2016-12

Disaster threat and the Dunning-Kruger effect

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

DISASTER THREAT AND THE DUNNING-KRUGER EFFECT

By

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December 2016

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.			
1. AGENCY USE ONLY ***(Leave blank)***	**2. REPORT DATE** December 2016	**3. REPORT TYPE AND DATES COVERED** Master's thesis	
4. TITLE AND SUBTITLE DISASTER THREAT AND THE DUNNING-KRUGER EFFECT			**5. FUNDING NUMBERS**
6. AUTHOR(S) Jeffrey W. Siems			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB protocol number 2016.0111-DD-N.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.			**12b. DISTRIBUTION CODE**

13. ABSTRACT (maximum 200 words)

Decision making is a cognitive process of selecting a course of action or belief among multiple alternative choices. However, pressures of time, circumstance or unappreciated wickedness can create a situation where an ostensibly illogical choice overtakes rational decision making. Sometimes, when evaluated by those considered experts, decisions made in disasters seem irrational, harmful, or iniquitous in nature.

A cognitive bias known as the Dunning-Kruger effect posits that individuals who lack the necessary skills to make rational decisions can also lack the metacognitive ability to realize that their decision making is flawed. The Dunning-Kruger theory theorizes this can result in the individual exhibiting overconfidence to adequately address the threat. Essentially, the unskilled are unaware and overconfident.

This thesis investigates the occurrence of the Dunning-Kruger effect in individual decision making during disasters. The author analyzed 12 indicators by coding interview transcripts of disaster survivors. This thesis includes two case studies: Hurricane Katrina, representing a natural disaster, and the World Trade Center attacks, exemplifying a human-caused disaster. In each case, 30 transcripts of survivors were reviewed, and Dunning-Kruger indicators were present in both case studies.

How individuals process realized or perceived threat is important for homeland security policy makers. Future research should be conducted to better understand how Dunning-Kruger effects influence disaster decision making.

14. SUBJECT TERMS Dunning-Kruger theory, Dunning-Kruger effects, disaster threat, human behavior, World Trade Center, Hurricane Katrina, natural disaster, human caused disaster, cognitive bias, decision making, disaster survivors			**15. NUMBER OF PAGES** 113
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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DISASTER THREAT AND THE DUNNING-KRUGER EFFECT

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Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF ARTS IN SECURITY STUDIES
(HOMELAND SECURITY AND DEFENSE)**

from the

**NAVAL POSTGRADUATE SCHOOL
December 2016**

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ABSTRACT

Decision making is a cognitive process of selecting a course of action or belief among multiple alternative choices. However, pressures of time, circumstance or unappreciated wickedness can create a situation where an ostensibly illogical choice overtakes rational decision making. Sometimes, when evaluated by those considered experts, decisions made in disasters seem irrational, harmful, or iniquitous in nature.

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LIST OF ACRONYMS AND ABBREVIATIONS

DHS	Department of Homeland Security
DK	Dunning-Kruger
DKE	Dunning-Kruger effect
HDMB	Hurricane Digital Memory Bank
RPD	recognition prime decision
SCT	social cognitive theory
WTC	World Trade Center

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EXECUTIVE SUMMARY

Decision making is a cognitive process of selecting a course of action or belief among multiple alternative choices. Each decision results in a sequence of behaviors or activities the decider deems satisfactory, beneficial, or in her or his best interest.[1] However, disasters can create chaos, wickedness, and pressures of time or circumstance that bound a person's decision-making capability.

Many poor decisions connected with threats are a result of cognitive bias.[2] One cognitive bias known as the Dunning-Kruger effect suggests that, "People who lack the knowledge or wisdom to perform well are often unaware of this fact."[3] In addition, theory on the effect posits, "the same incompetence that leads them to make wrong choices also deprives them of the savvy necessary to recognize competence, be it their own or anyone else's."[4] Sometimes this results in an overconfidence of skills relative to capability.

As it is important for homeland security policy makers to understand how an individual processes a realized or perceived threat, this thesis investigates if indicators of Dunning-Kruger effects are present in individuals during disasters when choice is also available. It also offers future research opportunities to better understand how Dunning-Kruger effects influence disaster decision making.

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1 Robert Duncan Luce, "Rationality in Choice under Certainty and Uncertainty," in *Emerging Perspectives on Judgment and Decision Research*, ed. Sandra L. Schneider and James Shanteau (Cambridge, NY: Cambridge University Press, 2003), 64–83.

2 Committee on Measuring Human Capabilities: Performance Potential of Individuals and Collectives; Board on Behavioral, Cognitive, and Sensory Sciences; Division of Behavioral and Social Sciences and Education; National Research Council. *Measuring Human Capabilities: An Agenda for Basic Research on the Assessment of Individual and Group Performance Potential for Military Accession* (Washington, DC: National Academies Press, 2015), http://www.nap.edu/catalog/19017, 53.

3 Justin Kruger and David Dunning, "Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments," *Journal of Personality and Social Psychology* 77, no. 6 (1999): 1121–1134, doi:10.1037/0022-3514.77.6.1121.

4 Ibid.

A. RESEARCH QUESTION

This thesis answers the question, “Are there indications of Dunning-Kruger effects in individuals who encountered natural or human-caused disasters?” Though this research specifically examines Dunning-Kruger indicators suggestive for the presence or absence of the effect, it does not measure the extent of the effect.

B. METHOD AND DESIGN

This research used qualitative research design to answer the research question. Two case studies were included as exemplars of significant disaster threat. Hurricane Katrina represented natural disaster and signified disaster with warning. The attacks on the World Trade Center exemplified human-caused disaster and epitomized disaster without warning. In each case study, 30 transcripts of survivors were examined for indicators of the Dunning-Kruger effect.

A total of 12 indicators were chosen and coded into three domains (incompetence, lack of metacognition, and illusionary superiority). Every indicator need not be identified for the effect to be present. For the effect to be coded as present, at least one indicator in each domain must be identified. The procedure included the researcher reading the transcripts, making notes regarding first impressions, and checking to see if the case studies satisfy inclusion criteria. Next, words, phrases, sentences, or relevant sections were coded according to the 12 indicators. Finally, researcher collated and classified the data in a spreadsheet for analysis.

C. CONCLUSION

Decision making in the context of disaster has a multitude of factors influencing human behavior. Often, seemingly rational thought is constrained by the circumstances surrounding disaster and allows decisions to appear irrational, harmful, or iniquitous. This research confirms the presence of the Dunning-

Kruger effect in both cases studied. While the extent of the effect's impact was not measured, a high prevalence (73 percent) of survivors of natural disaster showed positive indicators of Dunning-Kruger effects. For human-caused disaster, 47 percent of respondents met the established criteria for the Dunning-Kruger effect.

The cases studied also represent disaster with prior warning (natural) and disaster without warning (human caused). It is possible that Dunning-Kruger effects increase as prior warning increases; or with advanced warning, more people choose to evacuate, so the individuals remaining are the ones experiencing the Dunning-Kruger effect. Additional research into this discovery is necessary to confirm this researches findings.

Another interesting outcome from the research was that respondents who self-identified as an authority also displayed indicators exhibiting Dunning-Kruger influences. What is not fully understood is if there is a correlation between individuals that self-identify as an authority and decision making influenced by the Dunning-Kruger theory. Further research is recommended; specifically, a prospective, quantitative research design focusing on policy decision makers measured against Dunning-Kruger effects. Establishing how the Dunning-Kruger cognitive bias influences individuals facing disasters will benefit homeland security professionals and benefit the planning, response, and recovery efforts to disasters.

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ACKNOWLEDGMENTS

A person never travels alone when discovering personal meaning and refinement. My experiences from responding to national disasters lend relevance to the concepts, situations, and circumstances an individual endures when confronting threat. Wanting to better understand human behavior and decision making when confronted with peril has been my motivation to write this thesis. Should even a single individual benefit from the work submitted, I would be completely satisfied.

I am deeply appreciative of the many individuals who have supported my endeavor and have continually encouraged me through the synthesis of this research. Without their time, attention, encouragement, thoughtful feedback, and patience, I would not have been able to see it through. Foremost, I would like to acknowledge and personally thank Dr. Lauren Fernandez, one of my advisors, for her kind encouragement, insightful advice, and friendly support. Likewise, my other advisor, Glen Woodbury, has provided me with motivation, thoughtful counsel, grounded perspective, and rational reasoning throughout this journey. Lauren and Glen, please know I am deeply indebted for your time, personal attention, and dedicated support.

It is important to recognize others who have contributed to my success. While I have benefited from our entire cohort, special acknowledgement is in order for my peers who expended the time to provide attentive feedback on my drafts. Reed Little, Katrina Woodhams, and Melanie Burnham, thank you for your efforts to better my writing. To my co-workers, thank you for supporting me by accepting additional tasks so that I may complete my master's. Perhaps most importantly, I wish to thank my wife, Jodie; children (Will and Blake); my family; and my friends from whom I received motivation, strength, and encouragement to complete this project.

This thesis, and its topic, is dedicated to all those who sacrifice during disasters so that others may benefit.

I. INTRODUCTION

> There are moments that define a person's whole life. Moments in which everything they are and everything they may possibly become hinge on a single decision.
>
> —Jonathan Mayberry

A. PROBLEM SPACE

Decision making is a cognitive process of selecting a course of action or belief among multiple alternative choices. Each decision results in a sequence of activities or behaviors that the decider deems satisfactory, beneficial, or in their best interest.[1] However, pressures of time, circumstance, or unappreciated confounding factors can create a situation where seemingly rational decision making is not realized.[2] Wickedness, mystifying unknowns, ostensibly illogical choice, or paralysis can overtake otherwise competent decision-making capabilities.[3] Retrospective analysis can sometimes reveal decision making to be irrational, harmful, or iniquitous in nature.

The literature reveals many poor decisions are the result of cognitive bias, which is a type of error in thinking that affects the judgments and decisions a person makes. First introduced by Amos Tversky and Daniel Kahneman, cognitive bias describes supposed flawed patterns of responses to judgments or

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[1] Robert Duncan Luce, "Rationality in Choice under Certainty and Uncertainty," in *Emerging Perspectives on Judgment and Decision Research*, ed. Sandra L. Schneider and James Shanteau (Cambridge, NY: Cambridge University Press, 2003), 64–83.

[2] J. Frank Yates, Elizabeth Veinott, and Andrea L. Patalano, "Hard Decisions, Bad Decisions: on Decision Quality and Decision Aiding," in *Emerging Perspectives and Decision Research*, ed. Sandra Schneider and James Shanteau (New York: Cambridge University Press, 2003), http://wesscholar.wesleyan.edu/cgi/viewcontent.cgi?article=1290&context=div3facpubs, 18–21.

[3] As defined by Rittel and Webber, a wicked problem is a social or cultural problem that is difficult, if not impossible, to solve for as many as four reasons: incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnected nature of these problems with other problems. Horst W. J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences* 4, no. 2 (1973): 155–169.

decision making.[4] Because of cognitive bias, decisions, choices, and judgments are influenced by a person's experiential understanding of information and can become riddled with miscalculations.[5]

A cognitive bias known as the Dunning-Kruger (DK) effect is when "people who lack the knowledge or wisdom to perform well are often unaware of this fact."[6] Kruger and Dunning attribute this lack of awareness to a metacognitive skill deficit, which is "the same incompetence that leads them to make wrong choices also deprives them of the savvy necessary to recognize competence, be it their own or anyone else's."[7]

This effect has been demonstrated by experiment in several ways.[8] The initial Dunning and Kruger research tested students on criteria including humor, syntax, and logic, and then compared each student's self-assessment with the actual test results of his or her performance. This revealed that those who scored lowest on the test were also found to have "grossly overestimated" their scores.[9] This phenomenon became known as the Dunning-Kruger effect. Furthermore,

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[4] Amos Tversky and Daniel Kahneman, "Judgment under Uncertainty: Heuristics and Biases," in *Utility, Probability, and Human Decision Making*, ed. Dirk Wendt, and Charles Vlek (New York: Springer, 1975), 141–162, http://link.springer.com/chapter/10.1007/978-94-010-1834-0_8.

[5] Kendra Cherry, "How Cognitive Biases Influence How We Think and Act," *Verywell*, February 5, 2016, https://www.verywell.com/what-is-a-cognitive-bias-2794963.

[6] Justin Kruger and David Dunning, "Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments," *Journal of Personality and Social Psychology* 77, no. 6 (1999): 1123–1124, doi:10.1037/0022-3514.77.6.1121.

[7] Ibid., 1125–1126.

[8] David Dunning, "The Dunning-Kruger Effect," in *Advances in Experimental Social Psychology*, vol. 44, ed. James M. Olson and Mark P Zanna (Cambridge, MA: Elsevier, 2011), http://linkinghub.elsevier.com/retrieve/pii/B9780123855220000056, 282.

