6

Cultural Influences on Cognitive Biases in Judgment and Decision Making: On the Need for New Theory and Models for Accidents and Safety

Atsuo Murata

CONTENTS

ABSTRACT We believe that cognitive biases are ubiquitous in distorted decision making and subsequent accidents. In addition, we contend that cultural differences may potentially compound the effects of cognitive biases in this domain. In this chapter, we briefly examine two case studies of how cross-cultural nuances contribute to crashes or disasters. Based on these analyses, an emphasis is placed on the concept of incorporating cultural differences into a safety culture or a preventive model of crashes or disasters. We suggest that a new theory needs to be built in the domain of safety, which account for cross-cultural nuances as part of the causal processes leading to accidents.

Introduction

Different from traditional economics, a concept known as *bounded rationality* is commonly assumed in behavioral economics (Kahneman 2011). Bounded rationality perspectives generally suggest that people often do not make decisions rationally; rather, people suffer from cognitive biases such as those pointed out by Kahneman (2011) as well as Tversky and Kahneman (1974). They suggest that our cognitive information processing is conducted by one of two systems, which they refer to as System 1 or System 2. System 1 operates quickly, automatically, and intuitively with little or no deliberate effort. System 1 approaches are

very simple and intuitive, yet such approaches often suffer from cognitive biases. System 2, on the other hand, is a far more effortful approach to decision making and is generally reserved for deliberation.

While both System 1 and System 2 processes are important to human decision making, this chapter will focus exclusively on System 1 processing because, as noted, these process are most commonly susceptible to cognitive biases. In addition, beyond the role System 1 processing plays regarding cognitive biases, Murata and Nakamura (2014) and Murata et al. (2015) discussed how such System 1 cognitive biases probably play a major role in downstream decision making as it is related to accidents. However, the importance of understanding decision making across different cultures and how this leads to distorted decision making was not discussed in these studies. Essentially, we are suggesting that accidents are often the result of System 1 cognitive biases and related errors. And that such errors can be compounded by cross-cultural differences in cognitive styles. Therefore, we attempt to discuss how cultural differences distort judgment, induce cognitive biases, and eventually lead to mistaken behavior. We begin this discussion with several very brief examples of how cultural differences lead to biased and irrational decision making and induce accidents.

Cognitive Biases and Accidents

Cognitive Biases

Before discussing how cultural differences distort judgment and induce irrational behavior, we will briefly discuss how cognitive biases distort decision making absent cultural issues. As shown in Figure 6.1, it is hypothesized that cognitive biases distort decision making, which subsequently leads to human errors in judgment, decision making, behavior, and might eventually trigger accidents if the commitment to the biased judgment, decision making, and behavior is escalated.

Bazerman and Moore (2001) provide several examples of System 1 heuristics such as the availability heuristic, representativeness heuristic, confirmation bias, affect bias, and anchoring and adjustment. Many of these biases are familiar to most readers, but we provide two quick examples for the uninitiated. The availability heuristic is a function of the vividness of imaginable events. Such vividness can bias our perception of the frequency of such events. Likewise, the confirmation bias is a tendency for people to seek information that confirms their expectations and hypotheses even when information disconfirming their expectations and hypotheses is actually more useful.

Bounded awareness prevents one from focusing on useful, observable, and relevant information. It is assumed that our bounded awareness, as described earlier, and uncertain (risk) situations form the basis of heuristics, overconfidence, and framing. Due to such bounded awareness, we sometimes behave irrationally. We frequently tend to behave irrationally and are, in most cases, unaware of how and to what extent these irrational behaviors influence us. Such irrational tendencies are sure to distort our decisions and, in the worst, cases lead to accidents. Without consideration of our bounded rationality, we cannot properly approach the prevention of accidents and analyze the root cause of accidents.

