

CHAPTER

1

A Primer on the Psychology of Cognitive Bias

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A PRIMER ON THE PSYCHOLOGY OF COGNITIVE BIAS

Psychological research has demonstrated how people's perceptions and cognitions are affected by context, motivation, expectation, and experience (e.g., Gilovich et al., 2002; Koehler and Harvey, 2004). Factors extraneous to the content of the information being considered have been shown to shape people's perceptions and judgments. This chapter reviews the nature of human cognition, and how people's limited capacity for information processing is remarkably efficient, but also introduces systematic errors into decision making. The cognitive shortcuts people take and the assumptions they make when processing information largely occur outside of conscious awareness and thus go undetected by decision makers. Experts are not immune to these cognitive vulnerabilities and hence often exhibit bias in their conclusions, but might be unaware of it. It is precisely because of people's "bias blind spot"

(Pronin et al., 2002) that interventions akin to blinding—that is, limiting people’s access to potentially biasing information—are a necessary procedural constraint when seeking ways to optimize decision making (Dror, 2013; Dror et al., 2015).

THEORETICAL FRAMEWORK OF HUMAN COGNITION

The role of contextual effects on raw sensory information is a basic tenet of human cognitive theory, that is, top-down processing (Rumelhart and McClelland, 1986). It is naïve to believe that people perceive the world objectively or that we encode and interpret the nature of a stimulus based only on the properties of the object i.e., bottom-up processing. Scores of research studies demonstrate the overwhelming power of top-down, conceptually driven processing (Kahneman, 2011). People unconsciously and seamlessly weave their knowledge of the world into their understanding of it. It is a cornerstone of human intelligence that people do not process information passively; rather, they interact and actively make sense of the world.

In the complex worlds of expert decision making, which can include medical, forensic, and legal information, top-down processing is critical. Expertise involves using past experience and knowledge in considering data and making decisions. Such top-down processing may draw on factors such as hopes, expectations, context, motivations, or states of mind—anything but the actual data being considered. These factors not only direct our attention to specific things (and ignore others), but also guide our interpretation and understanding of incoming information.

The human cognitive system has a limited capacity to process all of the information presented to it, and therefore people have to be selective in what receives attention (Simons and Chabris, 1999). As efficient consumers of information, people selectively attend to what they assume is worthy of consideration and process it in ways that fit with any preexisting knowledge or state. This information processing is largely automatic and beyond conscious awareness. While such automaticity and efficiency is the bedrock of expertise, paradoxically, it has also been found to be the source of much bias (Dror, 2011a). For instance (1) literature on the escalation of commitment has demonstrated that people at times continue to invest resources in failing or questionable strategies (Kahneman and Tversky, 1979), (2) hindsight bias has shown that once an outcome is known, people tend to believe the outcome was more predictable for the decision maker than it truly was at the time of the decision (Roese and Vohs, 2012), (3) correspondence bias has illustrated that people are inclined to infer dispositional qualities about actors from observing those actors’ behaviors rather than concluding that there were situational constraints (Gilbert and Malone, 1995), (4) belief perseverance has shown that people tend to maintain their initial beliefs in the face of contradicting information (Nisbett and Ross, 1980), and (5) confirmation bias has demonstrated that people tend to seek and interpret information in a way that is consistent with their initial beliefs (Nickerson, 1998). All of these examples illustrate that the cognitive system has very effective ways to deal with information processing, especially given its limited resources; however, such effective shortcut mechanisms can also bring about vulnerability to bias and error.

CONTEXT EFFECTS

Context effects are environmental factors, such as the attributes of the stimulus, the features of the situation, or the information recipient's expectations (Edmond et al., 2014). Stemming from established theoretical roots (Tversky and Kahneman, 1974), research on context's influence on expert decision making has gained momentum in the past decade. The literature from forensic science (Dror and Rosenthal, 2008; Found, 2014), investigation—both industrial (MacLean et al., 2013) and forensic (Meissner and Kassin, 2002)—judicial process (Jones, 2013), and medical judgments (Bornstein and Emler, 2001) has consistently demonstrated that environment is a powerful influence on how people construct their initial impressions, seek and interpret information, and render their final judgments (Edmond et al., 2014; Saks et al., 2003). This literature also presents conclusive evidence that honest, hardworking decision makers can reach inaccurate conclusions not because of nefarious intent but because of the nature and limitations of human cognition (Dror, 2011a).