[9] Kathryn Schulz, *Being Wrong: Adventures in the Margin of Error*, 1st ed (New York: Ecco, 2010).

that research revealed the paradoxical inverse, which also applied: competent people tend to underestimate their ability compared to others.[10]

The Dunning-Kruger effect is similar to a related, but slightly less specific bias, illusory superiority. Illusory superiority is a self-favoring disorder wherein a person overestimates her or his positive attributes in comparison to others, while simultaneously underestimating his or her negative attributes.[11] However, an important difference between illusory superiority and the Dunning-Kruger effect occurs when the overconfidence is due to a lack of metacognition of the individual. According to Dunning and Kruger, "The miscalibration of the incompetent stems from an error about the self."[12] That is, the individuals with lesser knowledge are less aware of their inadequacy and therefore cannot accurately gauge or assess their incompetence. Simply stated, they do not know they do not know, and therefore they believe they possess sufficient skills, awareness, or knowledge necessary to deal with the situation.

Dunning and Kruger first reported individuals frequently overvalue their competence. The research has been replicated in subsequent studies by multiple authors and suggests everyone suffers to a degree from the Dunning-Kruger effect.[13] In an interview with Errol Morris, Dr. David Dunning alluded to an ironic paradox of the Dunning-Kruger effect when he stated, "the skills you need to produce a right answer are exactly the skills you need to recognize what a right

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[10] Kruger and Dunning, "Unskilled and Unaware of It," 1121–1134.

[11] Vera Hoorens, "Self-favoring Biases, Self-Presentation, and the Self-Other Asymmetry in Social Comparison," *Journal of Personality* 63, no. 4 (1995): 796, doi:10.1111/j.1467-6494.1995.tb00317.x.

[12] Dunning, "The Dunning-Kruger Effect," 258.

[13] Studies by Dunning, Heath and Suls (2004), Dunnng (2005), Ehrlinger, Johnson, Banner, Dunning and Kruger (2008), and Cole (unpublished manuscript) purport that even very smart people are not immune from the Dunning-Kruger effect. Just because one is intelligent at one specialty does not mean one is an expert in other domains.

answer is."[14] Incompetence denies individuals the ability to recognize that they are making poor decisions. An added burden of the Dunning-Kruger effect is that the individuals experiencing it believe they have the requisite skills to make a rational choice. Therefore, these individuals not only make unrecognized poor decisions, they also suffer an overconfidence of ability when reaching their erroneous conclusions, a form of illusory superiority.[15] The classic example of this is exemplified by the actions of McArthur Wheeler:

> McArthur Wheeler, a man who robbed two banks after covering his face with lemon juice in the mistaken belief that, because lemon juice is usable as invisible ink, it would also prevent his face from being recorded by surveillance cameras.[16]

According to Kruger and Dunning, Mr. Wheeler was incompetent when it came to understanding how lemon juice works and thus could not comprehend why his face would be visible on a surveillance camera.[17] The case of McArther Wheeler inspired Dr. Dunning and his graduate student, Justin Kruger, to research and develop what is now understood as the Dunning-Kruger effect.

Another example comes from a Hurricane Katrina experience. Flooding resulting from heavy rains and storm surge are commonly associated with hurricanes. As Katrina approached, administrators of a New Orleans hospital, Pendleton Methodist, were offered assistance to evacuate the hospital's in-patient population before Katrina made landfall; however, they decided against evacuation.[18] After the hurricane, the hospital was sued because of its disaster

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[14] Errol Morris, "The Anosognosic's Dilemma: Something's Wrong but You'll Never Know What It Is (Part 1)," *New York Times Opinionator* [blog], June 20, 2010, http://opinionator.blogs.nytimes.com/2010/06/20/the-anosognosics-dilemma-1/.

[15] Jeffrey Way, "Do You Suffer from the Dunning-Kruger Effect?," envatotuts+, October 12, 2011, http://code.tutsplus.com/articles/do-you-suffer-from-the-dunning-kruger-effect--net-22227.

[16] Daniel Simons and Christopher Chabris, "Why Losers Have Delusions of Grandeur," *New York Post*, May 23, 2010, http://nypost.com/2010/05/23/why-losers-have-delusions-of-grandeur/.

[17] Kruger and Dunning, "Unskilled and Unaware of It," 1121–1134.

[18] Lacoste v. Pendleton Methodist Hospital (Supreme Court of Louisiana, 2007).

planning, or lack thereof. According to the suit, the hospital was accused of being negligent in the death of a patient and for not properly preparing for hurricane situations.[19] The suit accused the hospital leadership of poor decision making leading up to Hurricane Katrina, which included the decision not to evacuate the facility and for locating the emergency power generators in the basement, an area known to have flooded in previous storms. When the hospital administrator was questioned about the generator he stated under oath, "I didn't know it would fail."[20] The attorney for the plaintiff provided experts who testified that the hospitals' emergency power system design was critically flawed in that it was located in an area that should have been known for flooding. One explained, "It was an obvious defect that could have been solved for a very little sum of money."[21] Also according to testimony, relocating the power generator to the roof of the hospital would have all but eliminated any chance of its being affected by flooding.[22]

Furthermore, the hospital disaster planners were unaware that emergency power generators would not operate if inundated by water. The administrators were skilled in hospital operations; however, though they were unaware of it, they lacked the knowledge necessary to properly plan for and safeguard their hospital's in-patient population. This lack of skill and awareness created a situation in which hospital administrators become overly confident in their ability

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[19] Ibid.

[20] "New Orleans Hospital Settles Post-Katrina Wrongful Death Lawsuit," *Insurance Journal* [online], January 28, 2010, http://www.insurancejournal.com/news/southcentral/2010/01/28/106964.htm.

[21] Alejandro de los Rios, "Hospital CEO Pounded over Generators Used during Katrina in Wrongful Death Trial," *Louisiana Record*, May 11, 2010, http://louisianarecord.com/stories/510580038-hospital-ceo-pounded-over-generators-used-during-katrina-in-wrongful-death-trial.

[22] de los Rios, "Hospital CEO Pounded;" Robert Hamilton, *Lessons in Emergency Power Preparedness: Planning in the Wake of Katrina* (Minneapolis MN: Cummins Power Generation, 2007), http://power.cummins.com/sites/default/files/literature/technicalpapers/PT-7006-Standby-Katrina-en.pdf.

to respond to anticipated disasters, and their overconfidence in the hospital infrastructure created a situation wherein at least one individual died.

Disasters are known for being multi-dimensionally chaotic, disjointed, and having uncoordinated or unreliable information streams on which people base decisions.[23] Combine this with a cognitive bias wherein individuals lack the necessary knowledge or skills to safely address the threat and the metacognitive proficiencies to realize they are lacking necessary skills, and it creates an opportunity for the individuals to be overly confident in their abilities to positively address threats. Competent disaster decision making becomes especially important because personal choice not only affects the individual, but may also impact others, including those tasked with responding to immediate life safety concerns.

Surprisingly, there is very little research surrounding the Dunning-Kruger effect on individuals facing choices during disasters; however, a better understanding of this effect may explain why in disasters some people make seemingly irrational choices—choices that sometimes result in unwarranted injury or death. Determining if Dunning-Kruger indicators manifest in survivors from disasters is a logical first step to addressing the wicked problem of how individuals make less than optimal decisions when confronted with perceived or realized disaster threats.

B. RESEARCH QUESTION

This thesis seeks to answer the question, "Are there indicators of Dunning-Kruger effects in individuals who encountered natural or human caused disasters?"

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[23] Ming-Chou Ho et al., "How Do Disaster Characteristics Influence Risk Perception?," *Risk Analysis* 28, no. 3 (June 2008): 635–643, doi:10.1111/j.1539-6924.2008.01040.x.

C. PURPOSE AND SIGNIFICANCE OF STUDY

This thesis applies the work of Dr. David Dunning and Justin Kruger. Previous and related studies have identified the presence of Dunning-Kruger (DK) effects in other domains such as academics, medicine, and finance. However, to date, no scholarly study has examined if the Dunning-Kruger theory applies in the dominion of individuals confronting natural and manmade disasters.

Furthermore, since the Dunning-Kruger theory is relatively new (first introduced in 1999), there is a lack of study on its application to the individual making decisions in the context of perceived or realized disaster peril. The subjects of this research are individuals that have experienced and survived a recent natural disaster or terrorist event. Focus for this research centered on the Dunning-Kruger effect and its relationship to individual decision making relating to disaster threats.

According to Auf der Heide, "Disaster planning is only as good as the assumptions on which it is based."[24] This thesis adds to the existing body of knowledge by determining if Dunning-Kruger indicators are present in the accounts of survivors of a natural (Hurricane Katrina) and human caused disaster (9/11) in the United States. To date, no academic research has examined the relationship of the Dunning-Kruger theory with homeland security threats. Moreover, research of the Dunning-Kruger cognitive bias associated with individuals facing significant threat might improve disaster planning and aid in combating the wickedness associated with realized significant perils.

D. THESIS OVERVIEW

This thesis is divided into six chapters, including this chapter, which defines the problem space and purpose of the thesis. It describes the research

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[24] Erik Auf der Heide, "The Importance of Evidence-Based Disaster Planning," *Annals of Emergency Medicine* 47, no. 1 (2006): 34–49, doi:10.1016/j.annemergmed.2005.05.009.

question and explains the significance of the research. Finally, this chapter identifies the thesis structure and provides an overview of what the reader may expect, including output benchmarks.

Chapter II focuses on existing literature related to disaster decision making, human behavior, and choice. Specific concepts and theories are introduced and expounded upon to provide a foundational discussion of free will, choice, and metacognition. In addition, it explores barriers and boundaries that create resistance to seemingly rational decision making. Finally, it introduces chaos associated with disasters and concludes by connecting human behavior to decisions influenced by the Dunning-Kruger effect.

Chapter III provides information on the research question and design. additionally, the chapter outlines the Dunning-Kruger theory and its basic components. Next, it explains justification of methodology, data collection sampling procedures, and the data analysis process. Lastly, assumptions, limitations, and bias are defined in this chapter.

Chapter IV is a meta-analysis case study of hurricane Katrina as an exemplar of a natural disaster. Using transcripts from previous interviews of Hurricane Katrina survivors, it introduces 12 indicators to evaluate the presence of Dunning-Kruger characteristics in the survivors. The indicators are explained in the appendix and form the basis to evaluate presence or absence of the Dunning-Kruger effect. Finally, it analyzes data obtained from the research and includes a discussion of the findings.

Chapter V continues the meta-analysis case study, but this time for a human caused disaster. The chapter focuses on attacks of the World Trade Center by using transcripts from interviews of World Trade Center survivors. An analysis and discussion of the World Trade Center data then follows.

Chapter VI applies the literature findings of Chapter III with the results in Chapters IV and V. This chapter also examines Dunning-Kruger influences that decision makers should consider when planning for disaster threats. This portion

of the thesis attempts to bridge the decision-making capabilities of those placed under life-threatening strain with policy strategies to achieve positive outcomes. Finally, this chapter provides a summary of the research findings, suggests future research opportunities, and identifies limitations discovered during research.

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II. LITERATURE REVIEW

We're not very good at knowing what we don't know.

—David Dunning

This literature review begins by defining threat, and more importantly, what threat-induced decisions look like to the U.S. homeland security community. This chapter also explores theories related to disaster decision making and choices. Next, is an evaluation of concepts associated with the Dunning-Kruger theory in the context of disaster decision making. Finally, strategies to minimize the negative effects of cognitive bias are explored.

A. THREAT

The concept of threat can be defined many ways. Overall, threat is an expression of potential to harm or place in peril an individual or thing. The *Oxford Dictionary* defines threat as "A statement of an intention to inflict pain, injury, damage, or other hostile action on someone in retribution for something done or not done; the possibility of trouble, danger or disaster."[25] *Merriam-Webster* defines threat as "the possibility that something bad or harmful could happen."[26] By these definitions, there are many threats an individual confronts any typical day. For instance, on a personal level, there is the threat of falling, the threat of fire, the threat of having an acute medical event, the threat of being attacked, and even the threat of being struck. Similarly, the United States, as a nation, faces threats. Examples of national threats include economic devaluation of the dollar,

[25] *Oxford Advanced Learner's Dictionary*, s.v. "Threat," accessed September 19, 2015, http://www.oxfordlearnersdictionaries.com/us/definition/english/threat?q=threat.

[26] *Merriam-Webster Collegiate Dictionary*, s.v. "Threat," accessed November 4, 2015, http://www.merriam-webster.com/dictionary/threat.

catastrophic large area natural disasters and fires, pandemic calamities, terrorist attacks, and cyber assaults.[27]

Director of National Intelligence James Clapper remarks, "Today, threats are more diverse, interconnected, and viral than at any time in history."[28] Local events that might seem irrelevant can affect U.S. national security in accelerated units of time.[29] Clearly, there are more potential threats than an individual—or nation—can identify, analyze, address, and mitigate. Subsequently, choices are made to allocate limited resources. During testimony to the Senate Select Committee on Intelligence, Clapper testified, "…if left unaddressed, some threats have minimal effects while other threats if left unchecked, may have monumental detrimental consequences."[30] Some threats are easy to identify, analyze, or mitigate while others become complex with multifaceted factors that make the threat difficult to recognize or address.[31]

B. DISASTER DECISION-MAKING CONCEPTS

Disasters represent high risk, low occurrence events for the average person and are often a perceived threat that becomes realized. Research is ongoing, but it is important to understand that others have studied disaster decision making. This thesis builds upon what is understood to be significant works in choice. Individuals, such as Amos Tversky and Daniel Khaneman, have

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[27] Office of the President of the United States, *2015 National Security Strategy* (Washington, DC: Office of the President of the United States, 2015), https://www.whitehouse.gov/sites/default/files/docs/2015_national_security_strategy.pdf, 2.

