

The unconscious mind rules *in absentia*

S. M. Dark

Bond University, Australia

Abstract

This paper offers an unconscious encounter between the incompatible entities of a vulnerable human populace and a high-intensity storm. The setting is a typically human social situation, a city nestled on the Mississippi River between Lake Pontchartrain and the Gulf of Mexico. The discussion is with the deadfly unconscious. The topic of discussion concerns the psychological constraints that tie humans to a particular ‘place’. A place that conflicts with scientific reality but melds quite well with the rhetorical narrative before the event: ‘it’s happened before and it will happen again but we are still OK ... aren’t we? The purpose of this paper is to (a) investigate the underlying impetus of why citizens choose to stay when threatened by an extreme climate event and (b) what can be learned in the aftermath. It is concluded here that rather than a failure of preparation or policy, or the pending promise of resilience, Hurricane Katrina’s deadly assault can be more so attributed to how citizens mentally model extreme climate events. This paper is an extraction from a theoretical PhD dissertation on mental model theory and policy and planning, to be submitted September 2016.

Keywords: hurricane Katrina, mental model, climate change, negativity bias.

1 Introduction

In absentia, Latin meaning, “In his, her, or their absence” [1]. The advent of Katrina was judged in accord with a universal understanding of a Category 3 or 4 hurricane and thus *in absentia*. That is, the responsibility for deliberative pre-action was passed from person to populace and subsequently dissolved into anonymity. At the place of least resistance, the unconscious mind discounted advice from expert mental models and endeavoured to defend the indefensible. Mental models herein are defined as personally formed, internally held cognitive representations or interpretations, that have to a mutable extent an analogical coherence with the external physical world – notwithstanding that gaps or blind

spots may exist and values and beliefs may exert an influence – that affect a person’s thinking and acting. Individuals use mental models and other cognitive mechanisms, such as heuristics and risk images, to judge risk [2]. Mental model analysis can be used to explore an individual’s thinking and reasoning [3] and identify differences and similarities in understanding [4].

Accepting the default mental model as a blueprint for thinking and acting can lead to large-scale deductive failure [5]. Large-scale deductive failures are prone to end in large-scale disaster. Hurricane Katrina is a case in point. Evidence suggests that the default mental model harboured by coastal dwellers was deficient in the knowledge that sea level rise and storm surges have the potential to inundate existing housing and infrastructure located in low-lying coastal zones. In particular, housing and infrastructure located on the banks of bays and the foredunes of sandy beaches. Indeed, because it contradicts the default mental model of coastal dwellers, their style of life, livelihoods, and the value of their properties, there is evidence to indicate an unwillingness to even discuss the concept of a planned retreat by local government authorities and the owners of properties in low-lying littoral regions [6].

2 Katrina: a sociological case study and human tragedy

On the morning of August 29, 2005 Katrina, a category 3 or 4 hurricane – also referred to as a typhoon or tropical cyclone depending on the region – slammed into the city of New Orleans causing catastrophic damage [7, 8]. From the moment the hurricane struck there was pandemonium. Solutions flooded the airwaves and arrived in force but all too slowly and lacking coordination. Things soon deteriorated into a competition for influence and power and further into a racial storm.

Katrina claimed the lives of 1,500 people and damage was estimated at \$US100 billion [these figures vary markedly] [9]. Estimated wind speeds were 190 kilometres per hour. In several locations along the Mississippi coastline the storm surge exceeded 10 metres and penetrated 10 kilometres inland. This surpassed that of Hurricane Camille in 1969 which was a category 5 hurricane [8]. Levees were overtopped and pumping stations flooded causing the entire flood control system to fail [10]. Katrina was the costliest hurricane and one of the most deadly to strike the United States of America [8, 11]. Reasons for this were attributed to, among other things: a failure of policy, planning, and practice; racial discrimination; public choice; and a neoliberal ideology incumbent at the time.

According to Koliba *et al.* [12], the Katrina catastrophe can be understood as multiple failures in accountability. It was a failure of policy, planning, and practice, and from the moment Katrina pounced on the city of New Orleans, poor coordination between public, private and voluntary sectors. Images flashed across television screens of thousands of survivors, mostly the poor and marginalised without the means to escape, crammed into the Louisiana Superdome [renamed the Mercedes-Benz Superdome in 2011] without adequate water, food, and security [7].