Initial Impressions

Judgments about events such as the likelihood of a suspect's guilt, whether a factor is causal in an event, or whether a patient has a particular ailment, are often uncertain because the decision makers may not have quick and reliable access to the ground truth. Classic work by Tversky and Kahneman (1974) suggested that when developing an initial impression about uncertain events, people often rely on how effortlessly the material is brought to mind (i.e., availability) or how well the current situation matches scenarios they have previously experienced (i.e., representativeness). These cognitive rules-of-thumb, or heuristics, are largely efficient strategies that result in many good decisions. However, there are times when such simple metrics of cognition may bias decision making. Errors emerge when features of context support quick access to some information relative to other information, or encourage viewing a scenario as more stereotypical than what would be appropriate given a truly rational weighing of the information (Kahneman, 2011).

Research has demonstrated that the presentation of information can make it overly persuasive if it is salient or distinctive (Taylor, 1982; Taylor and Fiske, 1975), encountered early rather than late in fact finding (Tetlock, 1983; but also see Price and Dahl, 2014 for the effect of recency in judgment), easy to read or understand (Reber and Schwarz, 1999), accompanied by an image (Newman et al., 2012), familiar (Bornstein, 1989), or delivered by a person who is professional looking (Furnham et al., 2013) or generally attractive (Dion et al., 1972; Eagly et al., 1991). Time of presentation can also affect early impressions. Danziger et al. (2011) found that prisoners' chances of being paroled were significantly greater if their hearings were early in the day or after the judge had taken a break for food.

Priming demonstrates how aspects of the information that may be irrelevant to the decision-making task, such as knowledge of a person's race, can guide judgments (Herring et al., 2013). In one study, Bean and colleagues showed that priming nursing and medical students with images of Hispanics activated negative stereotypes regarding these patients' compliance with treatment recommendations (Bean et al., 2013). The basic association that medical practitioners demonstrated between race and compliance is relevant because these types of implicit

biases can subtly guide treatment choices (Sabin and Greenwald, 2012). Racial knowledge can also affect juror decision making because congruency between a suspect's race and a crime (e.g., as with a black man accused of auto theft) tends to result in higher ratings of suspect culpability than if the race and crime were incongruent (Jones and Kaplan, 2003).

The literature on framing demonstrates that the structure of the problem—how the problem is presented—can affect people's choices (Kahneman and Tversky, 1979). Presenting the same medical research statistics as a gain or a loss to medical students affected their selections of treatment options (Marteau, 1989). In the adversarial forum of the judicial system, forensic experts who believed that they were working for the defense rated the risk level of offenders as lower than experts who believed they were working for the prosecution rating the same offenders (Murrie et al., 2013). These experts did not willfully bias their assessments. Rather, their judgments were affected by their affiliations and the goals imposed by the side that retained them.

Judgments

Context that is consistent with a correct situational assessment will facilitate the formation of an accurate hunch or hypothesis. However, confirmation bias demonstrates that an inaccurate initial understanding of the situation can be a significantly compromising first step for experts attempting to reach correct decisions (Kassin et al., 2013; Nickerson, 1998). Once initial impressions are formed, individuals tend to seek and interpret additional information that matches their expectations (Findley and Scott, 2006). People tend to give greater weight to information consistent with their expectations. They also tend to ignore, discredit, or weigh very low information that is inconsistent and interpret ambiguous information as consistent with their working theory (see Ask et al., 2008 for a discussion of the elasticity of evidence).

An erroneous initial impression does not ensure that the decision maker will pursue a biased investigative trajectory; however, research does endorse that the initial impression can be a central predecessor to distorted final judgments (O'Brien, 2009). Once in motion, the momentum of confirmation bias can build quickly for the decision maker because people generally require less hypothesis-consistent evidence to convince themselves that their initial theories are accurate than hypothesis-inconsistent evidence to reject their theories. Contributing to such momentum are motivational factors such as personal goals, organizational norms, and the cognitive effort required for the decision. For instance, people were shown to increase their scrutiny of information in a simulated investigation not only because the information conflicted with their initial hypotheses, but also because the information conflicted with their goal of solving the case (Marksteiner et al., 2011). Research that asked participants to assume the norm of "efficiency"—versus "thoroughness"—in a simulated investigation found that efficient participants were less rigorous in processing the evidence and less open to information presented later in the investigation (Ask et al., 2011).

In a study with physicians, Redelmeier and Shafir (1995) found that 53% of participants who had decided on a treatment option and who were then informed that one more medication could be tried with the patient prior to surgery opted to stay with their original plan of just the referral. By contrast, 72% of physicians who were informed that there were two medications that could be tested with the patient chose to proceed with

just the referral. In essence, the effort involved with deciding between two medications versus one medication resulted in a higher percentage of physicians defaulting to their original referral plans.

