



When knowledge activated from memory intrudes on probabilistic inferences from description - the case of stereotypes

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ARTICLE INFO

Keywords:

Intrusion effects in decision making
 Probabilistic inferences
 Stereotypes
 Decision biases

ABSTRACT

To make decisions in probabilistic inference tasks, individuals integrate relevant information partly in an automatic manner. Thereby, potentially irrelevant stimuli that are additionally presented can intrude on the decision process (e.g., Söllner, Bröder, Glöckner, & Betsch, 2014). We investigate whether such an intrusion effect can also be caused by potentially irrelevant or even misleading knowledge activated from memory. In four studies that combine a standard information board paradigm from decision research with a standard manipulation from social psychology, we investigate the case of stereotypes and demonstrate that stereotype knowledge can yield intrusion biases in probabilistic inferences from description. The magnitude of these biases increases with stereotype accessibility and decreases with a clarification of the rational solution.

1. Introduction

In everyday life, we are faced with countless decisions between different options that require making judgments about the world. In such contexts, individuals are often faced with the question of which option is the best concerning a specific criterion. This criterion may relate to the motivation of potential future employees, durability of consumer products, or good weather at a specific travel destination. Often, the criterion is not directly observable and must instead be inferred based on probabilistic cues (Brunswik, 1955). In the literature, such problems are referred to as *probabilistic inferences* (e.g., Bröder, 2000), which are a special case of judgments. For example, in order to select the product with the highest quality from a choice set, one can take into account the recommendations of different more or less reliable product testers. Predictive pieces of information are referred to as *cues*; and their predictions as *cue values*. The predictive accuracy of cues is referred to as *cue validity*, which is usually defined as the conditional probability of a positive prediction given a positive criterion.

1.1. Adaptive use of deliberate strategies versus automatic coherence construction

When faced with a decision task, a rational decision maker, the *homo oeconomicus*, is believed to integrate cues according to the rules of probability (i.e., Bayes theorem) and then integrate the resulting

probabilities and values of consequences before finally choosing the option with the highest calculated expected utility (Savage, 1954). The deliberate implementation of these effortful calculations seems nearly impossible given typical constraints of time and cognitive capacity. Therefore, classic approaches to adaptive decision making assume that individuals use only some of the available information and apply simplified decision rules to make decisions quickly and with reasonable cognitive effort (e.g., Gigerenzer, Hoffrage, & Kleinbölting, 1991; Payne, Bettman, & Johnson, 1988; Simon, 1955). Still, decision making and cognition in general are not only governed by controlled processes. Rather, automatic information integration processes also play a non-negligible role (e.g., Glöckner & Witteman, 2010; Hogarth, 2001; Kahneman, 2003; see Evans, 2008, for an overview). Parallel constraint satisfaction (PCS) models for probabilistic inferences (e.g., Glöckner & Betsch, 2008a, 2008b; Simon & Holyoak, 2002; Simon, Snow, & Read, 2004), for example, postulate that information integration in such tasks is at least partially based on an automatic process. This prediction has been corroborated empirically (e.g., Betsch & Glöckner, 2010; Glöckner & Betsch, 2012; Glöckner, Hilbig, & Jekel, 2014). Particularly, PCS conceptualizes information (e.g., cues and options in decision making) as bidirectionally linked nodes in a network. If one node is activated, adjacent nodes that are highly related become activated, as well. At the same time, negatively linked nodes are deactivated until a coherent activation pattern in the network results. In decision making, for example, information would be

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activated favoring one out of at least two options. Approaches like PCS assume that such processes are automatic, allowing decision makers to integrate information in a time frame that is much shorter than that necessary to perform the task deliberately (Glöckner & Betsch, 2008a). In fact, under certain conditions more information can be even processed more quickly than less if the task structure promotes quick processing (Glöckner & Betsch, 2012). This evidence converges with findings from other areas of cognition showing that the integration of multiple information can happen unintentionally, very quickly, and without noticeable effort (e.g., spatial perception: Cheng, Shettleworth, Huttenlocher, & Rieser, 2007; understanding irony: Wang, Lee, Sigman, & Dapretto, 2006; categorization: Troje, 2002).

1.2. Information intrusion from given information

Recent research shows that – in line with the prediction of associative network models such as PCS – adults and children have difficulty preventing intrusions of irrelevant information when making decisions.

Söllner and colleagues (Söllner, Bröder, Glöckner, & Betsch, 2014) trained individuals to use a simple strategy in an information board environment, where only the most valid cue/information is taken into account (“take-the-best”, TTB, Gigerenzer & Gaissmaier, 2011). Participants could maximize choice accuracy and payment if they used this simple rule and focused only on the most important dimension of outcomes. Occasionally, the computer program uncovered information in the board related to less important dimensions. These outcomes were irrelevant to the TTB strategy and, moreover, did not help to increase decision accuracy. Nevertheless, these pieces of strategy-irrelevant information systematically biased participants' decisions and confidence judgments, indicating that participants considered this information although they attempted to apply the TTB strategy.