We should explore how cognitive biases distort decision making, induce preconception, and become a trigger of accidents. To do this, we must further clarify the mechanism on

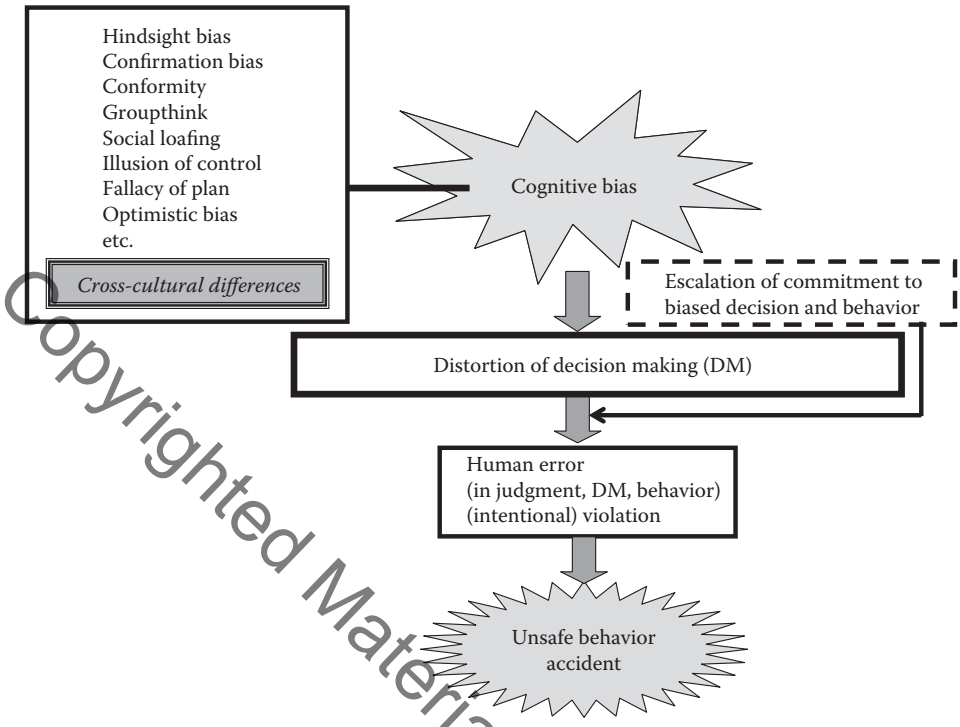

FIGURE 6.1
Relational model between cognitive biases and unsafe behaviors or accidents. (From Murata, A., and Nakamura, T. 2014. Basic study on prevention of human error,—How cognitive biases distort decision making and lead to crucial accidents. *Proceedings of AHFE 2014*, 136–141; Murata, A., Nakamura, T., and Karwowski, W. 2015. *Safety* 1: 44–58.)

why we suffer from cognitive biases, what type of cognitive bias is potentially dangerous, and when or how cognitive biases distort decision making and become a trigger of error, violation, and accident. Moreover, we need to identify the causal paths by which cognitive biases, compounded by cultural nuance, induce errors or violations of regulations or safety rules and how this leads to unsafe behaviors or critical accidents.

Example of How Cognitive Biases Are Related to Accidents

One example of how cognitive biases can relate to accidents is provided by Brafman and Brafman (2008) who pointed out that a concept known as the *loss aversion* (an urge to avoid loss) probably contributed to the famous Royal Dutch Airlines (KLM) Flight 4805 disaster. On KLM Flight 4805, a Boeing 747 was leaving Amsterdam and bound for Las Palmas Airport in the Canary Islands. However, a terrorist bomb exploded at the airport flower shop in Las Palmas Airport, and the flight was diverted to another airport. Subsequently, the KLM flight found itself waiting for air traffic controller (ATC) clearance at a foggy and unexpected airport. After waiting for some time, the captain of the KLM flight attempted to take off without the permission from ATC. Unfortunately, a Pan American 747 was parked across the runway, and KLM Flight 4805 crashed into the Pan American aircraft. All crew and passengers lost their lives.