Types of Decision-Making Activities

The varied effects of context on specific decision-making activities can be illustrated by the breadth of affected judgments. For example, one of the least-complex judgments required of a decision maker is of visual matching. In one study, participants were asked to rate the facial resemblance of child–adult pairs who in reality were genetically unrelated. However, participants who were told that that the pair were related rated the dyad as significantly more similar compared to those who were told the child–adult pairs were not related or who were given no information (Bressan and Dal Martello, 2002). A study in forensic anthropology found that given contextual information that a skeleton was male (when in fact it was female) biased most examiners to conclude that the skeletal was male. This is in stark contrast to zero participants judging the skeleton to be male when given female contextual information (Nakhaeizadeh et al., 2014). In another study, fingerprint experts who had determined years earlier that certain sets of prints were a match or an exclusion for a particular suspect was given new contextual information that stated that either the suspect had confessed in questioning or that the suspect was in custody at the time of the offense. After receiving the new information, approximately 17% of the experts subsequently changed at least one of their decisions on the prints from match to exclusion or exclusion to match (Dror and Charlton, 2006).

Motivation contributes to the misinterpretation of visual stimuli as well (Dunning and Balcetis, 2013). Participants, who had a vested interest in seeing an ambiguous figure as either a letter or a number, because they would receive either a reward or punishment based on their perception, were more likely to authentically interpret the figure in a way that was consistent with their desired outcomes (Balcetis and Dunning, 2006).

The social judgments literature is where we can gain a fuller appreciation of the implications of context, because expectations have been shown to extend beyond people’s private opinions and affect the behavior of others. In a famous study, Rosenthal and Jacobson (1966) provided teachers at the outset of the school year with information that some of their students had greater academic potential than others. An important feature of the experiment was that the students in the group labeled “promising” were selected at random from the class and did not differ in their academic aptitude than those in the rest of the class. At the end of the year, external evaluators who were not privy to the study details evaluated students’ academic progress, and pupils who were preidentified as promising scored significantly higher than their classmates. Hence, expectation became reality as teachers’ beliefs established patterns of interacting with the students that ultimately resulted in changes in the students’ behaviors.

Contemporary literature on expectancy effects demonstrates the breadth of laboratory and real-world circumstances in which these results are replicated. Significant relationships have been demonstrated between the expectations of judges regarding suspects’ guilt and the decisions of their juries (Blanck et al., 1985); case managers regarding

schizophrenics' abilities and the duration that the affected persons maintained employment (O'Connell and Stein, 2011); dog handlers regarding where the dogs should alert to scents and dogs' performances (Lit et al., 2011); and mock investigators and their questioning styles with witnesses and then subsequent third-party evaluations of witnesses' credibility (MacLean et al., 2011).

The Bias Snowball Effect

It is clear that context can affect a range of decision making. This finding underpins a particularly perilous decision-making phenomenon termed the "bias snowball effect" (Dror, 2012). This effect occurs when information that is perceived to be independent and corroborating may in fact have been contaminated by similar sources of contextual information. Imagine that a witness erroneously identifies the suspect from a target-absent line-up and this information is shared with, and biases, the judgment of the forensic fingerprint expert making the print assessment. The investigating officer shares the positive identification decision and the fingerprint match with the suspect during questioning, which helps to elicit a false confession from the suspect. These three pieces of evidence are not orthogonal, yet when presented at trial, they will be offered as three independent sources of corroborating evidence. Importantly, the information being shared at times may not be relevant to the people it is being shared with (e.g., fingerprint examiner knowing about the identification decision), but it may have real effects on their processing and collection of information (Edmond et al., 2014; Kassin et al., 2013). Hence, rigor should be employed when deciding what information is required and when that information should be shared with those who are either providing information or fact finding.

It is important to note that contextual biasing information may be derived from many different sources.



FIGURE 1 Different levels which may contain irrelevant information that can bias decision makers.

1. The actual data, if they contain irrelevant information. For example, judging handwriting in forensic science may include biasing contextual information within the text.
2. Biasing context within the reference materials that may direct the interpretation of the actual data being evaluated. For example, a suspect's license plate number or fingerprint may direct the evaluator's interpretation of an image of a license plate or partial print obtained from a crime scene. Thus, the evaluator will be working from the suspect to the evidence rather than from the evidence to the suspect.
3. The surrounding context of the case. For example, knowing that suspects confessed or that there is additional evidence against them, such as eyewitnesses.
4. Base-rate expectation of what is typical or expected based on past experience, so there is an expectation of outcome before the actual evidence has even been seen.
5. The wider organizational and cultural factors, such as working for "a side" in the adversarial system or being part of the police team.

Figure 1, which presents the five-level taxonomy for the different sources of irrelevant and potentially biasing information, is based on four-level taxonomy suggested by [Stoel et al. \(2015\)](#).

