test of CRAFT: Experiment

A real-world topic with considerable significance for many people is nutrition. The TTB algorithm predicts which of two food items a particular participant will choose as having more cholesterol before and after feedback. The input to the algorithm is participants' knowledge about the values on the saturated fat, calorie, and protein cues for food items which we told them were excellent (80% cue validity), good (70%), and weak (60%) predictors for cholesterol, respectively. To control knowledge, we started the experiment with a learning phase in which participants learned about 50% of the cue values on the saturated fat, calorie, and protein cues for 36 food items. Immediately after the learning phase, participants were given a list of food items and were asked "Which food do you think has the higher amount of cholesterol?

In the second session, the experimental group received feedback for each of the questions they answered previously (the cholesterol values). In addition, they were asked to recall (a) which food they originally chose as having the higher amount of cholesterol and (b) the amounts of saturated fat, calories, and protein that they learned in the learning phase. The control group received no feedback and had to answer the same questions.

By comparing the choices predicted by the TTB algorithm at time 3 with the actual choices (at time 1), CRAFT predicted for each food pair and each participant whether hindsight bias (shift in choice consistent with feedback), reversed hindsight bias (shift inconsistent with feedback), or no hindsight bias would occur.

In the experimental group, CRAFT accurately predicted 82% of the observed outcomes. In the control condition, the algorithm accurately predicted 87% of the observed outcomes.