[28] *Report of the Select Committee on Intelligence United States Senate Covering the Period January 5, 2011, to January 3, 2013*, United States Senate, 113th Cong., 1 (2013) (statement of James Clapper, Director of National Intelligence).

[29] Ibid.

[30] Ibid., 4.

[31] Ibid., 65.

developed taxonomies for framing decisions or managing risks of uncertainty.[32] L. Douglas Kiel incorporated the instability of chaos with disaster decision making, and Gary Klein has studied the fire service to understand how critical decision making under the real-life constraints of time and tremendous loss (life) are made.[33] Understanding threat-based decision making continues with recent work completed at the Naval Postgraduate School by Robert Mahoney. Mahoney asserts that each research study builds a dataset from which society can gain a better understanding of how threat-induced decisions are made by the individual and as a collective group.[34]

In its most basic form, decision making is the act of choosing between multiple alternatives. In addition, decisions are derived from knowledge in a particular area. Using this knowledge, decisions are constructed from the internal preferences and external inputs contributing to compose a set of choice options. It is a reasonable assumption that rational individuals will utilize the information available, along with their social construct of reality, to decide among existing options the most beneficial alternative.[35]

People also make decisions to solve problems. Sometimes the issue at hand can be simple and relatively inconsequential; other times, the choice can bring with it importance of great significance. Furby and Beyth-Marom have identified a five-step, normative model of decision making:

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[32] Daniel Kahneman, Paul Slovic, and Amos Tversky, eds., *Judgment under Uncertainty Heuristics and Biases* (Cambridge, MA: Cambridge University Press, 1982), http://dx.doi.org/10.1017/CBO9780511809477.

[33] Gary A. Klein, *Sources of Power: How People Make Decisions*, 7th ed. (Cambridge, MA: MIT, 2001).

[34] Robert T. Mahoney, "Deciding Who Lives: Considered Risk Casualty Decisions in Homeland Security" (master's thesis, Naval Postgraduate School, 2008), http://calhoun.nps.edu/handle/10945/3737.

[35] Thomas Sowell, *Knowledge and Decisions* (New York: Basic Books, 1996).

1. Identify the possible options,
2. Identify the possible consequences that may follow each option,
3. Evaluate the desirability of each of the consequences,
4. Assess the likelihood of each consequence,
5. Make a choice.[36]

A critical analysis of the Furby and Beyth-Marom framework suggests this is an imperfect model because individuals will not always have all the information, the information may not be correct and timely, or there may be other constraints impeding optimal choice options.

1. Chaos Theory

Chaos is the science of the nonlinear, the unpredictable, and the infinitely complex. By studying the interconnectedness of complex, chaotic dynamics often associated with disaster situations, one can attempt to escape potentially damaging actions that may be detrimental.[37] Often, a threat is time constrained such that an individual must perceive, identify, and make decisions in a short period with incomplete or inaccurate information.[38] The concept that threat may be misinterpreted to scope, scale, and impact is well demonstrated through adaptations of chaos theory.[39] Chaos theory, which dates back to 1880, addresses "nonlinear things that are effectively impossible to predict or control

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[36] Ruth Beyth-Marom et al., "Perceived Consequences of Risky Behaviors: Adults and Adolescents.," *Developmental Psychology* 29, no. 3 (1993): 549–563, doi:10.1037/0012-1649.29.3.549.

[37] "What Is Chaos Theory?," Fractal Foundation, accessed July 7, 2016, http://fractalfoundation.org/resources/what-is-chaos-theory/.

[38] Mahoney, "Deciding Who Lives."

[39] L. Douglas Kiel, "Chaos Theory and Disaster Response Management: Lessons for Managing Periods of Extreme Instability," in *What Disaster Response Management Can Learn from Chaos Theory*, ed. Gus Koehler, (California Research Bureau Sacramento, CA, 1995), http://www.library.ca.gov/CRB/96/05/over_12.html.

(like turbulence, weather or the stock market), and often is described by fractal mathematics."[40] Principals of chaos theory include:

- The butterfly effect (how a butterfly flapping its wings may influence weather patterns on the other side of the world),
- Unpredictability (not knowing and accounting for all of the influencing conditions render accurate predictions impossible),
- Transitions between order and disorder with feedback (one factor influences another factor, which in turn, influences the original factor),
- Fractals ("infinitely complex patterns that are self-similar across different scales").[41]

Disasters, like chaos, are influenced by nonlinear events and therefore susceptible to increased levels of unpredictability and uncertainty, which in turn can influence outcomes.[42] Koehler further expands on the similarities of chaos theory to homeland security threats by connecting nonlinear events and homeland security threats as those situations that are unpredictable and can occur at any time, unfold in geographic space and time with unknown boundaries, with illicit information that is incomplete or inaccurate, and tax resources available to address the threat.[43] As Koehler explains, "Disaster and emergency situations epitomize the nonlinearity of human events."[44] This heuristic is supported by Drabek's assentation that disasters represent

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[40] Henri Poincaré first developed chaos theory in the 1880s while studying the three-body problem. Later, in 1898, Jacques Hadamard advanced the concept of chaotic motion and then in 1961 Edward Lorenze employed chaos theory to explain weather patterns and predictions. Today, chaos theory continues to evolve and be redefined with a growing body of research beyond weather patterns. Adapted from, "What Is Chaos Theory?," Fractal Foundation," accessed July 7, 2016, http://fractalfoundation.org/resources/what-is-chaos-theory/.

[41] "What Is Chaos Theory?," Fractal Foundation.

[42] Kiel, "Chaos Theory and Disaster," 1–4.

[43] Ibid.

[44] Ibid.

complexity and instability consistent with chaos, and he also asserts it is important to establish order from the disorder associated with disasters.[45]

2. Rational Choice

Humans desire to create order from disorder; however, chaotic "events often seem to churn one step ahead of best efforts."[46] Rational choice theory is a framework for modeling and understanding how individuals' decisions are based on their ability to maximize their own benefit(s).[47] Through individuals' socially constructed reality, the rational choice can be predicted across an aggregate pattern of others choices, such that the act of decision making is consistent in choosing the self-determined best choice of action.[48]

Critics of rational choice theory say the model makes assumptions that may be unrealistic because often people have an imperfect data set of relevant information. In addition, there may be an oversimplification of influencers that leads the decision maker to be constrained to make incomplete or irrational choices. Another criticism of the rational choice theory is that it "denies the existence of any kind of action other than what is considered the purely rational choice."[49]

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[45] Thomas E. Drabek, "Predicting Disaster Response Effectiveness," *International Journal of Mass Emergencies and Disasters* 23, no. 1 (2005): 49–72, http://www.ijmed.org/articles/540/download/.

[46] Kiel, "Chaos Theory and Disaster Response Management," 186.

[47] Rational choice theory is also known as choice theory and rational action theory. It was well described and studied by Amos Tversky and David Kahneman, "Rational Choice and the Framing of Decisions," *The Journal of Business* 59, no. 4 (1996): S251–S278.

[48] Tversky and Kahneman, "Rational Choice and the Framing of Decisions;" Peter L Berger and Thomas Luckmann, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge* (New York: Open Road Integrated Media, 1966).

[49] Gary K. Browning, Abigail Halcli, and Frank Webster, eds., *Understanding Contemporary Society: Theories of the Present* (Thousand Oaks, CA: Sage, 2000), 126–127, 136.

3. Bounded Rationality

Bounded rationality builds on the common criticisms of rational choice theory and postulates, "when individuals make decisions, their rationality is limited by the information they have."[50] This cognitive restriction is further affected by factors such as time available to make a decision and any prior skills and experiences, or lack thereof, individuals have relative to the decision to be made.[51] Herbert A. Simon proposed the concept of bounded rationality based on these considerations.[52] Additionally, research by Fauconnier and Turner indicates that individuals can experience increased bounded rationality from a cognitive "tunnel vision" resulting from information overload.[53] A hallmark of disaster decision making includes an excess of informational inputs, some germane, some irrelevant to reaching a seemingly rational choice.

Kiel's description of chaos theory introduces nonlinear inputs that are impossible to predict or control during disasters.[54] In addition, Fauconnier and Turner posit that humans are poor deductive logic thinkers but better at pattern recognition when faced with a threat.[55] This banding of chaos, rational choice, and bounded reality, coupled with the findings of Fauconnier and Turners, greatly confines human decision making. It also explains why people facing significant threats might make poor decisions.

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50 Herbert A. Simon, "Bounded Rationality and Organizational Learning," *Organization Science* 2, no. 1 (1991): 126, doi:10.1287/orsc.2.1.125.

51 James March, Herbert Simon, and Harold Guetzkow, *Organizations* (New York: Wiley, 1958), 157–159.

52 Ibid.

53 Gilles Fauconnier and Mark Turner, *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities* (New York: Basic Books, 2003), 1.

54 Kiel, "Chaos Theory and Disaster Management."

55 Fauconnier and Turner, *The Way We Think*, 249.

Numerous theories and models of threat decision making have contributed to developing human response taxonomies to threat.[56] From them, patterns emerge, and three basic themes congruent with the basic tenants of the Dunning-Kruger theory materialize from synthesis of these studies:

1. Individuals are often ill prepared to respond to new, nonlinear, and multifaceted threat scaled at the possibility of death or severe impairment.[57] Congruent with being "unskilled" in the Dunning-Kruger domain.

2. "People tend to hold overly favorable views of their abilities" to effectively respond to threats—a form of illusion superiority.[58]

3. Multiple option choices create complexity such that decision paralysis and decreased satisfaction results from making "hard choices."[59] Represented by Dunning and Kruger as being "unaware" since the individuals lack the skills necessary to recognize what abilities are required to effectively respond to the presented threat.[60]

4. Immeasurability of Choice

According to Ruth Chang, identifying and quantifying factors influencing human decision making remains a challenge.[61] Performance and predictability decision making in the face of threat (time-constrained, high impact, and nonlinear or chaotic) remain elusive, and often failure can be traced back to

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56 Keith Punch, *Introduction to Social Research: Quantitative and Qualitative Approaches*, 2nd ed. (Thousand Oaks, CA: Sage, 2005), 13–33.

57 Gus Koehler, *What Disaster Response Management Can Learn from Chaos Theory* (Sacramento, CA: California Research Bureau, 1995); Kaylene Williams, "Fear Appeal Theory," *Research in Business and Economics Journal* 5, no. 1 (2012): 1–21, http://m.www.aabri.com/manuscripts/11907.pdf.

58 Kruger and Dunning, "Unskilled and Unaware of It," 1121.

59 Dan Ariely, *Predictably Irrational: The Hidden Forces That Shape Our Decisions*, 1st ed. (New York: Harper, 2008); Christopher L. Dancy et al., "Using a Cognitive Architecture with a Physiological Substrate to Represent Effects of a Psychological Stressor on Cognition," *Computational and Mathematical Organization Theory* 21, no. 1 (2015): 90–114; Sheena Lyengar, *The Art of Choosing*, 1st ed. (New York: Twelve, 2010); Ruth Chang, "Are Hard Choices Cases of Incomparability?," *Philosophical Issues* 22, no. 1 (2012): 108–113.

60 Kruger and Dunning, "Unskilled and Unaware of It," 1121.

61 Chang, "Are Hard Choices Cases of Incomparability?"

human factors.[62] Rarely do humans behave optimally.[63] Consequently, rarely do predicted results of rational choice—or for that matter, bounded rationality—replicate in actual disasters.[64]

The chaos concept indicates that any multitude of inputs can influence results, and even the seemingly smallest and inconsequential variable can alter outcomes. Moreover, every disaster has seemingly infinite factors influencing how it will present itself. Equally impressive are the influencers introduced by human response. Combined, the opportunity for choice becomes neither rational nor bounded because of the immeasurable possibilities that may influence human decisions.

5. Cognitive and Decision Illusion

Behaviorist Dan Ariely has developed the idea that we, as humans, do not know our own preferences and therefore make irrational decisions. In his studies, Dr. Ariely advances the concepts of "cognitive illusion," which leads to "decision illusion."[65] Since humans do not understand their own cognitive limitations, decision making becomes flawed and irrational (cognitive illusion).[66] This cognitive illusion falsely supports a sense of capability. It is not because humans do not care about the consequences; rather, it is because the threat analysis is complex and presents in a nonlinear, multifaceted environment that irrationality develops.[67] As described by Kiel in 2015, complexity creates chaos, which, in

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[62] Jean Carlson et al., "Measuring and Modeling Behavioral Decision Dynamics in Collective Evacuation," *PLoS ONE* 9, no. 2 (2014), doi: 10.1371/journal.pone.0087380, 12, 14, 42–45.

[63] Ibid., 42–45.

[64] Dancy et al., "Using a Cognitive Architecture."

[65] Dan Ariely, "Are We in Control of Our Own Decisions?" Ted Talks, video, December 2008, http://www.ted.com/talks/dan_ariely_asks_are_we_in_control_of_our_own_decisions, Ted Talk video recording, 17:26.

[66] Fauconnier and Turner, *On Identifying Human Capital,* 1–10.