MITIGATING THE EFFECT OF CONTEXT

Mitigating biasing effects is a challenge. One of the difficulties in mitigating bias is the lack of cognitive control, so when the biases are revealed and observers are aware of it, the



FIGURE 2 What do you see in this image?

observers may still be unable to adjust their cognitions and counter the effects of the biases. Therefore actual measures must be taken (Dror, 2013 ; Dror et al. 2015). To illustrate this issue, please examine Figure 2 from the previous page. Can you guess what image is presented in it? Please remember what you see. Your current interpretation of the image (or your inability to make sense of it) has been formed without any context.

Now that you have had a good look at Figure 2, please view Figure 3 (below). Now that you have seen Figure 3, you are more likely to decipher Figure 2 as consistent with the image in Figure 3. This is the effect of contextual knowledge. Furthermore, once people are exposed to the context, then it is very difficult (if not impossible) for people to turn back the clock to before the context was presented and to see the original image/evidence without the influence of the context. The experience of viewing Figures 2 and 3 shows that there is no “going back” or “blocking” context: once exposed, people are affected and biased without their control or despite their willpower. Hence, an effective frontline strategy to mitigate bias is in the first place to blind decision makers to irrelevant information that can bias their objective interpretations of the facts. Of particular importance is the need to blind information through context management. One method for managing context is Linear Sequential Unmasking (LSU), whereby some information is totally masked, while other is sequentially unmasked and presented when needed (see Dror et al., 2015 for details).

To understand the necessity of limiting people’s exposure to biasing information we turn to the literature concerned with de-biasing. To control for biases, competent researchers have drawn on cognitive theory. A great deal of the literature concerned with reducing bias has



FIGURE 3 Can you also see this image in Figure 2?

focused on increasing people's cognitive investment in information processing. Awareness-based approaches have employed incentives, either through rewards or accountability, and these interventions have yielded mixed results (Samuels and Whitecotton, 2011; Stone and Ziebart, 1995; Tetlock, 1983; Vieider, 2011). These strategies employ the rationale that people generally hold the skills, knowledge, and resources to identify their errors and adjust their judgments accordingly. This approach has limited benefit because much bias is outside of awareness (Arkes, 1991). Thus, decision makers must rely on their intuitive theories of how they have been biased in their attempts to control or correct for biases (Wegener and Petty, 1995), resulting in possible under- or overcorrections to their judgments (Wilson and Brekke, 1994). An additional challenge to awareness-based approaches is that research demonstrates that people are less willing to see their own decisions as biased than those of other people (Pronin et al., 2002) and expertise breeds overconfidence (Baumann et al., 1991). To find a current example of the limits of the incentives approach one needs to look no further than the evolution of the medical system's approach to error in the United States. Despite a consistent ratcheting up of fines and penalties for medical professionals who make diagnostic or surgical errors, the US health-care system has not experienced a significant decrease in mishaps (Dror, 2011b).

Researchers have also attempted to encourage deeper processing of information at a procedural level by (1) asking participants to consider alternatives (or the opposite) of their primary working hypothesis (Hirt and Markman, 1995; O'Brien, 2009), (2) introducing features designed to disrupt the fluency of participants' cognitive processes such as difficult-to-read text (Gervais and Norenzayan, 2012; Hernandez and Preston, 2013), and (3) incorporating explicit and implicit priming targeted at enhancing engagement with the material (Gervais and Norenzayan, 2012). These strategies vary in their success and also have real limitations. For example, because it can be challenging to generate multiple alternative hypotheses, participants who have been asked to consider too many alternatives may demonstrate the same level of bias as those only considering their primary hypothesis (O'Brien, 2009). The above literature, as well as our understanding of human cognition, makes a clear case that the simplest and most reliable approach to mitigating bias is to limit the cognitive contamination of the person processing the information. There are many practical ways for achieving and implementing such antibias measures (Dror, 2013) as well as the LSU method (Dror et al., 2015).

CONCLUSION

In this chapter, we have demonstrated that motivations, expectations, and context influence perception and interpretation of basic and complex stimuli, as well as information synthesis and decision making. The processes of information collection, interpretation, and deliberation underpin judgment and decision making. In developing solutions to mitigate cognitive contamination, it is imperative that we rely on the science of cognition and adopt informed approaches to become as objective as possible in our consideration of the facts. The issue of bias is applicable to all human endeavors, including experts' decision making in the medical, legal, and forensic domains. All of these domains require blinding as a cognitively informed approach to reduce contamination and bias, and use it as a powerful ally in the quest to enhance objectivity in decision making.

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