The media played a leading role in promoting and portraying a scene of chaos, lawlessness, and looting [13]. According to Tierney *et al.* [13] these depictions were highly exaggerated and harmful in that they had inadvertently manoeuvred governmental, organisational, and public responses into misdirecting vital resources. Racial and class diversity emerged as a polemic issue. It was purported that racial discrimination, in the case of African Americans, was the reason emergency services were so slow to respond and disaster relief was impeded [14, 15]. The Federal Emergency Management Agency (FEMA), in particular, was heavily criticised for its inept response [13].

Sobel and Leeson [16] argued that public choice (self-interest) was the root cause of FEMA's failure. They claimed that every major disaster that the United States of America faced prompted yet another Congressional Inquiry into corruption in government disaster management. Layers of self-interested politicians and bureaucrats had the power to veto the use of resources and did so in their own self-interest. In the case of Hurricane Katrina, in order to achieve public recognition, government officials forcibly prevented for-profit and non-profit organisations from delivering emergency supplies at the chance they might seize the credit for helping those in dire need. Perceived to be doing good was the sole dispensation of politicians. Sobel and Leeson [16] also pointed to shortsightedness with respect to policymaking; specifically, a bias toward current benefits at the expense of future benefits.

Robertson [17], however, pointed to a neoliberal ideology as a principal cause of the failure. She argued that an unfettered free-market was ill-conceived in terms of public health and safety. Squeezing government funding for disaster relief makes it impossible for governments to cope with market failures; such was the case with Hurricane Katrina. Notably, the rule of minds at the time of Katrina was decidedly conservative. All three divisions of the Federal Government were in Republican hands or the appointees thereof, which set about privatising relief efforts [18]. This led to allegations of profiteering and the exploitation of public resources [19].

Notwithstanding that the discussion thus far has pointed to self-interest as the principal antagonist, Rodríguez *et al.* [20] argued that evidence of altruism was also widespread. Despite media reports of antisocial behaviour, prosocial behaviour was by far the foremost response. Smith [21] reported that in the years following Katrina, more than 800,000 volunteers aided Mississippi's hurricane victims and sacrificed an estimated 18.2 million hours of their time in relief and comfort efforts. Despite these efforts, a study by McLaughlin *et al.* [22] revealed a high level of post-traumatic stress disorder (PTSD) among adult victims of Hurricane Katrina. Those individuals that experienced life-threatening situations and housing-related stress were slower to recover than those who did not. While families with higher incomes that were exposed to hurricane-related stresses were more likely to recover than those of lower socioeconomic means. DeSalvo *et al.* [23] identified this as a significant burden to the economic recovery of the city of New Orleans.



3 The climate change conundrum

Ismail-Zadeh and Takeuchi [24] claimed that storm surges and hurricane-induced flooding were the single most destructive type of natural disaster to threaten humans worldwide. Smith [21] observed that ‘ordinary coastal citizens’ often underestimated the danger of hurricanes: the human tendency is to make false judgements concerning risk based on prior experiences. False analogies were prevalent in the case of Hurricane Katrina. Both educated laypersons and local officials made the incorrect assumption, founded on outdated mental models, that Katrina could not be more devastating than Hurricane Camille in 1969, a category 5 hurricane. Citizens made the decision to remain in their homes based on this false premise, and many lost their lives as a consequence. Smith [21] concluded that ‘class, race, education status, or lack of character or purposeful recklessness’ was not to blame for the Katrina catastrophe. Flawed assessment of risk premised on previous experience was relative to the degree of destruction. Citizens organised their lives around risk then relied heavily on the efficacy of governmental planning and emergency services to insulate and extricate them from harm [25]. This view was endorsed by the Committee on New Orleans Regional Hurricane Protection [26] which found that there was unrealistic optimism in the capability of defensive structures to provide adequate protection from storm surges. Toplak *et al.* [27] categorised ‘unrealistic optimism’ (value placed on unsubstantiated knowledge), as well as dysfunctional beliefs and superstitions, as ‘crystallised inhibitors’, which can result in irrational thinking and acting. Add to this the conundrum of a changing climate, and predictions of storm surge and intensity reach a new height of uncertainty.