[67] Ibid., abstract.

turn, creates more complexity.[68] Added complexity generates opportunity for irrational decision making (decision illusion), and Dr. Ariely posits the idea that cognitive limitations are much more difficult to recognize than physical limitations and subsequently are much more difficult to manage.[69]

6. Disaster Decision-Making Frameworks

The concept of disaster decision making can be separated into two main themes, pre-event and event.[70] Decisions arrived at before a disaster allow the prospect to generally increase opportunity for rational choice and control for some restraints, such as time, available resources or other factors that may bound an individual or group in their decision making.[71] Decision-making illustrations abound for both the government and individuals. For example, in an area such as New Orleans, known for flooding and wind damage from hurricanes, the government has developed pre-disaster strategies to mitigate, protect, respond, and recover from the threat of natural storms.[72] Likewise, individuals living in the area can have developed plans to safeguard their property and family members, including predetermined triggers for when to implement such planning.[73]

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[68] Kiel, "Chaos Theory and Disaster Management."

[69] Ariely, Predictably Irrational, 1.

[70] Benjamin Wisner, ed., *At Risk: Natural Hazards, People's Vulnerability, and Disasters*, 2nd ed. (New York: Routledge, 2004), 5.

[71] Adam Cartier et al., "Disaster Decision Making: Hurricanes Katrina and Gustav in New Orleans" (paper, Worcester Polytechnic Institute, 2009), http://m.wpi.edu/Pubs/E-project/Available/E-project-031609-172505/unrestricted/IQPReportFINAL.pdf.

[72] U.S. Governmental Accountability Office, *National Response Framework: FEMA Needs Policies and Procedures to Better Integrate Non-Federal Stakeholders in the Revision Process* (GAO-08-768) (Washington, DC: U.S. Governmental Accountability Office, 2008), http://www.gao.gov/assets/280/276372.pdf.

[73] National Weather Service, "Hurricane Preparedness Week, May 15–21, 2016," accessed July 8, 2016, http://www.nws.noaa.gov/com/weatherreadynation/hurricane_preparedness.html.

C. DUNNING-KRUGER THEORY AND APPLIED WORK

1. Dunning-Kruger

The Dunning-Kruger theory advances the idea that individuals who lack the cognitive skills to accurately identify or assess threats are also deprived the metacognitive reasoning capability to recognize their shortcomings.[74] Essentially, people do not know they do not know and therefore have an inflated—and often irrational—capability perception. In the context of realized threat, what they perceive as a simple choice is actually a complex, nonlinear decision evolving in a chaotically unpredictable environment. Subsequently, what an individual perceives as a simple threat decision rapidly becomes a hard choice.[75] According to author Tal Yarkoni, "It's important to note that Dunning and Kruger never claimed to show that the unskilled think they're better than the skilled; that's just the way the finding is often interpreted by others."[76] Their findings simply state that the unskilled have an inflated perception of capability that is unwarranted.[77] However, additional studies by Ehrlinger et al. reveal that the incompetence of those lacking skill produces a double curse. First, individuals' incompetence denies them the ability to produce correct responses, and therefore they make many mistakes. Second, this very same incompetence furthermore deprives the individuals of successful metacognitive task recognition regarding whether a particular decision is a correct or an incorrect choice.[78]

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[74] Kruger and Dunning, "Unskilled and Unaware of It," 1121–1134.

[75] Kruger and Dunning, "Unskilled and Unaware of It;" Ariely, "Are We in Control of Our Own Decisions;" Ruth Chang, "How to Make Hard Choices," May 2014, http://www.ted.com/talks/ruth_chang_how_to_make_hard_choices.

[76] Tal Yarkoni, "What the Dunning-Kruger Effect Is and Isn't," *Tal Yarkoni* [blog], July 7, 2010, http://www.talyarkoni.org/blog/2010/07/07/what-the-dunning-kruger-effect-is-and-isnt/.

[77] Ibid.

[78] Kruger and Dunning, "Unskilled and Unaware of It," abstract; Joyce Ehrlinger et al., "Why the Unskilled Are Unaware: Further Explorations of (Absent) Self-Insight among the Incompetent," *Organizational Behavior and Human Decision Processes* 105, no. 1 (2008): 98–121, doi:10.1016/j.obhdp.2007.05.002.

2. Threat Convergence

James J. F. Forest published multiple papers outlining the effects of decision making as it relates to the threat of weapons of mass destruction (WMD) terrorism.[79] In his studies, Forest found that as complexity increases, the probability of successful threat analysis and response decreases.[80] Additional studies by J. F. Forest then apply the Dunning-Kruger cognitive bias to illustrate as complexity increases, the opportunity of the unskilled overestimation of ability also increases and suggests human decision making can be substituted with artificial intelligence.[81]

3. Fear Appeal

Kaylene C. Williams's theory of fear appeal hypothesizes the risk of deciding to not act to a threat may create dire consequences for an individual or group. That is, fear appeal is predicated on a threat to a person's wellbeing so much that it motivates him or her toward action.[82] Williams's fear appeal relies upon rational choice theory as its foundational belief that a person should act based on what provides the individual greatest benefit.

However, what happens when the individuals lack the skills necessary to achieve rational choice? The Dunning-Kruger effect further complicates the situation because the unskilled are also unaware. That is, individuals lack requisite skill and awareness, which bounds rational choices and creates

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79 James Forest, "Framework for Analyzing the Future Threat of WMD Terrorism," *Journal of Strategic Security* 5, no. 4 (2012): 51–68, doi: 10.5038/1944-0472.5.4.4.

80 Ibid., 55.

81 James J. F. Forest and Russell D. Howard, *Weapons of Mass Destruction and Terrorism* (New York: McGraw Hill, 2013).

82 Williams, *Fear Appeal Theory,* 1–21; Herbert A. Simon, "Bounded Rationality and Organizational Learning," *Organization Science* 2, no. 1 (1991): 125–134, doi:10.1287/orsc.2.1.125.

opportunity for the choices to be detrimental.[83] According to Williams, Dunning, and Kruger, "Incompetent performers display little insight into just how poorly they perform."[84] In these instances, "fear is more powerful than reason."[85] This position is further supported with Stephen Maren's work advancing the idea that fear creates an autonomic reaction that can be irrational and not subject to reason.[86]

In a similar study, Kim and Crowston advanced the evaluation of decision making; what they discovered was important in understanding basic human decision development.[87] According to Kim and Crowston, humans develop patterns of learned behavior that they can then apply to situations that, while new and different to the individual(s), are similar to past experiences. Kim and Crowston present an analogy of people looking into their Rolodex® of past experiences to respond to a new challenge, but with similarities to prior encounters.[88] This is analogous to Gary Klein's assertion that decision making becomes naturalistic from prior involvement to threat.[89]Concerns of bolstering

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[83] Kruger and Dunning, "Unskilled and Unaware of It," 1–10; Williams, "Fear Appeal Theory," 2.

[84] Elanor F. Williams, David Dunning, and Justin Kruger, "The Hobgoblin of Consistency: Algorithmic Judgment Strategies Underlie Inflated Self-Assessments of Performance," *Journal of Personality and Social Psychology* 104, no. 6 (2013): 976–994, doi:10.1037/a0032416.

[85] Williams, "Fear Appeal Theory," 977; Sharon Begley et al., "The Roots of Fear," *Newsweek* 150, no. 26 (2007): 36.

[86] In "The Roots of Fear," Begley et al. theorize that fear is a dominant evolutionary primacy trait that overrides the brain's higher functions of reason. Advances the idea that fear is much like an autonomic reaction that is irrational and not subject to reason—a higher function of the human brain. Stephen Maren, "Pavlovian Fear Conditioning as a Behavioral Assay for Hippocampus and Amygdala Function: Cautions and Caveats," *European Journal of Neuroscience* 28, no. 8 (2008): 1661–1666, doi:10.1111/j.1460-9568.2008.06485.x.

[87] Youngseek Kim and Kevin Crowston, "Technology Adoption and Use Theory Review for Studying Scientists' Continued Use of Cyber-Infrastructure," *Proceedings of the American Society for Information Science and Technology* 48, no. 1 (2011): 1–10, http://onlinelibrary.wiley.com/doi/10.1002/meet.2011.14504801197/full.

[88] Kim and Crowston, "Technology Adoption," 8.

[89] Gary A. Klein, *A Recognition-Primed Decision (RPD) Model of Rapid Decision Making* (New York: Ablex Publishing Corporation, 1993), 143–144.

poor decision making arise when, despite a lack of skill, positive outcome is achieved thereby naturalizing bad choice.[90]

Individuals experiencing Dunning-Kruger effects may bolster their overconfidence simply because they did not experience negative consequences from the previous situation. Dr. David Dunning advances a similar hypothesis in some of his publications addressing flawed decision making.[91] He observes, "A person undergoing Dunning-Kruger effects may create an overconfidence simply because they did not experience negative consequences from the previous situation."[92]

4. Social Cognitive

To support their findings, Dunning and Kruger present social cognitive theory (SCT) as substantiation. According to Bandura, the author of SCT, "what people think, believe, and feel affects how they behave."[93] Dunning and Kruger refer to Bandura's 1977 work to explain how people "acquire and maintain certain behavioral patterns based on the learning from others."[94] Additional information from Youngseek and Crowston suggests that both outcome expectations and self-efficacy can influence behavior.[95] Outcome expectations and the self-

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[90] Vicky Arnold et al., "The Effect of Experience and Complexity on Order and Recency Bias in Decision Making by Professional Accountants," *Accounting and Finance* 40, no. 2 (July 2000): 109–134, doi:10.1111/1467-629X.00039.

[91] Kruger and Dunning, "Unskilled and Unaware of It," 1–10; David Dunning, "On Identifying Human Capital: Flawed Knowledge Leads to Faulty Judgments of Expertise by Individuals and Groups," in *On Identifying Human Capital*, vol. 32, ed. Edward J. Lawler and Shane R Thye (Emerald Group Publishing Limited Bradford, 2015): 149–176, http://www.emeraldinsight.com/doi/abs/10.1108/S0882-614520150000032006.

[92] Dunning, "The Dunning-Kruger Effect," 260.

[93] Albert Bandura, *Social Foundations of Thought and Action: A Social Cognitive Theory* (Englewood Cliffs, NJ: Prentice-Hall, 1986), 25.

[94] Kim, and Crowston, "Technology Adoption," 1–10; Albert Bandura, *Social Learning Theory, Prentice-Hall Series in Social Learning Theory* (Upper Saddle River, NJ: Prentice-Hall, 1977).

[95] Kim and Crowston, "Technology Adoption," 4–5.

perceived ability to complete a task are in turn influenced by individuals' prior behavior.[96] If this is true, then the unskilled and unaware modeling, as described by Dunning and Kruger, can also propagate inappropriate skills and behavior in others who are also unaware that the learned skills are unfitting for the situation or task. This ignorance can create a false sense of overconfidence in a group.

A study published in the *American Journal of Public Health* also supports the findings of Youngseek and Crowston wherein the authors identify that when communicating threats to the public, the message matters. As Wray et al. explain, "First, messages should emphasize simple, practical steps and basic information about the threat."[97] Also according to Wray et al., "Messages should be simple enough for people to understand under high-stress conditions."[98] This approach is in harmony with Dr. Ariely's instructions on how to minimize decision illusion and facilitate rational choice while attempting to control chaos theories nonlinear, butterfly effects associated with disasters.[99] The second finding to come out of the work of Wray et al. is that the message must be disseminated quickly because one of the first actions taken by individuals challenged with threat is that of personal protection.[100] This assignment is congruent with Williams fear-appeal work and fits well with Maslow's hierarchy of needs theory.[101]

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[96] Ibid., 6.

[97] Ricardo J. Wray et al., "Communicating with the Public about Emerging Health Threats: Lessons from the Pre-event Message Development Project," *American Journal of Public Health* 98, no. 12 (December 2008): 2214–2222.

[98] Ibid., 2220.

[99] This is the author's synthesis of chaos theory, rational choice theory, decision illusion, and Fauconnier and Turner's work.

[100] Wray et al., "Communicating with the Public," 2220.

[101] Maslow's hierarchy of needs is a well-accepted theory proposed by Abraham Maslow in his 1943 paper "A Theory of Human Motivation." According to Maslow, a person's physiological and safety needs must be achieved before any other needs are met. Abraham H. Maslow, "A Theory of Human Motivation," *Psychological Review* 50, no. 4 (1943): 370–396, doi: 10.1037/h0054346.

5. Simple and Hard Choices

Dr. Ruth Chang's analysis helps science further expand the difference between simple and hard choices.[102] Chang states, "What makes a choice hard is the way the alternatives relate…small choices can be hard" and hard choices sometimes lead to "the safest" option choice.[103] Also according to Chang, values do not equate to scientific quantities—that is "ought does not equal is."[104] Rather, hard choices have an additional consideration, which Chang coins "on a par."[105] A hard choice may create options that are on a par with each other for an individual, but the choice may not be a rational choice when examined from an objective perspective.[106] Dr. Chang ties the work of Banduras, Youngseek, and Crowston, Dancy et al., Dunning and Kruger, Ariely, and Kiel together in such a way to realize why folks make seemingly irrational decisions to perceived or actual threats. Dr. Chang's work also provides an opportunity to understand why individuals may experience decreased satisfaction and less engagement when making hard choices.[107]

The findings of Chang and the other researchers mentioned thus far in this literature review lead to the question what strategies can be used to make choices easier? Carlson et al. examined this particular question in 2014.[108] They identified and quantified factors influencing human decision making when facing a threat in the setting of a natural disaster. Many poor outcomes they identified

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[102] Chang, "Are Hard Choices Cases of Incomparability," 106–126.