In the studies by Söllner et al. (2014), irrelevant information was openly provided along with the relevant information. Hence, intrusion might be caused by automatic attentional responses or even the experienced demand to integrate all pieces of information that are explicitly provided. With these results, it becomes apparent that decision makers have difficulties with suppressing or ignoring given information as predicted by associative models such as PCS.

1.3. Information intrusion from memory

In many real-life situations aside from explicitly given and directly accessible cues as described in the previous section, additional information is activated — for example by stereotypes — that could intrude on the decision process, as well. The intrusion of potentially irrelevant or even erroneous information from memory has received little attention in research on probabilistic inferences from description — i.e., decisions in which participants are provided with cue values and cue validities concerning the options at stake.

Preliminary evidence for the existence of such intrusion effects from memory comes from studies in developmental psychology (Betsch, Lang, Lehmann, & Axmann, 2014). Betsch and colleagues studied probabilistic inference decisions in children (5–6 y., 9–10 y.) and adults in both an open and closed information board. In a closed information board, individuals must open information boxes (e.g., by clicking on them) to receive access to cues' predictions. In the open information board, in contrast, all pieces of information can be inspected at once without requiring serial information search. An open board fosters quick and intuition-based decision making (Glöckner & Betsch, 2008a, 2008b). Most importantly, Betsch et al. (2014) varied the presence of irrelevant information. Specifically, one of the advice givers (cues) was announced as a “friend” of the participant (the lure), without this information being relevant for making a correct choice. Participants working in the closed-board environment were not influenced by the lure. In contrast, in an open-board environment, choices of both children and adults were systematically influenced by the lure. This finding

is especially interesting with respect to children. Children's capacities for complex deliberate calculations are arguably lower than those in adults. Therefore, children should be especially prone to reducing the effort in decision making by ignoring information. The fact that irrelevant information intrudes on their decision process indicates that information integration is not as effortful as predicted by models of bounded rationality. It also provides first evidence for the hypothesis that information can intrude that is not explicitly provided as a valid cue. Still, it remains unclear whether the “friend” manipulation was indeed perceived as irrelevant by all participants as well as the extent to which this finding generalizes to more indirect relations involving more complex memory constructs such as stereotypes.

Studies focusing on other types of judgments and decision making indicate that prior knowledge is involved in constructing preferences. With regard to the introductory examples, for instance, researchers found that individuals take into account the potentially irrelevant cue physical appearance when judging the qualifications of a potential future employee (Agerström, 2014; Agerström & Rooth, 2011). When purchasing products, individuals infer healthiness from the design of the package (Orquin, 2014; Orth & Malkewitz, 2008). Finally, when judging different travel offers, individuals evaluate vacations more favorably when information is provided as a narrative rather than in the form of a list (Adaval & Wyer, 1998). These examples suggest that individuals not only use explicitly provided information but even “go beyond the information given” (Bruner, 1957) based on samples of their knowledge that is accessible and applicable at the time of judgment (Higgins, Rholes, & Jones, 1977).

1.4. Research questions and general method

In the studies reported below, we systematically investigate intrusion effects of memory contents in probabilistic inference decisions. In particular, we examine (1) to what extent information activated from memory, in this case stereotypes, intrudes on the decision process; (2) whether this assumed intrusion effect can be influenced by increasing the accessibility of the knowledge (stereotype); and (3) to what extent individuals can control such intrusion.

We consider the case of stereotype knowledge as a memory-based source of information intrusion since numerous studies have shown that stereotypes are automatically activated (e.g., Brewer, 1988; Fiske & Neuberg, 1990). In the current study, we combine an information board approach from decision research with techniques used in social psychology to manipulate the activation of stereotype knowledge. Specifically, participants make decisions between products based on product recommendations stated by male and female product testers (cues). These products are generally considered to be either male or female in that either men or women are stereotypically believed to have more expertise concerning these products (confirmed in a pre-study). Providing sex specific information is expected to activate stereotype knowledge. Since this activation upon encountering individuating information is automatic (e.g., Brewer, 1988; Fiske & Neuberg, 1990; Freeman & Ambady, 2011; Kunda & Thagard, 1996) we assume that the information will intrude on the decision process unwillingly and unconsciously. More specifically, the sex of a product tester activates a stereotype that implies increased knowledge for the respective product if a stereotype match exists between the product and the product tester's sex (e.g., a male tester for soccer balls).

To render stereotype knowledge irrelevant for the decision task, we incentivized participants to base their decisions on the given information only (validities of cues and their cue-values/predictions) so that including stereotype information would lead to suboptimal outcomes. In the experimental instructions, participants were requested to provide the rational solution to the task in order to make correct decisions and maximize their experiment payout.

We expect that stereotype knowledge intrudes on probabilistic inference decisions. For the specific task described above, this would

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