Climate change is predicted to increase the intensity of hurricanes and storm surges in the decades ahead. In a study by Irish *et al.* [28], a comparison was made between the devastation caused by Hurricane Katrina and that of a hypothetical hurricane in 1900. The regional sea level rise was estimated at 0.75 metres over this period, which included a substantial land subsidence of 0.57 metres. New Orleans sits on sinking clay soils and a large part of the city is more than two metres below sea level. This makes it highly vulnerable to storm surges. Storm surge simulations have indicated that flood levels under conditions in 1900 would have been 15 to 60 per cent lower, demonstrating that significantly more flood damage can be expected as a result of rising sea levels in the future. Moreover, Irish *et al.* [28] concluded that sea level rise was significantly more instrumental in terms of storm surge generation than climate-change induced storm intensification. Katrina’s storm surge caused most of the initial damage to New Orleans [18]. In effect, Katrina was a category 3 or 4 hurricane with a category 5 storm surge.

This suggests that in the main, default mental models constructed principally on the destruction inflicted by Hurricane Camille some 35 years prior prevailed. In the case of Katrina, neither officials nor citizens had the capacity to accurately mental model the misery and mayhem that lay ahead. That said, repeated warnings from a variety of experts that New Orleans’ storm preparedness and planning was inadequate went unheeded [26]. Brunsmas *et al.* [29] supported this account,



suggesting that “politicians and policy makers at all levels failed to act on the predictions of physical and social scientists” [29]. Furthermore, noting that levees and floodwalls cannot fully eliminate the risk posed by storm surges, the Committee on New Orleans Regional Hurricane Protection [26] advised that re-establishing the settlement patterns that existed prior to Hurricane Katrina would only invite more Katrina-like catastrophes. As such, the voluntary relocation to safer ground [planned retreat] of residents and structures, although politically contentious, was a commensurate policy worth pursuing. Despite these warnings, and negligible debate and economic analysis, it is evident that large sections of New Orleans will be rebuilt below sea level and in hurricane-prone locations. Levees will be unconsciously reconstructed on the foundations of a 1-in-a-100 year extreme climate event, despite several events of this nature occurring in recent decades [30]. This subsequently enshrines the default mental model. As Sparks [31] duly noted, the decision to rebuild New Orleans on the same site will place people back in harm’s way. Planners should be guided by the science, and endeavour to work with nature rather than master it. Relying on the promise of technology to hurricane-proof a city is apt to fail. As Lipari [32] observed, “... faithless listening is exemplified by innumerable failures to listen and heed a warning.”

4 Katrina: a pause for reflection

Theories of causality are pervasive and open to contestation. But what causes one to reflect on causality, and reflect intelligently? It is evident that people tend to dwell on negative experiences long after the event. They reflect on what went wrong, why the signs were not recognised earlier, and why a different course of action or no action was taken. It resonates in their memories. Post-traumatic stress disorder (PTSD) is a psychological disorder in which one experiences stressful and/or frightening memories attributed to a traumatic event [33]. It is an extreme mutation of a survival adaptation to protect one from harm. It is an inhibition of an otherwise normal adaptive and effective reaction to diminishing extreme threat and is triggered by stimuli characteristic of that threat [34]. Although most individuals diagnosed with PTSD eventually remit, there remains a significant minority that continues to experience the symptoms for decades after the stressor event occurred [35].

Negativity bias might be construed as the normal response to a negative experience, such as Hurricane Katrina, and thus a mechanism for survival adaptation. In this way it is a cause for reflection rather than a frightening recollection. Negativity bias can be succinctly defined as “... the propensity to attend to, learn from, and use negative information far more than positive information” [36]. As such, it is attuned to worry not fear, and is more likely to result in advocacy for deliberative climate change policy [37].