[103] Ibid.

[104] Ibid.

[105] Chang, "How to Make Hard Choices," 14:42.

[106] Ibid.

[107] In *The Art of Choosing*, Lyengar presents the idea that decreased satisfaction arises from hard choices. Chang supports the idea in her Ted Talk, "How to Make Hard Choices."

[108] Carlson et al., "Measuring and Modeling Behavioral."

were traced to human factors.[109] In addition, Carlson et al. recognized overload and miscommunication attributed to a "temporal urgency associated with the imminence of the disaster."[110] They also discovered that individual decision making is influenced by the cohort populations' groupthink and coined the concept of "cascading behavior" to explain how fads (generalized ideas about the situation, regardless if based upon fact or not), emerge or fade.[111] This study supports the assentation of Dunning and Kruger, Chang, Ariely, and Kim and Crowston that decision making to threat is not always rational, is often based upon fear, and it can be learned behavior from others—even if the learned behavior is from the unskilled and not altogether rational. The study also affirmed Fauconnier and Turner's assertion that due to information overload, a cognitive tunnel vision is entirely plausible, which, in turn, can contribute to cognitive illusion.[112] Unfortunately, these individuals also lack the skills necessary to make such decisions. More importantly, they are unaware they lack skill, leading to a false sense of overconfidence of ability—hallmarks of the Dunning-Kruger effects.[113]

6. Enhancing Decision Making

Billings, Milburn, and Schaalman also looked at opportunities to enhance decision-making abilities and identified three variables:

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[109] Ibid., 15.

[110] Ibid., 16.

[111] Ibid., 1.

[112] Fauconnier and Turner, *The Way We Think*, 1–10.

[113] Ehrlinger et al., "Why the Unskilled Are Unaware," 98–121.

1. Decrease surprise,
2. Lengthen decision time, and
3. Have realistically valued goals.[114]

Surprise can be decreased through intelligence, education, engineering, and pre-event planning.[115] By reducing surprise, the authors submit that there may be less physiological effects that can produce "tunnel vision" associated with the fight or flight response of humans.[116] Dancy et al. support the interaction between cognition and physiology. A longer decision-making time allows the user to gather more relevant information and may also facilitate coping proficiencies along with rational thought process such that realistically valued goals can be formulated.[117] Again, the original work of Dunning and Kruger's appears to show agreement in this argument when applied to self-awareness and decision-making skills.[118]

Thus far, review of the literature has been primarily focused on individualistic approaches to understanding decision making in the face of threat. What about a larger approach of decision making as it relates to national threat—that of homeland security? John Mueller claims that the U.S. government policy making is based almost entirely on the "contemplation of the consequences of a terrorist attack while substantially ignoring the equally important likelihood component of risk assessment as well as the key issue of risk reduction."[119] This

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[114] Robert S. Billings, Thomas W. Milburn, and Mary Lou Schaalman, "A Model of Crisis Perception: A Theoretical and Empirical Analysis," *Administrative Science Quarterly* 25, no. 2 (1980): 300, doi:10.2307/2392456.

[115] Morgan Stanley, *Preparing for a Disaster or Catastrophic Event* [brochure] (New York: Morgan Stanley, 2013), https://www.morganstanley.com/wealth/wealthplanning/pdfs/disaster_preparedness_brochure.pdf.

[116] Billings, Milburn, and Schaalman, "A Model of Crisis Perception," 313.

[117] Ibid., 300.

[118] Ehrlinger et al., "Why the Unskilled Are Unaware," 98–121.

[119] Mark G. Stewart and John Mueller, "Balancing the Risks, Benefits, and Costs of Homeland Security," *Homeland Security Affairs* 7, no. 1 (2011): 43, https://www.hsaj.org/articles/43.

statement indicates a lack of skill and a lack of metacognitive awareness by government officials—hallmarks of the Dunning-Kruger effect.

7. Approaches to Minimize Poor Decision Making

Stephan Marsar's work on threat decision making focuses on individual and group decision making when confronted with life-threating situations.[120] Using natural disasters, terrorist attacks, and localized events as subject matter, Marsar identified key faults authorities use to message the public. Marsar delves deep into each observed failure and identifies root causes that prevent effective messaging strategies. For example, Marsar established that the message matters; keeping messages simple, specific, and relevant to time, place, and person are important.[121] However, Marsar digs deeper to find faults in each subset. Marsar posits that policy makers should be informed in order to make informed decisions.[122] He asserts, "The public message during hurricane Sandy that affected New York, NY on October 29, 2012, was to simply be somewhere else when the storm struck."[123] In addition, Marsar points to the work of McLennan et al. and agrees that in the case of Hurricane Sandy, "the overemphasis on simply being somewhere else when the emergency occurs [does] not give people the skills necessary to protect themselves and to make proper decisions."[124] Consequently, the officials responsible for making

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[120] Stephen Marsar, "Why Some People Live and Some People Die in the Same Emergencies and Disasters: Can the General Public Be Taught to Save Themselves?" (master's thesis, Naval Postgraduate School, 2013).

[121] Marsar, "Why Some People Live and Some People Die;" Nancy Dragani, "Personal Preparedness in America: The Needle Is Broken" (master's thesis, Naval Postgraduate School, 2015), 25–29.

[122] Ibid., 84.

[123] Ibid., 88.

[124] Jim McLennan et al., "'Deep Survival': Experiences of Some Who Lived When They Might Have Died in the 7 February 2009 Bushfires," *The Australian Journal of Emergency Management* 26, no. 2 (2011): 41–46, http://search.informit.com.au/documentSummary;dn=141438180244882;res=IELAPA.

individuals aware deny individuals the awareness skills necessary to protect them from the threat of a storm.

The relationship between "threat" associated with terrorism or disaster and the "response" of an individual or group is intricately woven into the homeland security fabric of the United States. At the core of any threat, a response is the moment decisions are made. Literature shows decision making is sometimes difficult. Hard choices are those decisions that may not have a right or wrong; rather, they have opportunities that are on a par with one another yet lead to unconnected outcomes.[125] Choice is further complicated by "decision-illusion," and this leads to choice overload, which explains why seemingly obvious self-preservation does not always occur.[126]

The correlation between decision making and self-preservation is influenced by a multitude of factors.[127] Often unskilled individuals can appear frozen in their decision making, waiting for someone else to make the first move.[128] Ad-hoc leaders emerge and form groups who react similarly with a herd mentality.[129] Unfortunately, some of these ad-hoc leaders suffer from what literature reveals as a Dunning-Kruger effect, and subsequently, the group can collectively choose wrong with deadly results, as evidenced in the 2001 World Trade Center attacks.[130]

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[125] Lyengar, "The Art of Choosing."

[126] Ariely, Predictably Irrational, 3.

[127] Dragani, "Personal Preparedness in America," 25.

[128] Lyengar, *The Art of Choosing*.

[129] Marsar, "Why Some People Live and Some People Die?"

[130] Richard Marinucci, "Solving the Unsolvable," *Fire Engineering*, August 2015, 35, http://digital.fireengineering.com/fireengineering/201508?folio=32&pg=35#pg35; Eric Webber, "Many WTC Workers Told to Return to Their Desks after Crash," Rense, September 28, 2001, http://rense.com/general14/afterd.htm; Robyn R. M. Gershon, David E. Hogan, and Kristine A. Qureshi, "Preliminary Results from the World Trade Center Evacuation Study—New York City, 2003," *Morbidity and Mortality Weekly Report* 53, no. 35 (2004): 815–817, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5335a3.htm.

D. SUMMARY

The goal of this literature review is to define threat in the context of U.S. homeland security, highlight certain human behavioral theories framed by perceived threat, and explore the concept of choice. Wickedness exists anytime human behavior, choice, and peril collide—synergized by circumstances outside the control of the affected.[131] A cognitive bias recognized as the Dunning-Kruger effect postulates the unskilled lack the necessary abilities to effectively respond to threat. Equally important, because they lack the skills required to recognize their inadequacies, they are unaware they lack the necessary skills to know their inability. The resultant lack of awareness enables the individual to have a false overconfidence in their perceived abilities. They do not understand they are making poor choices, which creates a double jeopardy of being unskilled and unaware. This thesis examines the influence Dunning-Kruger effects have on individuals to determine if it is worthy of consideration by the homeland security policy decision maker.

[131] Rittel and Webber, "Dilemmas in a General Theory," 155–169.

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III. RESEARCH DESIGN

> I want to understand the world from your point of view. I want to know what you know in the way you know it. I want to understand the meaning of your experience, to walk in your shoes, to feel things as you feel them, to explain things as you explain them. Will you become my teacher and help me understand?
>
> —James P. Spradley

This thesis research uses a multi-case study approach centered on indicators of the Dunning-Kruger effect theory. The research focuses on 12 indicators to evaluate the presence or absence of the Dunning-Kruger effect in individuals who experienced a disaster (Katrina or 9/11). Additionally, this chapter discusses data analysis methodology, assumptions, bias, and limitations of the research.

A. METHOD

Defined by Cohen, Manion, and Morrison, case study research gathers data as a basis for inference and interpretation and can be used to explain or predict human behavior.[132] Identifying real-world phenomena experienced by individuals during actual disasters through interviews is a highly appropriate approach for investigating the presence or absence of Dunning-Kruger effects.

The case study approach is appropriate because the research describes real-world experiences and the dynamics associated with human behavior, choice, and decision making. In this chapter, Table 1 is adapted from Fritze's 2003 work, and it provides an overview of the methodological approach used for this thesis.

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[132] Louis Cohen, Lawrence Manion, and Keith Morrison, *Research Methods in Education*, 5th ed. (New York: Routledge Falmer, 2000), 224–263.

Table 1. Methodological Approach[133]

Conceptual framework	Dunning-Kruger theory
Paradigm	Qualitative
Methods used to collect data	Transcripts from previous interviews
Data analysis	Individual case analysis applying indicators of Dunning-Kruger effect
Research participants	Survivors of natural (Hurricane Katrina) and human caused (World Trade center) disasters
Qualifiers	Must have been present prior to the onset of disaster threat. For natural disaster, three days prior and for human caused disaster immediately prior to threat

B. DATA COLLECTION

Two case studies are included in this study: Hurricane Katrina and the attacks on the World Trade Center. Selected as examples of significant national disasters, Hurricane Katrina represents natural disaster with warning and the attacks on the World Trade Center exemplify human-caused disaster with no warning.

To complete this study, the researcher obtained previously conducted interview transcripts of survivors from each case. The analysis uses 12 indicators indicative of the Dunning-Kruger effect. These indicators are based on academic peer-reviewed works by Dunning and Kruger (see Appendix).

The first case study employs transcripts of Hurricane Katrina survivor interviews of individuals who did not evacuate, against recommendations by

[133] Adapted from Paul A. Fritze, "Innovation in University Computer-Facilitated Learning Systems: Product, Workplace Experience and the Organization" (master's thesis, Royal Melbourne Institute of Technology, 2003).

experts to leave, when confronted with imminent threat from Hurricane Katrina. Transcripts from the Roy Rosenzweig Center for History and New Media at George Mason University were organized by the University of New Orleans to form the Hurricane Digital Memory Bank (HDMB). According to the HDMB website, "HDMB was awarded the Award of Merit for Leadership in History, and is the largest free public archive of Hurricanes Katrina and Rita with over 25,000 items in the collection."[134]

The second case study utilizes interview transcripts of survivors from the World Trade Center attacks. Transcripts obtained from the Roy Rosenzweig Center for History and New Media, 9/11 digital archives, and the Columbia University Library afforded open source World Trade Center interview transcripts with more than 69,000 items from which to choose.[135]

To be included in the research, the interviewed respondents must have been present immediately prior to the onset of the disaster and survived to provide insight to their decision making in response to threat. For the natural disaster case study, the participants had to be present in the disaster area three days prior. To be eligible for the human-caused disaster case study, the participants had to be in the building(s) at the time the World Trade Center was attacked or had be an emergency responder to the event.

C. PROCEDURE

For each case study, interview transcripts were evaluated for indicators of the Dunning-Kruger effect. Indicators of the Dunning-Kruger effect came from two primary sources. Dr. David Dunning provides the most relevant and accurate assessment of indirect indicators in his book section titled "The Dunning-Kruger

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[134] Hurricane Digital Memory Bank, "Oral Histories," accessed August 26, 2016, http://hurricanearchive.org/items?type=4.

[135] September 11 Digital Archive, "Personal Accounts," accessed August 26, 2016, http://911digitalarchive.org/collections/show/278; "9-11 Survivors," in World Trade Center Attack: The Official Documents, Columbia University Libraries, accessed August 29, 2016, http://library.columbia.edu/locations/usgd/wtc.html.

