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What's next? Disentangling availability from representativeness using binary decision tasks☆

João N. Braga[a,b,*], Mário B. Ferreira[b], Steven J. Sherman[c], André Mata[d], Sofia Jacinto[c,e], Marina Ferreira[e]

[a] Católica Lisbon School of Business of Economics, Universidade Católica Portuguesa, Portugal
[b] Research Center for Psychological Science, Faculty of Psychology, University of Lisbon, Portugal
[c] Indiana University, Bloomington, United States
[d] William James Research Center – ISPA, Portugal
[e] Instituto Universitário de Lisboa (ISCTE-IUL), CIS-IUL, Lisboa, Portugal

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ABSTRACT

People's intuitive predictions under uncertainty may rely on the representativeness or on the availability heuristics (Tversky & Kahneman, 1974). However, the distinction between these two heuristics has never been clear, and both have been proposed to underlie the same judgment tasks. For instance, when judging what outcome is likely to be next in a coin flip after a streak, representativeness leads to predicting an alternation in the outcome, ending the streak (gambler's fallacy), whereas availability leads to predicting the streak's continuation. We propose that availability (direct use of accessibility) is computed earlier than representativeness (comparing to an abstract representation of the expected outcome). In five studies, we pit one heuristic against the other in binary prediction tasks, both in coin flip and athlete's performance contexts. We find that, although the streak outcome is cognitively more available, judgments are usually based on representativeness, leading more often to a prediction of an alternation after a streak. However, under time-pressure conditions, representativeness processes are constrained and participants are more prone to base their predictions on the most salient and cognitively available outcomes.

1. Introduction

What is the next outcome of a coin toss in a sequence? Will it rain tomorrow? Will a certain athlete achieve the qualifying standards for the Olympic Games? Since the 70's, based on work by Tversky and Kahneman, the representativeness and the availability heuristics are assumed to play a role in the processes underlying intuitive predictions or judgments about future outcomes (e.g., Kahneman & Frederick, 2002; Tversky & Kahneman, 1974). The processes underlying people's intuitive predictions could thus be resumed by one of these two heuristics. People could either expect the future to conform to an abstract representation of the event (representativeness); or they could simply expect the future unfold as the most easily imagined scenario (availability). Despite these conceptual differences, both representativeness and availability could often anticipate and explain the same judgment or prediction outcome (Gigerenzer, 1991, 1996). Therefore, clarifying the cognitive processes underlying these heuristics, disentangling their empirical effects, and understanding when one or the other will be used to predict a future outcome proved to be trickier than initially expected (see Anderson, 1991; Kahneman & Frederick, 2002; Sherman & Corty, 1984).

The present work aims to address these issues. We propose that one crucial conceptual difference between these two heuristics is that availability is a simpler heuristic, relying directly on the accessibility of specific instances (e.g., Gabrielcik & Fazio, 1984), whereas representativeness depends on a more complex process in which the target is compared to an abstract representation of the event (e.g., Kahneman & Frederick, 2002). Consequently, availability (direct use of accessibility) should be computed faster than representativeness (comparison with an abstract representation of the event), and the time available to compute the judgment may then determine whether representativeness or availability will be used. We present a series of studies that make use of a binary decision task, where both heuristics can be computed but anticipate different outcomes, to test these hypotheses and to disentangle availability from representativeness, conceptually and empirically.

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* Corresponding author at: Católica Lisbon School of Business & Economics, Universidade Católica Portuguesa, Palma de Cima, 1649-023 Lisboa, Portugal.
E-mail address: joaonizabraga@ucp.pt (J.N. Braga).

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2. When representativeness, when availability?

In Tversky and Kahneman's heuristics-and-biases research program, the conceptions of representativeness and availability were outlined by clearly different definitions. Representativeness was defined in terms of a similarity assessment between the target and a category in memory, and judgments would then be based on the extent to which the target represents the attributes central to the subjective category (Kahneman & Tversky, 1972). For instance, after a streak of three "Heads", the next outcome of a coin toss is expected to be a "Tail" and end the streak (the gambler's fallacy), because the observed streak is not representative of people's subjective notion of a binary random event (Kahneman & Tversky, 1972; Tversky & Kahneman, 1971), which is expected to have very few streaks and to be approximately 50% Heads and 50% Tails even in small samples (e.g., Bar-Hillel & Wagenaar, 1991; Lopes & Oden, 1987; Wagenaar, 1972).

On the other hand, availability was defined in terms of the mental sampling of specific exemplars, whereby the judged likelihood of an event depends on the ease of retrieval or the accessibility of these specific instances (Tversky & Kahneman, 1973). As an example of the direct effect of accessibility, exposing subjects to subliminally presented words containing the letter t increased frequency estimations of words beginning with "t" (Gabrielcik & Fazio, 1984). In this vein, in the coin flip example, one could expect that after a streak of three "Heads", the next outcome of a coin toss would be a "Heads", because "Heads" is the most salient outcome.