Beck [38] observed that a traumatic experience, such as Hurricane Katrina, induced a process of reflection in which connections between things were made that were not thought of before. For instance, Hurricane Katrina brought to bear the issue of racial inequality. Beck [38] called this ‘social catharsis’, an awakening



to social injustice. He also pointed out that ‘social catharsis’ was not a routine response to an extreme climate event, but a product of the individuals and groups that engaged in the rescue and witnessed the suffering. Relevant is that a negative experience is a cause for reflection that might elucidate the interconnectedness of the stressor events occurring and most importantly, the issues that underlie them. The inference is that through this process the mind/brain will reconstruct an ‘up to date’ mental model of the event and modify the user’s thinking and acting accordingly and hence, learn from the experience.

Whereas a negativity bias serves as a warning to better prepare for a repeat of a stressor event, an extreme climate event, for example, a positivity bias does not have the same affect. A positive experience is unlikely to cause one to dwell on the event or cause stress. What is problematic is when an event has morphed unexpectedly into something quite different but is not recognised as such. For example, Hurricane Katrina (2005) was markedly different from Hurricane Camille (1969). Although Camille was a category 5 hurricane and Katrina a category 3 to 4, Katrina unleashed a devastating storm surge substantially higher and voluminous than Camille. This distinction was not recognised until it was too late. This highlights the importance of reflecting on each event of the same phenomena, but as a separate interconnected entity, which is hardly straightforward when confronted with the complexity of a changing climate.

There remains a degree of indifference about dangerous climate change [39]. Not everyone is convinced. In terms of causality, for instance, would a similar event to Hurricane Katrina today be viewed in the same light? More precisely, would the causality of intensity be attributed to natural variability in the climate system or to climate change? Although the language surrounding a hurricane of this magnitude would be similar, and on the face of it, the damage caused and stress imposed would be similar, the difference if there is one is not so apparent. It looks like a Category 4 Hurricane which has been observed before. What is debatable is the underlying cause of its intensity which is open to conjecture. If causality is attributed to climate change, a new mental model of a Category 4 Hurricane is required and a line drawn through the old one. The organising principles of the mind/brain orchestrate the construction, or reconstruction, of the new mental model of a Category 4 Hurricane that incorporates these new parameters – an updated model. This requires more effortful reasoning. The human brain, however, is considered a cognitive miser with a preference for conserving energy. Humans therefore, have a predisposition to retain their outdated mental models and risk underestimating the threat of an extreme climate event. In a sense, the mind/brain is guilty by association – what happens today is simply an extension of yesterday and the day before.

5 The unconscious mind rules *in absentia*

Research has suggested a dominance of the unconscious mind and although there is considerable advocacy for this argument [40–46], Newell and Shanks [47] have argued that the evidence was weak in support of a significant unconscious influence on human decision-making and actions. They argued that much of the



research demonstrated that behaviour is under the control of the conscious mind or can be otherwise explained without resorting to unconscious influences. In direct response to this, Bernacer *et al.* [48] argued that Newell and Shanks [47] had ignored the process of habitual decision-making that routinely prompts the transfer of decisions and actions between the domains of the unconscious and conscious mind. This is, in effect, a reference to dual-process theory – the primitive mind (unconscious and intuitive) as opposed to the sophisticated mind (conscious and reflective). In short, if the unconscious mind/brain is perceived to work adequately under most conditions then why expend additional energy adopting a mind mode that requires considerably more cognitive exertion?

Decisions require human judgement circumscribed by an uncertain outcome premised on a loosely defined probability [49, 50]. Subjectively, one is confronted with the critical exercise of judging what is of threat and what is not. Objectively, one cannot possibly know and have gained access to ‘all the knowledge’ that is of value and relevant to the execution of one’s judgement. Subsequently, a question is pursued on the premise of a series of assumptions and ideally within the bounds of the scientific method, but at the same time smitten with the ‘romanticism of place’ and a set of personalised biases. ‘This is my home built through toil and task ... I am part of its survival history, its social fabric and folklore, and I will risk life and limb to protect it.’ Reasoning does not operate in isolation from emotion [51] and human visual perception is fallible [52]. Furthermore, the reality of an error of judgement in the presence of uncertainty is hardly avoidable. There is thus reasonable cause and emotional effect to underestimate the danger.