Effect."[136] Additional information from Dr. Dunning is provided through a pro-board communications channel titled "The Quodlibeta Forum."[137] Finally, Dr. Dunning provides confirmation of indicators in the *New Reddit Journal of Science* when he discusses Dunning-Kruger indicators.[138] The second source of indicators is from the works of Joyce Ehrlinger and her colleagues.[139] The Ehrlinger et al. studies broaden self-assessment of participants to include direct (absolute) and indirect (comparative) measures.[140]

To perform qualitative research, the researcher organized 12 indicators associated with the Dunning-Kruger theory into three domains: incompetence of an individual, lack of metacognition, and illusionary superiority. Figure 1 illustrates the organization of indicators.

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[136] Dunning, "The Dunning-Kruger Effect," 276.

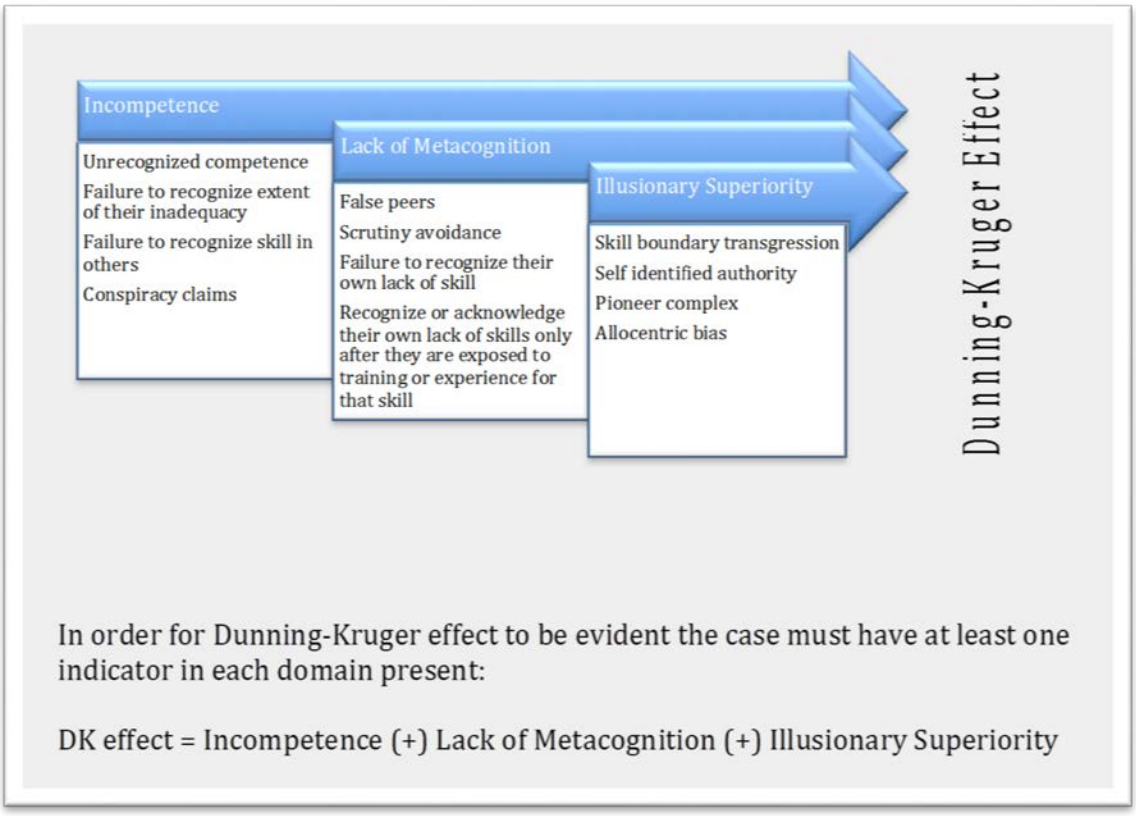
[137] Tim O'Neill, "A Dunning-Kruger Detection Kit," *The Quodlibeta Forum*, posted March 2, 2012, http://jameshannam.proboards.com/thread/1074/dunning-kruger-detection-kit.

[138] David Dunning, "Science AMA Series: I'm David Dunning, a Social Psychologist Whose Research Focuses on Accuracy and Illusion in Self-Judgment (You May Have Heard of the Dunning-Kruger Effect). How Good Are We at 'knowing Thyself'? AMA!," *Reddit*, accessed August 6, 2016, https://www.reddit.com/r/science/comments/2m6d68.

[139] Ehrlinger et al., "Why the Unskilled Are Unaware," 98–121.

[140] Ibid., 101.

Figure 1. Coding of Indicators to Measure the Dunning-Kruger Effect



Each transcript was analyzed using the following procedure:[141]

1. Read the transcript and make notes regarding first impressions and to identify if the participant met the inclusion criteria.
2. Code words, phrases, sentences, or relevant sections using Dunning-Kruger indicators
3. Collate obtained data on spreadsheet.

Table 2 provides each indicator's definition and the domain to which it relates. An indicator could be identified multiple times in the same interview

[141] Procedures were adapted from the works of Alan Bryman, *Social Research Methods*, 5th ed. (New York: Oxford University Press, 2016); Steinar Kvale and Svend Brinkmann, *InterViews: Learning the Craft of Qualitative Research Interviewing*, 3rd ed. (Los Angeles: Sage Publications, 2015).

transcript, but only the presence or absence of the indicator was considered in the analysis.

Table 2. Research Domain, Indicator and Indicator Definition

	Indicator	Indicator Definition
Illusionary Superiority	Allocentric bias	"The individual explains the difference between their views and those of qualified professionals, as the result of inherent bias on the part of the professionals; accusations of bias are directed at anyone other than themselves, and they claim objectivity."[142]
	Skill boundary transgression	"The individual is seeking to operate as an authority or qualified individual, in a field beyond their personal level of academic and professional qualification."[143]
	Self-identified authority	The individual identifies himself or herself as sufficiently competent to act authoritatively on the subject[144]
	Pioneer complex	The individual self-identifies as a pioneer uncovering previously unknown or unrecognized facts—a Copernicus or Galileo.[145]
	False peers	"The individual believes that the favorable commentary of other unskilled and non-professional individuals indicates they themselves are sufficiently qualified."[146]

[142] O'Neill, "A Dunning-Kruger Detection Kit."

[143] Kruger and Dunning, "Unskilled and Unaware of It," 1122.

[144] Ibid.

[145] Atle Næss, *Galileo Galilei: When the World Stood Still* (New York: Springer, 2005), 131.

[146] Kruger and Dunning, "Unskilled and Unaware of It," 1131; Hillel J. Einhorn, "Learning from Experience and Suboptimal Rules in Decision Making," in *Judgment under Uncertainty*: Heuristics and Biases, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky (Cambridge, MA: Cambridge University Press, 1982), 268–284.

	Indicator	Indicator Definition
Lack of metacognition	Scrutiny avoidance	"The individual fails to submit their work for professional scrutiny (such as in the relevant scholarly literature), for review by those genuinely qualified."[147]
	Failure to recognize her or his own lack of skill	The individual is deficient of necessary metacognition to adequately assess if they are truly qualified in the skillset.[148]
	Recognize or acknowledge his or her own lack of skills only after being exposed to training or experience for that skill	According to Dunning and Kruger, the only way to recognize proper skills for a domain is to train the individual so they understand what good performance is, and then show them examples of their own inferior actions.[149]
Incompetence	Unrecognized competence	"The individual's self-assessed competence is not recognized by those who are academically and professional competent."[150]
	Failure to recognize the extent of his or her inadequacy	Inadequate identification of internal and external factors to appreciate an accurate understanding of skill, or lack thereof.[151]
	Failure to recognize genuine skill in others	Recognition of another person's skills as useful first requires an individual to recognize or distinguish competence. Thus, if people lack the skills to produce correct answers, they are also cursed with an inability to know when

147 Kruger and Dunning, "Unskilled and Unaware of It," 1131; Mark Chen and John A. Bargh, "Nonconscious Behavioral Confirmation Processes: The Self-Fulfilling Consequences of Automatic Stereotype Activation," *Journal of Experimental Social Psychology* 33, no. 5 (1997): 541–560.

148 Kruger and Dunning, "Unskilled and Unaware of It," 1122.

149 Ibid., 1121–1134.

150 Ibid., 1132.

151 Diane F. Halpern, "Teaching Critical Thinking for Transfer across Domains: Disposition, Skills, Structure Training, and Metacognitive Monitoring," *American Psychologist* 53, no. 4 (1998): 449–455, doi:10.1037/0003-066X.53.4.449.

	Indicator	Indicator Definition
		their answers, or anyone else's, are right or wrong.[152]
	Conspiracy claims	"The individual explains opposition by qualified professionals as a coordinated attempt to suppress truth, in order to defend the existing scholarly consensus."[153]

Once all of the transcripts were coded, the researcher analyzed and interpreted the results. If all three domains had at least one indicator coded, the researcher marked that the Dunning-Kruger effect was present.

D. ASSUMPTIONS

This research is predicated on an assumption that rational decision making would include removing oneself from impending threat based upon recommendations of experts. In both cases studied, there were conflicting authoritative recommendations, initially to stay and then later to evacuate. It is assumed that individuals based decisions on the information available at the time of perceived or realized threat. Additionally, it is assumed the respondents were afforded opportunity to access adequate resources and options to stay or evacuate. The researcher presumed that individuals giving testimonies understood the questions asked in the interview and answered them honestly and accurately. It was also assumed that adequate time was allotted to each question for respondents to answer completely. Finally, the researcher assumed the transcription of interviews was accurate and reliable.

[152] Kruger and Dunning, "Unskilled and Unaware of It," 1121–1134.

[153] O'Neill, "A Dunning-Kruger Detection Kit."

E. LIMITATIONS AND BIAS

Time, data set size, and available resources contributed to the limitations. During the research process, several limitations were encountered. Perhaps the most important limitation is that the research method only identifies Dunning-Kruger indicators absence or presence in these case studies; it cannot readily quantify the size of the effect. Everyone suffers to some extent Dunning-Kruger effects at some point, and it would be helpful to understand the extent the individuals suffered this cognitive bias.[154]

The researcher was limited to obtaining disaster survivor interview transcripts. It is possible that victims that did not survive the realized threat may have had a perspective different from the individuals interviewed. Transcripts and phone conversations are available from victims before they succumbed to the threat; however, the sources could not be considered academically reliable, or the information available was insufficient for this study.

Another limitation to the study is that both case studies had conflicting information presented to the decision makers. For example in the Hurricane Katrina case study, there are documented instances of inconsistent recommendations to evacuate.[155] Similarly, the World Trade Center case study has evidence of conflicting information presented to the decision makers.[156] It is

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[154] Sui Huang, "When Peers Are Not Peers and Don't Know It: The Dunning-Kruger Effect and Self-Fulfilling Prophecy in Peer-Review," *BioEssays* 35, no. 5 (May 2013): 414–416, doi:10.1002/bies.201200182; David Dunning, "We Are All Confident Idiots," *Pacific Standard*, October 27, 2014, https://psmag.com/we-are-all-confident-idiots-56a60eb7febc#.2qixb260u.

[155] According to the U.S. House of Representatives Bipartisan Committee Report to Investigate the Preparation for and Response to Hurricane Katrina the state governor and city mayor 'delayed' mandatory evacuation orders until 19 hours before landfall, despite the national warning 56 hours before landfall." U.S. Congress House Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina, *A Failure of Initiative: Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina*, (Washington, DC: U.S. Government Printing Office, 2006), https://www.uscg.mil/history/katrina/docs/USHouseOfRepKatrina2006MainR1eport.pdf, 337.

[156] Gershon, Hogan, and Qureshi, "Preliminary Results."

possible that, had consistent, reliable, and accurate information been given to the decision makers, their choices may be different.

Since the researcher did not conduct the interviews, it is possible that other influences, of which the researcher was not aware, may have contributed to the responses of the interview survivors. The length of the interview varied for many of the individual cases and was not controlled by the researcher. Additionally, the interview questions may have been different had the researcher initiated the dialog.

Qualitative analysis can be subject to researcher bias. Since the researcher was not present during the interview, it is possible the researcher did not appreciate non-verbal cues or gestures that occurred during the interview. Furthermore, bias can happen at any point during research. Although only the researcher coded the data, co-advisors with advanced academic degrees guided this researcher.

Of the thousands of possible interview transcripts available, the researcher sampled only a small fraction of possible candidates. A goal of qualitative research is to achieve data saturation.[157] After reviewing 30 cases for natural threat and 30 cases for human-caused threat, the researcher determined that new information was not likely to emerge through use of the coding scheme by including additional cases. The researcher coded 942 pages of transcripts for natural threat and 858 pages for human caused threat. Flipping a coin randomized cases to decrease the possibility of sample bias; if heads landed, the

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[157] Donna Bonde, "Qualitative Interviews: When Enough Is Enough" (Australia: Research by Design, 2013), http://www.researchbydesign.com.au/media/RBD-WhitePaper-Margin-of-Error.pdf, 1–5; David Rice, "European Journal of Orthodontics: Editor's Report 2015," *The European Journal of Orthodontics* 38, no. 3 (2016): e1–e1, doi:10.1093/ejo/cjw030; Phillip J. Brown and Wayne A. Fuller, *Statistical Analysis of Measurement Error Models and Applications Proceedings of the AMS-IMS-SIAM Joint Summer Research Conference Held June 10-16, 1989, with Support from the National Science Foundation and the U.S. Army Research Office* (Providence, RI: American Mathematical Society, 1990), http://www.ams.org/books/conm/112/conm112-endmatter.pdf; Hae-Young Kim, "Statistical Notes for Clinical Researchers: Evaluation of Measurement Error 2: Dahlberg's Error, Bland-Altman Method, and Kappa Coefficient," *Restorative Dentistry & Endodontics* 38, no. 3 (2013): 182, doi:10.5395/rde.2013.38.3.182.

transcript was included in the sample, and if tails landed, the transcript was not included. The coin flipping randomization continued until 30 transcripts populated the sample set. It is possible that results may have been different had more transcripts been evaluated in the sample set.