Review: Loss aversion is a human tendency to strongly prefer avoiding loss over and above acquiring gains. As would be expected, the more meaningful a potential loss, the more people are motivated to avoid the loss.

Naturally, multiple factors contributed to the KLM crash, but as noted, one plausible contributing factor is known as loss aversion. This concept is such that the more meaningful a potential loss is, the more likely people are to try and avoid the loss. In the KLM example, the pilot probably had multiple loss factors in mind as he made his decisions. For example, the pilot was probably considering factors such as the mandated rest period for crew, the cost of accommodating the passengers for making them stay at a hotel until the weather improved, and the blot on the captain's reputation for not being punctual in his flight. With all this in mind, the captain may have been preoccupied with the urge to avoid this cascade of losses. With hindsight, it is easy to believe that the captain was foolish in his decision making. Yet, the loss aversion concept is a powerful one in human psychology and may well have been a contributing factor in the KLM disaster.

Case Studies of Crashes and a Disaster in Regions Other than Western Countries

The KLM Flight 4805 example described earlier provides an example of how cognitive biases, such as loss aversion, are probably involved in accidents. This section will expand upon this concept by demonstrating how cultural nuances are probably involved in accidents as well. In this section, we lay out examples of how cultural nuances can generate accidents across the aviation and chemical industries.

Aviation

One example of how cultural differences probably play a role in accidents comes from the analysis of the Korean Air Flight 801 disaster (Boeing 747-3B5; August 1997). In this crash, a possible root cause is a cultural concept known as *power distance*. Power distance (defined by Hofstede [1980] as the extent to which the less powerful members of organizations accept and expect that power is distributed unequally) suggests that high power distance cultures (such as that observed in many East Asian nations such as Korea) tend to display strong obedience to people in high positional rank and considerably less obedience to people in low positional rank. In the case of the Korean Air crash, power distance probably contributed to the crash.

Generally speaking, the landing approach to Guam is straightforward. Guam airport has a glide scope (a technology tool that emits a beam stretching upward to the sky, which helps guide the landing). Unfortunately, the glide scope at the Guam airport was under repair in this instance. What was worse is that the pilots did not recognize that the guide scope was broken in spite of such information being presented to some crew members in advance.

Review: Power distance is the degree to which the less powerful members of organizations accept and expect that power is distributed unequally. This is one of Geert Hofstede's (1980) original cultural dimensions such as individualism–collectivism, masculinity–femininity, and uncertainty avoidance. Later research has discovered additional dimensions as well.

After the analysis of the flight recorder transcript, it was found that power distance might well have been a notable factor in the crash. In the case of Korean culture, the captain of the aircraft is a rather high positional rank. All other crew members are subordinate to the captain and must generally follow the captain's orders without question. According to analysis of the flight recorder, the flight engineer noticed that the captain misunderstood several instructions, yet the overriding cultural framework he was operating within made it such that directly informing the captain of his error would have been nearly impossible in this cultural context. As pointed out by Sohn (1993), in Western cultures, the responsibility of the speaker is to communicate ideas clearly and unambiguously. In Korea, not the speaker but the receiver is responsible for understanding what the speaker communicates. In the analysis of the flight recorder transcript, it seems clear that the flight engineer indirectly attempted to tell the captain that he was wrong about his interpretation of his approach information but never directly warned the captain.

Union Carbide's Bhopal Chemical Plant Accident

Beyond psychological cultural differences such as the power distance concept mentioned earlier, other types of cultural distinctions, such as distinctions between the industrial safety culture between developing countries and advanced countries may be a key in understanding accidents. One possible organizational cultural distinction between developed versus developing nations might be illustrated by the infamous Union Carbide chemical plant accident in Bhopal, India (Reason 1990). In December 1984, the plant released a deadly gas known as methyl isocyanate. At least 4000 people died and over 20,000 people were injured. At the time of the disaster, Union Carbide's profit was declining, especially in this plant. As a result, the plant laid off key personnel who were accustomed to the details of Union Carbide's Bhopal chemical plant. The plant decreased the shift size from 11 to 5 and reduced the maintenance crew by one-half. They further cut the maintenance and other costs (e.g., shut down the refrigeration unit for saving costs and left safety flares and washing towers unrepaired).