Goldacre [53] demonstrated that our ‘truth-checking apparatus’ can fail as clever people are fooled by five cardinal cognitive illusions: ‘(1) we see patterns where there is only random noise; (2) we see causal relationships where there are none; (3) we overvalue confirmatory information for any given hypothesis; (4) we seek out confirmatory information for any given hypothesis; and (5) our assessment of the quality of new evidence is biased by our previous beliefs’. Cognitive illusion number five is indeed a formidable force. Furthermore, an obvious and major constraint to a rational and systematic method of reasoning is that thinking and reasoning, for the most part, is neither logical nor rational [54, 55] – reality and rationality are relative, and belief is selectively relevant. In addition, there is always some uncertainty in the science: meaning that the truth in any premise, which is crucial to achieving a plausible conclusion, is always less than absolute.

Gifford [56, 57] argued that the role of psychology is essential to breaking down the barriers that impede climate change mitigation and adaptation. Indeed, the extreme end of the automaticity argument is expressed by McRaney [58] who observed that “there is a growing body of work coming out of psychology and cognitive science that says you have no clue why you act the way you do, choose the things you choose, or think the thoughts you think” – and your memory is mostly fiction. Kaku [59] posed a similar hypothesis: “The brain is influenced by thousands of unconscious factors that predispose us to make certain choices ahead of time, even if we think we made them ourselves.” In accord with a violent history and a competition for survival, humankind unconsciously ranks self-preservation



as the overriding priority. The primitive mind overrides the probability of a delayed reaction as a precautionary measure that might otherwise be thwarted by a proclivity for reflective thinking when a quick reaction is necessary to protect or remove one from harm's way ('fight-or-flight') [60]. But this is problematic when it becomes the norm in inappropriate situations, and a habitual misallocation of cognitive resources occurs.

Kaku [59] said that "Human consciousness, I believe, is the process of continually forming a model of the world, in order to simulate the future and carry out a goal." Gilbert [61] argued that our ancestors escaped from the 'here and now' about two or three million years ago by way of a highly-specialised layer of grey matter that precipitated the brain's ability to imagine objects and episodes that are not apparent in the realm of the real ... the brain's greatest achievement is its infinite capacity to think about the future. In view of this, if one cannot mental-model the future by engaging the sophisticated mind it is fair to argue that one also cannot realistically imagine and comprehend the threat of a high-intensity storm or the peril that climate change might inflict. The two are inextricably linked.

6 Conclusion

Gifford [62] asserted that "Much of today's behavior [sic] simply follows from yesterday's behavior [sic]." As with Hurricane Katrina, the most familiar neural pathways lead to default mental models that might be accurate or deficient and are quickly retrieved. Less familiar neural pathways lead to more abstract and complex mental models that might be more accurate or less deficient and are slower to retrieve [63]. The latter requiring considerably more cognitive exertion than the former. Moreover, the issue of divergent worldviews in relation to the cause and effect of climate change has become a focal point. Under extreme climatic conditions, would the layperson (the non-scientist) recognise climate change as the intensifying cause? To accept as such, renders much of yesterday's knowledge obsolete in terms of how the climate system works and the impact of high-intensity storms on coastal cities. Updating one's default mental model to accurately reflect the scientific reality of the day when humans have a predisposition for observed association as a basis for causal explanation, and the human brain harbours a preference for cognitive economy, is a pervasive challenge [64–66].

To conclude, a judgement of the probability of an outcome should be anchored to a plausible base rate which is often not intuitively obvious [65]. In the case of Katrina, an error occurred because the initial estimate of belief (a representation based on a prior belief or base rate) did not equate with a plausible base rate. Citizens failed to update their default mental model of how the Earth is changing in light of new evidence. As Hunter [67] explained, any method useful for the measurement of future risk should combine knowledge of the present, a best approximate of how the Earth will change, and the uncertainty in both. Under these conditions, a primary course of action is to reorganise and rearrange both 'city and society' to reflect the scientific reality of the day. The inadvertent alternative is to allow the mind of popular unconsciousness to rule *in absentia*.