F. SUMMARY

This chapter focused on the methods employed to examine the indicators associated with the Dunning-Kruger effect. The chapter began with descriptions and approaches applied in analyzing and researching this thesis. The researcher used methodological, multi-case study approach centered on indicators of the Dunning-Kruger theory. Moreover, the research focused on indicators associated with the Dunning-Kruger theory to evaluate the presence or absence of a cognitive bias experienced by individuals presented with realized natural or human caused disaster threat. In addition, this chapter outlines justification, methodology, participant inclusion, and data collection procedures to reach data analysis. Finally, this chapter discussed assumptions, bias, and limitations of the research.

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IV. CASE STUDY HURRICANE KATRINA

> The reasons why people react as they do during periods of impending disaster is still obscure. Out of ignorance or denial of danger, the majority of people act inappropriately and fail to respond in the way that is most likely to preserve life.
>
> –Unknown[158]

A. BACKGROUND

According to the National Oceanic and Atmospheric Administration (NOAA), "Hurricane Katrina was the eleventh named storm and the fifth hurricane of the 2005 Atlantic hurricane season."[159] Katrina made landfall on August 28, 2005 as a Saffir-Simpson category three storm.[160] Having sustained winds of 100–140 miles per hour, the storm extended more than 400 miles across the U.S. Gulf Coast and delivered a maximum storm surge exceeding 26 feet.[161] In addition to causing an estimated $135 billion in damage, Hurricane Katrina was one of the most deadly storms to affect the United States with an estimated 1,833 deaths attributed to it.[162] Hurricane Katrina is characterized as a major U.S. natural disaster (see Figure 2) and therefore was chosen to represent the natural disaster case study for this research.

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158 "Human Behaviour in Disaster," *Canadian Medical Association Journal* 101, no. 10 (1969): 120–121.

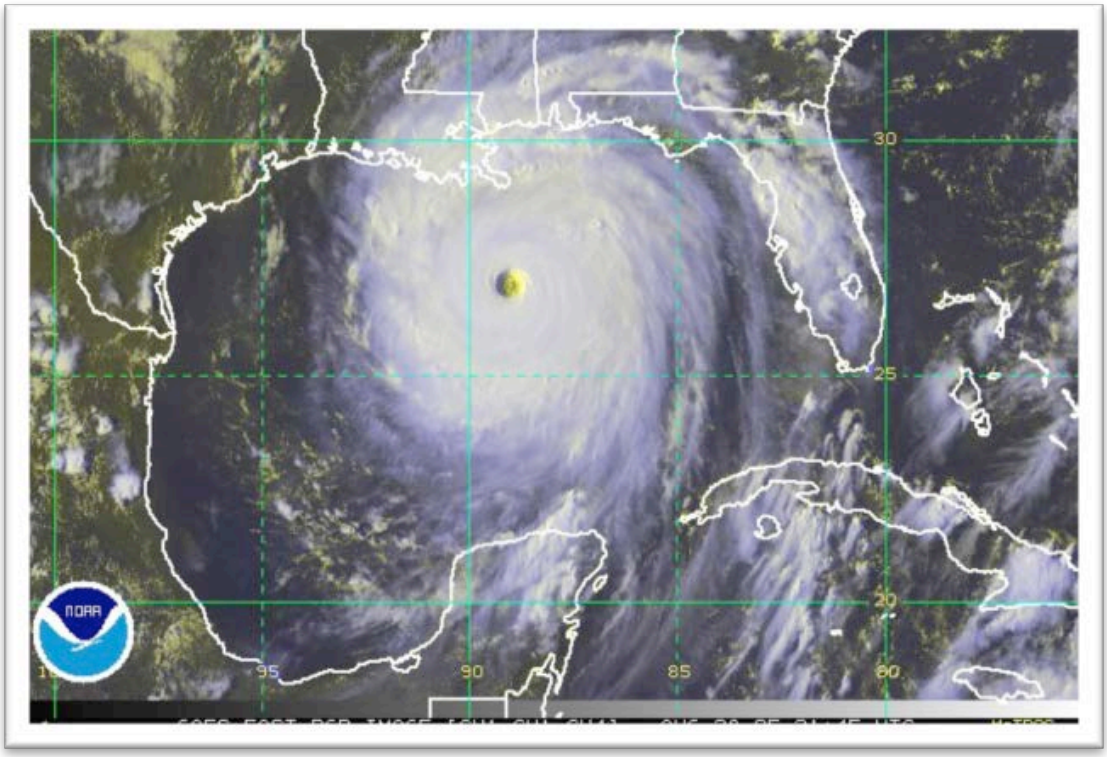
159 National Weather Service, "Post Storm Data Acquisition Aerial Wind Analysis and Damage Assessment Hurricane Katrina," October 31, 2005, http://www.nws.noaa.gov/os/data/pdfs/KatrinaPSDA.pdf.

160 According to the National Hurricane Center, the Saffir-Simpson hurricane wind scale ranges from one to five and bases a storm's potential for major damage by the storm's sustained wind speed. Category three or higher is considered a major storm with potential for significant loss of life. National Hurricane Center, "Saffir-Simpson Hurricane Wind Scale," accessed August 19, 2016, http://www.nhc.noaa.gov/aboutsshws.php.

161 Live Science, "Hurricane Katrina: Facts, Damage and Aftermath," accessed July 11, 2016, http://www.livescience.com/22522-hurricane-katrina-facts.html.

162 National Oceanic and Atmospheric Administration, "10th Anniversary of Hurricane Katrina," accessed July 11, 2016, http://www.srh.noaa.gov/lix/?n=katrina_anniversary.

Figure 2. Satellite Photo of Hurricane Katrina[163]



B. DATA

Table 3 provides a numerical representation of the Hurricane Katrina data collected.

163 Source: National Oceanic and Atmospheric Administration, "NOAA-Hurricane-Katrina" [image], August 28, 2005, https://upload.wikimedia.org/wikipedia/commons/d/db/NOAA-Hurricane-Katrina-Aug28-05-2145UTC.jpg.

Table 3. Case Study Hurricane Katrina: Numerical Representation of Data

Reference number	Notes	Exhibited at least one indicator in each domain?	Skill-boundary transgression	Self-identified authority	Allocentric bias	Pioneer complex	False Peers	Recognize skill only after exposure	Scrutiny avoidance	Failure to recognize their own lack of skill	Failure to recognize the extent of their inadequacy	Failure to recognize genuine skill in others	Unrecognized competence	Conspiracy claims	Number of Indicators
1		✔	Y	N	N	N	Y	N	N	Y	Y	Y	N	Y	6
2		✔	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	8
3		✔	Y	N	N	Y	N	Y	N	N	N	Y	Y	N	5
4			N	N	N	N	N	N	N	N	N	N	N	N	0
5			N	N	N	N	N	N	N	N	N	N	N	N	0
6		✔	Y	Y	N	N	Y	Y	N	Y	Y	Y	N	N	7
7	A	✔	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	11
8	B	✔	N	Y	N	Y	Y	Y	N	N	Y	N	Y	N	6
9			N	N	N	N	Y	Y	N	Y	Y	N	N	N	4
10		✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
11		✔	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	9
12		✔	Y	Y	N	Y	Y	Y	N	Y	Y	N	N	N	7
13			N	N	N	N	N	N	N	N	N	N	N	N	0
14			N	N	N	N	N	N	N	N	N	N	N	N	0
15			N	N	N	N	N	N	N	N	N	N	N	N	0

Reference number	Notes	Exhibited at least one indicator in each domain?	Skill-boundary transgression	Self-identified authority	Allocentric bias	Pioneer complex	False Peers	Recognize skill only after exposure	Scrutiny avoidance	Failure to recognize their own lack of skill	Failure to recognize the extent of their inadequacy	Failure to recognize genuine skill in others	Unrecognized competence	Conspiracy claims	Number of Indicators
16		✔	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	N	9
17		✔	N	Y	Y	N	Y	N	Y	Y	Y	N	N	Y	7
18	C	✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
19		✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	11
20	D	✔	N	N	Y	Y	Y	N	N	Y	Y	N	N	Y	6
21	E	✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
22		✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
23			N	N	N	N	N	N	N	N	N	N	N	N	0
24	F	✔	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	10
25		✔	Y	N	N	N	Y	Y	Y	N	Y	N	Y	N	6
26	G	✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
27	H	✔	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	7
28			N	N	N	N	N	N	N	N	Y	Y	N	N	2
29		✔	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	10
30		✔	Y	Y	Y	N	N	N	Y	Y	Y	N	N	Y	7
Sum			18	17	16	14	20	18	15	18	23	11	15	13	
A: Mayor, B: Gov't, C: City council, D: Univ. Pres., E: Congressman, F: Meteorologist, G: Fire Chief, H: Army Corp. Engineer															

Table 4 displays the distribution of the Hurricane Katrina data along with how many times each identifier was noted (sum).[164] Table 4 also displays the percentage of time each indicator was identified. Finally, Table 4 shows the percentage of time at least one indicator in the domain was identified.

Table 4. Case Study Hurricane Katrina: Sum, and Distribution of Data for Each Indicator

	Indicator	Sum	Percentage (Indicator)	Percentage (Domain)
Illusionary Superiority	Allocentric bias	16	8.1%	32.8%
	Skill boundary transgression	18	9.1%	
	Self-identified authority	17	8.6%	
	Pioneer complex	14	7.1%	
Lack of Metacognition	False peers	20	10.1%	35.9%
	Scrutiny avoidance	15	7.6%	
	Failure to recognize their own lack of skill	18	9.1%	
	Recognize or acknowledge their own lack of skills only after being exposed to training or experience for that skill	18	9.1%	
Incompetence	Unrecognized competence	15	7.6%	31.3%
	Failure to recognize the extent of their inadequacy	23	11.6%	
	Failure to recognize genuine skill in others	11	5.6%	
	Conspiracy claims	13	6.6%	
Total		198	100.2%	100%

[164] It is possible that the total may not equal 100 percent due to a rounding discrepancy.

C. ANALYSIS

In this research, Hurricane Katrina represents decision making of individuals experiencing a natural disaster. Thirty interview transcripts obtained from a single source, the Roy Rosenzweig Center for History, were reviewed for the presence of Dunning-Kruger indicators.[165] Highlights of the data from the case study include:

- The DK effect was present in 22 of the 30 cases (73 percent).
- The indicators most often identified for each domain:
  - Illusionary superiority = Skill boundary transgression (9.1 percent)
  - Lack of metacognition = False peers (10.1 percent)
  - Incompetence = Failure to recognize the extent of their inadequacy (11.6 percent)
- The most coded indicator, "failure to recognize the extent of their inadequacy," appeared in 95 percent of the cases that met the studies criteria for Dunning-Kruger indicators.[166]
- The indicators least often identified for each domain:
  - Illusionary superiority = Pioneer complex (7.1 percent)
  - Lack of metacognition = Scrutiny avoidance (7.6 percent)
  - Incompetence = Failure to recognize genuine skill in others (5.6 percent)
- The least coded indicator, "failure to recognize genuine skill in others," appeared in 45 percent of the cases that met the studies criteria for Dunning-Kruger indicators.[167]
- Each domain represented roughly one third of the indicators, showing relatively equal distribution:[168]

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[165] Hurricane Digital Memory Bank, "Browse Items," accessed July 11, 2016, http://hurricanearchive.org/items?type=4.

[166] This indicator presented in 21 of the possible 22 cases that coded positive for Dunning-Kruger influences.

[167] This indicator presented in 10 of the possible 22 cases that coded positive for Dunning-Kruger influences.

- Illusionary superiority = 65 coded identifiers (32.8 percent)
- Lack of metacognition = 75 coded identifiers (35.9 percent)
- Incompetence = 62 coded identifiers (31.3 percent)

- In 24 of 30 cases reviewed, at least one indicator was identified.
  - Illusionary superiority: An indicator was identified in 22 of 30 cases
  - Lack of metacognition: An indicator was identified in 23 of 30 cases
  - Incompetence: An indicator was identified in 24 of 30 cases
- Every respondent that self-identified as a governmental representative exhibited the Dunning-Kruger effect (at least one indicator in each domain).

D. DISCUSSION

At first glance, a 73 percent positive correlation of coding for Dunning-Kruger effect indicators surprised this researcher. However, it makes sense when consideration is given to the data set. The interview transcripts centered on individuals who self-selected to not evacuate when confronted with the imminent threat from hurricane Katrina. Whether because of a sense of duty to act, as in the case of a Mississippi fire chief, or because the individual had endured previous storms in the area, the individual made a choice to stay. If the data set included all individuals who resided in the area, including those who chose to evacuate prior to the storm, the researcher believed the data would not show such a strong Dunning-Kruger correlation.