We suggest that, in this tragedy, it might be that the safety culture in developing nations may be less of a focus than in developed nations. In this case, the emphasis on economy instead of safety might well stem from the previously mentioned loss aversion (loss of profit due to the safety measures such as enhancing maintenance expenses to enhance safety). Although, to our knowledge, there is no systematic quantitative evidence that distinctions in safety culture between developing and developed nations exist, we believe that this concept is worth serious considerations and future theory development.

Summary and Call for Additional Theory Development on Cross-Cultural Concept of Safety Culture

Although it is recognized that nurturing safety culture is important for safety management (Dessai et al. 2006; Flin et al. 2000), cross-cultural differences are rarely taken into account in the framework of safety culture or man–machine interface. As stated in the Case Studies of Crashes and a Disaster in Regions Other than Western Countries section, cultural differences (Helmreich 1994; Helmreich and Merritt 2000) seem to affect decision making in the safety domain. Throughout our brief case examples, we speculated that cultural differences, as well as cognitive biases, may distort judgment and eventually lead to mistaken behaviors. Therefore, we believe it is critical to build additional safety models and theories that directly incorporate cultural distinctions (whether based in psychology, cultural anthropology, sociology, etc.) into causal chains.

Summary

We have briefly argued that cross-cultural differences might be a potential causal factor in distorted decision making, which could lead to critical crashes or disasters through the examples of accidents, that is, the Korean air crash accident and Union Carbide's Bhopal chemical plant accident.

As well as a variety of biases, the consideration of cross-cultural differences in thinking, behavior, or decision making is important for understanding the root causes of accidents. It is predictable that cultural nuances can lead to unanticipated and irrational decision making and behavior and can eventually be a trigger or a risk leading to a crash or a disaster. Therefore, an emphasis must be placed on considering cultural differences that distort judgment, induce cognitive biases, and eventually lead to a mistaken behavior. Rather, we had better classify the irrational behavior triggered by the cross-cultural nuances (Helmreich 1994; Helmreich and Merritt 2000) as one of the cognitive biases. In conclusion, we must recognize that the consideration of cross-cultural difference, as well as cognitive biases, is important in the area of accidental prevention and analysis.

As seen and recognized from the two examples, many critical accidents originate from cognitive biases (including an irrational behavior that stems from cross-cultural nuances) as one of the main causes of accidents. The correction or the modification of bias in decision making must be one of the promising measures for preventing critical accidents. When the designers, the engineers, and the managers of modern technologies such as transportation systems, nuclear power plants, and social inflation systems do not understand humans' fallibility (error-prone properties) and the cross-cultural difference related to our irrational mind, we tend to design new and improved systems that do not take our limitation (irrationality) into account, that is, man–machine incompatible systems.

Consequently, we may distort our decisions and make serious errors. These distortions or errors lead to critical accidents such ones as analyzed in the Case Studies of Crashes and a Disaster in Regions Other than Western Countries section. Without such understanding

of our irrationality together with the cross-cultural nuances, we unwillingly repeat critical accidents and cannot get out of the vicious circles of similar accidents. The understanding of how cognitive biases (including ignorance of the cross-cultural difference) distort decision making and lead to accidents is essential in order to avoid such vicious circles as pointed out by Dekker (2006).

DISCUSSION QUESTIONS

1. How often do you believe you behave rationally?
2. What would be the most difficult element of building new theories of accident generation that incorporate cross-cultural nuances?
3. Do you ever underestimate the effect of cross-cultural differences on the behavior of others (and yourself)?
4. What cultural nuances do you believe should be part of future causal theories of accidents?

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