References

- [1] Speake, J. and M. LaFlaur, *In absentia. The Oxford Essential Dictionary of Foreign Terms in English*, Oxford University Press: New York NY, p. 320, 1999.
- [2] Wachinger, G., *et al.*, The risk perception paradox – implications for governance and communication of natural hazards. *Risk Analysis*, **33(6)**, pp. 1049–1065, 2013.
- [3] Johnson-Laird, P.N., S.S. Khemlani, and G.P. Goodwin, Logic, probability, and human reasoning. *Trends in Cognitive Sciences*, 19(4), pp. 201–214, 2015.
- [4] Jones, N.A., *et al.*, Eliciting mental models: A comparison of interview procedures in the context of natural resource management. *Ecology and Society*, **19(1)**, pp. 1–7, 2014.
- [5] Johnson-Laird, P.N., *Human and machine thinking*, Taylor and Francis: Hoboken NJ, pp. 56–57, 2013.
- [6] Niven, R.J. and D.K. Bardsley, Planned retreat as a management response to coastal risk: A case study from the Fleurieu Peninsula, South Australia. *Regional Environmental Change*, **13(1)**, pp. 193–209, 2013.
- [7] Comfort, L.K., Cities at risk: Hurricane Katrina and the drowning of New Orleans. *Urban Affairs Review*, **41(4)**, pp. 501–516, 2006.
- [8] Fritz, H.M., *et al.*, Hurricane Katrina storm surge distribution and field observations on the Mississippi Barrier Islands. *Estuarine, Coastal and Shelf Science*, **74(1)**, pp. 12–20, 2007.
- [9] National Oceanic and Atmospheric Administration, Storm surge and coastal inundation, N.H.R. Division, National Oceanic and Atmospheric Administration, Washington DC, http://www.stormsurge.noaa.gov/event_history_2010s.html
- [10] Griffis, F.H., Engineering failures exposed by Hurricane Katrina. *Technology in Society*, **29(2)**, pp. 189–195, 2007.
- [11] Brunkard, J., G. Namulanda, and R. Ratard, Hurricane Katrina deaths, Louisiana, 2005. *Disaster Medicine and Public Health Preparedness*, **2(4)**, pp. 215–223, 2008.
- [12] Koliba, C.J., R.M. Mills, and A. Zia, Accountability in governance networks: An assessment of public, private, and nonprofit emergency management practices following Hurricane Katrina. *Public Administration Review*, **71(2)**, pp. 210–220, 2011.
- [13] Tierney, K., C. Bevc, and E. Kuligowski, Metaphors matter: Disaster myths, media frames, and their consequences in Hurricane Katrina. *Annals of the American Academy of Political and Social Science*, **604(1)**, pp. 57–81, 2006.
- [14] Downey, D.C., Disaster recovery in black and white: A comparison of New Orleans and Gulfport, *The American Review of Public Administration*, pp. 1–24, 2014.