One crucial conceptual difference between these two heuristics is that representativeness depends on comparisons with categorical abstract representations whereas availability relies on the accessibility of instances. Theoretical efforts to understand and disentangle these two heuristics suggested that the use of either representativeness or availability would depend on the accessibility of, respectively, representations (categorical information) or specific instances (exemplar information) (e.g., Kahneman & Frederick, 2002; Sherman & Corty, 1984). In fact, priming abstract mindsets (high levels of construal, which facilitate similarity judgments and the reliance on abstract information) has been shown to increase the use of the representativeness heuristic in base-rate or conjunction problems, whereas concrete mindsets (low levels of construal, which focus on concrete specific instances) increase reliance on the availability heuristic (Braga, Ferreira, & Sherman, 2015).

However, despite the aforementioned differences, the same problem can elicit and make accessible both categorical and exemplar information. For example, if asked whether there are more deaths caused by rattlesnake bites or bee stings, one may answer based on the memory accessibility of instances of deaths caused by rattlesnake bites or bee stings (a judgment by availability). Alternatively, one's response may be based on which of these animals' representations is more representative of (i.e., more similar to) a dangerous animal (a judgment by representativeness). Assuming that snakes are perceived to be more similar to the representation of a dangerous animal than bees, and to the extent that deaths by snakebites may be more cognitively accessible events than deaths by bee stings, both heuristics would predict the same answer. This example, offered by Anderson (1991), clearly illustrates that it is often difficult to identify a priori which heuristic – representativeness or availability – is going to underlie the judgment behavior, although both heuristics can, a posteriori, be used to explain the same judgment (Gigerenzer, 1991, 1996).

But even in such cases where both heuristics apply, availability and representativeness should nonetheless rely on a different processing of the same information. Availability relies directly on the accessibility of target instances to generate a response (e.g., predicting "Heads" on a coin toss – "Heads or Tails?" – because "Heads" is favored by being presented first in the sentence, hence comes to mind sooner than "Tails"; Bar-Hillel, Peer, & Acquisti, 2014); whereas representativeness involves the comparison of the target with a representation (in the gambler's fallacy example this requires not only processing the observed streak, but also comparing it to a representation of random binary events). Therefore, when both heuristics can be computed, availability judgments, being a direct effect of accessibility, should be completed before judgments by representativeness, which involve not only assessing the target but also comparing it with an abstract representation.

However, when such a comparison is completed, the representativeness-based response takes precedence over availability-based responses. Indeed, research on the availability heuristic shows that, if participants are aware of an alternative explanation for an item's accessibility, the effect of accessibility disappears (Kubovy, 1977; Oppenheimer, 2004; Schwarz, 1998; Schwarz et al., 1991; Waenke, Schwarz, & Bless, 1995). For instance, when judging the frequency of certain letters in a text, participants overestimate the frequency of their own name's initials (because our own name initials are chronically accessible), but underestimate their frequency if they had previously used their initials in an unrelated task (Oppenheimer, 2004, Study 3). These results suggest that, even though specific instances are accessible, people do not necessarily rely on the availability heuristic (e.g., Gabrielcik & Fazio, 1984; Oppenheimer, 2004). They may discount the direct effect of accessibility and rely on other judgment processes, such as representativeness (e.g., Kubovy, 1977).

Nonetheless, reliance on the representativeness heuristic seems to be constrained by time-pressure manipulations during the processing of the target problem (Villejoubert, 2009). For instance, the conjunction fallacy, an effect attributed to the use of representativeness (Tversky & Kahneman, 1973), was found to be reduced when the time to process and respond to the conjunction problem was constrained (Villejoubert, 2009). This result is consistent with the idea that heuristic responses requiring the processing of the target *and* its comparison with a representation (representativeness) need more processing time to be fully computed than relying directly on the accessibility of instances (availability).

We thus suggest that the processing time conditions, and not only the accessibility of information (Kahneman & Frederick, 2002), determine whether judgments rely on availability or representativeness. Decision contexts amenable to both heuristics, but where the responses suggested by the two heuristics are in opposition, provide an ideal setting to test the above hypothesis by directly pitting availability against representativeness.

3. Predictions of future outcomes: alternation vs. continuation

Tasks that require predicting the next outcome in a sequence may satisfy our methodological need of opposing the representativeness and the availability heuristics in the same task. As mentioned before, after a streak of three consecutive "Heads" generated by a coin toss, people show a tendency to alternate, predicting the opposite outcome (Tails, the gambler's fallacy). This tendency has been seen as a manifestation of the representativeness heuristic (Tversky & Kahneman, 1971; see Oskarsson, Boven, McClelland, & Hastie, 2009, for a review of different accounts). Because participants compare the observed sequence with a representation of a binary random event (50% Heads and 50% Tails, and few streaks), they expect a new toss to bring the overall level of Heads and Tails closer to the expected value of 50% every time the observed sequence deviates from that representation (Kahneman & Tversky, 1972).

On the other hand, as a streak of "Heads" unfolds, this outcome becomes cognitively more accessible. However, people do not rely directly on the most available answer, predicting streak's continuation (e.g., guessing "Heads" after a streak of Heads). This may be because, in the standard use of this "what's next?" paradigm, people have the time to compute the comparison between the observed sequence and the representation of the event, thus replacing the availability of "Heads" with the more "representative" option "Tails".