- [15] Diamond, A., *Neoliberalism, cultural racism, and depoliticization in the era of Katrina*, in *Hurricane Katrina in Transatlantic perspective*, R. Huret, et al., Editors. LSU Press: Baton Rouge LO, pp. 81–99, 2014.
- [16] Sobel, R.S. and P.T. Leeson, Government's response to Hurricane Katrina: A public choice analysis. *Public Choice*, **127(1/2)**, pp. 55–73, 2006.
- [17] Robertson, L., *How shall we remember New Orleans? Comparing news coverage of Post-Katrina New Orleans and the 2008 Midwest Floods*, in *The neoliberal deluge: Hurricane Katrina, late capitalism, and the remaking of New Orleans*, C. Johnson, Editor. University of Minnesota Press: Minneapolis MN, pp. 269–299, 2011.
- [18] Cutter, S., et al., *Hurricane Katrina and the forgotten Coast of Mississippi*, Cambridge University Press: New York, NY, p. 91, 2014.
- [19] Gotham, K.F., Disaster, Inc. Privatization and post-Katrina rebuilding in New Orleans. *Perspectives on Politics*, **10(3)**, pp. 633–646, 2012.
- [20] Rodríguez, H., J. Trainor, and E.L. Quarantelli, Rising to the challenges of a catastrophe: The emergent and prosocial behavior following Hurricane Katrina. *Annals of the American Academy of Political and Social Science*, **604(1)**, pp. 82–101, 2006.
- [21] Smith, J.P., *Hurricane Katrina: The Mississippi story*, University Press of Mississippi: Jackson MS, pp. 114–135, 2012.
- [22] McLaughlin, K.A., et al., Recovery from PTSD following Hurricane Katrina. *Depression and Anxiety*, **28(6)**, pp. 439–446, 2011.
- [23] DeSalvo, K.B., et al., Symptoms of posttraumatic stress disorder in a New Orleans workforce following Hurricane Katrina. *Journal of Urban Health*, **84(2)**, pp. 142–152, 2007.
- [24] Ismail-Zadeh, A. and K. Takeuchi, Preventive disaster management of extreme natural events. *Natural Hazards*, **42(3)**, p. 459–467, 2007.
- [25] Beck, U., *World at risk*, Polity: Cambridge, England, pp. 46–47, 2013.
- [26] *Committee on New Orleans Regional Hurricane Protection, Lessons learned in Hurricane Katrina and its aftermath*, in *New Orleans hurricane protection system: Assessing Pre-Katrina vulnerability and improving mitigation and preparedness*, National Academies Press: Washington DC, pp. 21–36, 2009.
- [27] Toplak, M.E., R.F. West, and K.E. Stanovich, *Assessing the development of rationality*, in *The developmental psychology of reasoning and decision-making*, H. Markovits, Editor. Psychology Press: East Sussex, England, pp. 7–35, 2014.
- [28] Irish, J.L., et al., Simulations of Hurricane Katrina (2005) under sea level and climate conditions for 1900. *Climatic Change*, **122(4)**, pp. 635–649, 2014.
- [29] Brunisma, D.L., D. Overfelt, and S.J. Picou, *Katrina as paradigm shift: Reflections on disaster research in the twenty-first century*, in *The sociology of Katrina: Perspectives on a modern catastrophe*, D.L. Brunisma, D. Overfelt, and S.J. Picou, Editors. Rowman and Littlefield: Lanham, MD, p. 2, 2010.

- [30] Fitzpatrick, J.H., Keynote address, climate related extreme events, liability regimes and the role of the global insurance industry. *Connecticut Insurance Law Journal*, **20(1)**, pp. 165–178, 2013.
- [31] Sparks, R.E., Rethinking, then rebuilding New Orleans. *Issues in Science and Technology*, **22(2)**, pp. 33–39, 2006.
- [32] Lipari, L., *Listening, thinking, being: Toward an ethics of attunement*, Pennsylvania State University Press: University Park PA, p. 204, 2014.
- [33] Kerr, L.K., *Post-traumatic Stress Disorder (PTSD)*, in *Encyclopedia of Critical Psychology*, T. Teo, Editor. Springer: New York NY, pp. 1466–1468, 2014.
- [34] Ogden, P., C. Pain, and J. Fisher, A sensorimotor approach to the treatment of trauma and dissociation. *Psychiatric Clinics of North America*, **29(1)**, pp. 263–279, 2006.
- [35] Chapman, C., *et al.*, Remission from post-traumatic stress disorder in the general population. *Psychological Medicine*, **42(8)**, pp. 1695–1703.
- [36] Vaish, A., T. Grossman, and A. Woodward, Not all emotions are created equal: The negativity bias in social-emotional development. *Psychological Bulletin*, 2008. **134(3)**, pp. 383–403, 2012.
- [37] Smith, N. and A. Leiserowitz, The role of emotion in global warming policy support and opposition. *Risk Analysis*, **34(5)**, pp. 937–948, 2014.
- [38] Beck, U., Emancipatory catastrophism: What does it mean to climate change and risk society? *Current Sociology*, **63(1)**, pp. 75–88, 2015.
- [39] Hulme, M., *Why we disagree about climate change*, Cambridge University Press: New York NY, pp. 1–20, 2009.
- [40] Uleman, J.S., *Introduction: Becoming aware of the new unconscious*, in *The new unconscious*, R.R. Hassin, J.S. Uleman, and J.A. Bargh, Editors. Oxford University Press: New York NY, pp. 3–6, 2004.
- [41] Mlodinow, L., *Subliminal: How your unconscious mind rules your behaviour*, Random House: New York NY, pp. 1–260, 2013.
- [42] Thuraingham, M., *The secret life of decisions: How unconscious bias subverts your judgement*, Ashgate: Burlington VT, pp. 5–26, 2013.
- [43] Bargh, J.A. and E. Morsella, The unconscious mind. *Perspectives on Psychological Science: A journal of the Association for Psychological Science*, **3(1)**, pp. 73–79, 2008.
- [44] Bargh, J.A., Our unconscious mind. *Scientific American*, **310(1)**, pp. 30–37, 2013.
- [45] Bargh, J.A., *et al.*, Automaticity in social-cognitive processes. *Trends in Cognitive Sciences*, **16(12)**: pp. 593–605, 2012.
- [46] Sax, H. and L. Clack, Mental models: A basic concept for human factors design in infection prevention. *Journal of Hospital Infection*, **89(4)**, pp. 335–339, 2015.
- [47] Newell, B.R. and D.R. Shanks, Unconscious influences on decision making: A critical review. *The Behavioral and Brain Sciences*, **37(1)**, p. 1–1, 2014.
- [48] Bernacer, J., *et al.*, The problem of consciousness in habitual decision making. *The Behavioral and Brain Sciences*, **37(1)**, pp. 21–22, 2014.



- [49] Kahneman, D. and A. Tversky, Subjective probability: A judgment of representativeness. *Cognitive Psychology*, **3(3)**, pp. 430–454, 1972.
- [50] Tversky, A. and D. Kahneman, Judgment under uncertainty: Heuristics and biases. *Science*, **185(4157)**, pp. 1124–1131, 1974.
- [51] Stollstorff, M., *Genes of rationality: Building blocks for the neurobiology of reasoning*, in *New approaches in reasoning research*, W. De Neys and M. Osman, Editors. Psychology Press: London England, pp. 5–19, 2014.
- [52] Hoffman, D.D., *The construction of visual reality*, in *Hallucinations: Research and practice*, J.D. Blom and I.E.C. Sommer, Editors. Springer: New York NY, pp. 7–15, 2012.
- [53] Goldacre, B., *Bad science*, Harper Perennial: London England, pp. 47–50, 2009.
- [54] Markovits, H., *Introduction*, in *The developmental psychology of reasoning and decision-making*, H. Markovits, Editor. Psychology Press: East Sussex, England, pp. 1–2, 2014.
- [55] Wason, P.C., Reasoning about a rule. *The Quarterly Journal of Experimental Psychology*, **20(3)**, pp. 273–281, 1968.
- [56] Gifford, R., Psychology's essential role in alleviating the impacts of climate change. *Canadian Psychology/Psychologie Canadienne*, **49(4)**, pp. 273–280, 2008.
- [57] Gifford, R., The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, **66(4)**, pp. 290–302, 2011.
- [58] McRaney, D., *You are not so smart: Why your memory is mostly fiction*, Penguin: Oxford England, p. xi, 2012.
- [59] Kaku, M., *The future of the mind: The scientific quest to understand, enhance, and empower the mind*, Doubleday: New York NY, pp. 268, 342, 2014.
- [60] Cannon, W.B., *The wisdom of the body*. Norton: New York NY, 1932.
- [61] Gilbert, D., *Stumbling on happiness*, Random House: New York NY, pp. 111–126, 2009.
- [62] Gifford, R., Environmental psychology matters. *Psychology*, **65(1)**, p. 547, 2014.
- [63] Johnson-Laird, P.N., S.S. Khemlani, and G.P. Goodwin, Logic, probability, and human reasoning. *Trends in Cognitive Sciences*, **19(4)**, pp. 201–214, 2015.
- [64] Jones, R.G., *Psychology of sustainability: An applied perspective*, Routledge: New York NY, pp. 25–32, 2015.
- [65] Kahneman, D., *Thinking, fast and slow*, Farrar, Straus and Giroux: New York NY, p. 182, 2011.
- [66] Stanovich, K.E., *What intelligence tests miss: The psychology of rational thought*, Yale University Press: New Haven CN, pp. 70–85, 2009.
- [67] Hunter, J.R., Estimating sea-level extremes under conditions of uncertain sea-level rise. *Climatic Change*, **99(3–4)**, pp. 331–350, 2010.