The Dunning-Kruger theory posits, "The miscalibration of the incompetent stems from an error about the self."[169] That is, the individuals with lesser knowledge or skill are less aware of their inadequacy and therefore cannot accurately gauge or assess their incompetence. The most frequent indicator

[168] It is possible that the total may not equal 100 percent due to a rounding discrepancy.

[169] Dunning, "The Dunning-Kruger Effect," 258.

identified by the research, “failure to recognize the extent of their own inadequacy,” supports this.

Interestingly, those who self-identified as governmental representatives also tested positive for Dunning-Kruger influences. Perhaps the high incidence occurred because these individuals felt a duty to act on behalf of their area of responsibility coupled with the overwhelming size of the event. This researcher recommends more in-depth analysis to confirm this observation.

In many of the interview transcripts, respondents used prior hurricane experience as a gauge of how bad things could get. One respondent stated, “If you live down here, you measure time by hurricanes. ‘Did you build it before or after Betsy? Did you build it before or after Camile?’ And the new yardstick is Katrina.”[170] These statements illustrate the miscalibration of metacognition about self. The rational decision would have been to remove oneself from impending threat based upon recommendations of experts. Each storm presents its uniqueness in strength, size, and landfall; therefore, each should be independently evaluated for threat to self when making a decision.

“False peers” was the next most reported indicator. For example, in the context of the Dunning-Kruger effect, individuals believe the opinions of other unskilled people is sufficient to justify their decision-making choices. Unfortunately, individuals who lack sufficient knowledge or skills to make “good choices” also are deficient in metacognition to comprehend that the people supporting their choice may also be providing negligent advice. Simply put, the individuals seeking false peers for counsel do not know what good advice looks like for the decision to be made. According to Einhorn, individuals choosing false peers typically place themselves in a setting that can prevent their errors from being exposed, thereby affirming their actions by those unqualified to assess

[170] Hurricane Digital Memory Bank, “Taylor, Gene,” accessed May 10, 2016, http://hurricanearchive.org/items/show/45863.

competently.[171] In the context of the Dunning-Kruger theory, there is a strong association with seeking unqualified advice from false peers with decision making immediately prior or during a disaster.[172]

What becomes apparent is the boundary at which people's legitimate skills or knowledge in an area ends; this can be much different from where their self-perceived abilities actually are. Incompetence is often invisible to the individual and may only become apparent after an event or formalized training. Lacking the metacognition to recognize their personal deficiency of skills is one of the hallmarks of those suffering from the Dunning-Kruger effect.[173]

The grouping of similar unqualified colleagues that form a cohort of misguidance represents a groupthink mentality suffering from a collective lack of metacognition. Illustrative of this effect is a quote taken from one of the respondents, who admitted, "We did not have a plan, we may have thought we did, but if we did, we didn't use it."[174] Another respondent stated,

> OK, here's what waiting for death on [in] a hurricane is [like]…I can remember feeling the wind and the rain hitting me on the side of the face and I was terrified…that's the day I said, Oh, no, I will never get taken by surprise again.

These examples indicate these individuals identified—after the fact—that their abilities and awareness was not sufficient to address the realized threat.[175]

Again, the data seems to make sense when evaluated against the Dunning-Kruger effect. This sub-group of society accepted imminent threat from

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171 Einhorn, "Learning from Experience," 268–284.

172 Athol Yates, "Technical Expertise as a Contributing Factor in Three Disasters," *Australian Journal of Emergency Management*, 15, no. 3 (2000): 2–6.

173 Kruger and Dunning, "Unskilled and Unaware of It."

174 Hurricane Digital Memory Bank, "Warr, Mayor Brent," accessed May 10, 2016, http://hurricanearchive.org/items/show/45877.

175 Hurricane Digital Memory Bank, "Tardo, Wendy," accessed May 10, 2016, http://hurricanearchive.org/items/show/45862.

natural disaster despite the many recommended and then mandatory evacuation notices. It is no surprise then that "failure to recognize genuine skill in others" was the least identified indicator (11) for the natural disaster threat case study encompassing disaster with warning. If individuals lack the metacognitive skills necessary to recognize their shortcomings in a particular domain, then also absent is the personal awareness to distinguish genuine skill in others. It is possible that the interviewees were less likely to recognize genuine skill in others and therefore discussed others' abilities less simply because they did not want recognize such skills for fear of highlighting their inadequacies.[176] In almost all cases reviewed, the individuals grouped with others of similar thinking to form allocentric groups of false peers.

Decision making involves the process of selecting among alternatives, and the rational choice theory supposes that an individual will act rationally and predicts patterns and outcomes of choices.[177] As noted earlier in this chapter, it appears that respondents were bounded by a hermeneutic of using prior storms as their high-water mark for defining their awareness and skills. This framing bounded (or hindered) the individuals' decision making and metacognitive abilities.

Hurricane Katrina exceeded any recent prior devastation in terms of strength, duration, storm surge, cost, and death toll.[178] Individuals who used prior storm experience as basis for decision making showed indicators suggestive of the Dunning-Kruger cognitive bias. Of the 30 transcripts this researcher evaluated, 80 percent displayed incompetence, 78 percent displayed

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176 Oliver J. Sheldon, David Dunning, and Daniel R. Ames, "Emotionally Unskilled, Unaware, and Uninterested in Learning More: Reactions to Feedback about Deficits in Emotional Intelligence," *Journal of Applied Psychology* 99, no. 1 (2014): 133, doi:10.1037/a0034138.

177 Sarah Grison, Todd F Heatherton, and Michael S. Gazzaniga, *Psychology in Your Life* (New York: W. W. Norton, 2015), 278.

178 Anne Waple, *Hurricane Katrina* (Asheville, NC: NOAA's National Climatic Data Center, 2005), http://www.ncdc.noaa.gov/extremeevents/specialreports/Hurricane-Katrina.pdf.

metacognition fault, and 74 percent of the respondents tested positive for illusionary superiority in the data set.

In modest terms, the Dunning-Kruger theory can be stated as the unskilled are unaware they lack the competence and therefore are overconfident. The research design coded four identifiers for each of the three domains (incompetence, lack of metacognition, and illusionary superiority) to show that, in at least many of the cases reviewed, individuals who chose to encounter the threat of a natural disaster—Hurricane Katrina—exhibited traits of the Dunning-Kruger cognitive bias.

E. SUMMARY

This chapter applied the indicators of the study associated with the Dunning-Kruger effect in the domain of natural disaster decision making. This case study also represents disasters with warning. A methodological multi-case study approach, focused on indicators of the Dunning-Kruger theory, represented the qualitative taxonomy. The research coded 12 indicators to associate traits of the Dunning-Kruger theory with individuals who failed to adequately remove themselves from natural threat with prior warning.

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V. CASE STUDY WORLD TRADE CENTER

> Great occasions do not make heroes or cowards; they simply unveil them to the eyes of men. Silently and imperceptibly, as we wake or sleep, we grow strong or weak; and at last some crisis shows what we have become.
>
> —Brook Foss Westcott

A. BACKGROUND

The World Trade Center (WTC) project was founded on a dream of free commerce to connect the entire world. Each tower was 110 stories, and approximately 105,000 tourists, commuters, and workers would pass through the two towers each workday.[179] Consisting of a total of seven buildings in lower Manhattan, New York, the WTC complex dream was realized when its doors opened on April 4, 1973. Boasting the two tallest buildings in the world—when first opened—at 1,368 feet (417 m), and 1,362 feet (415 m), the complex contained 13,400,000 square feet (1,240,000 m^2) of office space and provided workspace for more than 35,000 people.[180]

The World Trade Center was the target of attacks by a group of extremist Islamic affiliated terrorists on at least two separate occasions. On February 26, 1993, a large vehicle borne urea-nitrate based explosive detonated in the underground parking garage with the perpetrators hoping to topple the building. Instead, the detonation created a 200-foot by 100-foot by seven-stories deep

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[179] 9/11 Memorial, "National September 11 Memorial and Museum," accessed July 14, 2016, http://www.911memorial.org/world-trade-center-history.

[180] John Holusha, "Commercial Property; in Office Market, a Time of Uncertainty," *New York Times*, January 6, 2002, http://www.nytimes.com/2002/01/06/realestate/commercial-property-in-office-market-a-time-of-uncertainty.html sec. Real Estate.

crater and sent acrid black smoke up to the 46th floor; ultimately, the incident killed six and injured more than 1,000.[181]

The second series of attacks occurred on September 11, 2001, when hijackers flew two Boeing 767 commercial airliners into the complex. In a coordinated attack, the north tower was impacted at 8:46 a.m., and then the south tower was struck at 9:03 a.m. (see Figure 3). This act of terrorism collapsed the south tower at 9:59 a.m., and the north tower fell at 10:28 a.m., killing 157 on board the two aircraft as well as 2,606 civilians and 421 emergency workers.[182] President G. W. Bush signed declaration DR-1391 designating this terrorist attack as a national disaster. More than 15 years later, the death toll continues to rise from illnesses and injury attributed to the attacks.[183]

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[181] John Parachini, "The World Trade Center Bombers," in *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons*, ed. Jonathan B. Tucker, 185–206 (Cambridge, MA: MIT Press, 2000).

[182] 9-11 Research "The World Trade Center," accessed July 13, 2016, http://www.911research.wtc7.net/wtc/attack/index.html.

[183] SP Schwartz, W Li, L Berenson, and RD Williams "Deaths in World Trade Center Terrorist Attacks New York City, 2001," *Morbidity and Mortality Weekly Report* [special issue] 51 (2002): 16–18, http://wonder.cdc.gov/wonder/help/CMF/Deaths%20in%20World%20 Trade%20Center%20Terrorist%20Attacks%20---%20New%20York%20City,%202001.htm.

Figure 3. Photo of the World Trade Center Attacks on September 11, 2001[184]

According to the 9/11 Commission report, "The 9/11 attacks were a shock, but they should not have come as a surprise."[185] Evacuation planning, training, and prior lessons learned from the 1993 attack attributed to the large number of survivors who successfully exited the buildings.[186] More than 14,000 people safely evacuated the buildings; however, only four individuals survived above the

[184] Source: Alan Taylor, "9/11: The Day of the Attacks," *The Atlantic*, September 9, 2011, http://www.theatlantic.com/infocus/2011/09/9-11-the-day-of-the-attacks/100143/. Photo by Sean Adair, Reuters.

[185] National Commission on Terrorist Attacks upon the United States, "Final Report of National Commission on Terrorist Attacks upon the United States, Executive Summary," 2004, http://www.9-11commission.gov/report/911Report_Exec.htm.

[186] Edwin R. Galea et al., "The UK WTC 9/11 Evacuation Study: An Overview of Findings Derived from First-Hand Interview Data and Computer Modelling," *Fire and Materials* 36, no. 5–6 (2012): 501–521, doi:10.1002/fam.1070.

84th floor of the south tower (floors above the area of impact), and only 16 people in the World Trade Center towers at the time of their collapse survived.[187]

The World Trade Center South Tower suffered catastrophic collapse 56 minutes following the impact of the United Airlines flight 175 into floors 77 through 85. The north tower stood 102 minutes after the crash of American Airlines Flight 11 into the 93rd through 99th floors.[188] Previous experience from the terrorist bombing of 1993 may have contributed to evacuation procedures employed on September 11, 2001, at the World Trade Center.[189]

B. DATA

Table 5 provides a numerical representation of the World Trade Center data collected during this research. Table 6 displays the distribution of the World Trade Center data along with how many times each identifier was noted (sum). Table 6 also displays the percentage of time each indicator was identified. Finally, Table 6 shows the percentage of time at least one indicator in the domain was identified.

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[187] Galea et al., "Methodologies Employed;" Robyn R. M. Gershon et al., "The World Trade Center Evacuation Study: Factors Associated with Initiation and Length of Time for Evacuation," *Fire and Materials* 36, no. 5–6 (2012): 481–500, doi:10.1002/fam.1080; History, "9/11 Attacks Facts & Summary," accessed July 14, 2016, http://www.history.com/topics/9-11-attacks.

[188] Jim Ritter, *Flight Path Study—American Airlines Flight 11* (Washington, DC: National Transportation Safety Board, 2002), file:///Users/chdsstudent/Desktop/Flight_Path_Study_AA11.pdf; Jim Ritter, *Flight Path Study—United Airlines Flight 175* (Washington, DC: National Transportation Safety Board, 2002), http://www.ntsb.gov/about/Documents/Flight_Path_Study_UA175.pdf.

[189] Gershon et al., "The World Trade Center."

Table 5. Case Study, World Trade Center: Numerical Representation of Data

Reference number	Notes	Exhibited at least one indicator in each domain?	Skill-boundary transgression	Self-identified authority	Allocentric bias	Pioneer complex	False Peers	Recognize skill only after exposure	Scrutiny avoidance	Failure to recognize their own lack of skill	Failure to recognize the extent of their inadequacy	Failure to recognize genuine skill in others	Unrecognized competence	Conspiracy claims	Number of Indicators
1		✔	Y	Y	Y	N	Y	N	Y	N	Y	Y	Y	Y	9
2			N	Y	Y	Y	N	N	N	N	N	N	N	N	3
3			N	N	Y	N	N	Y	Y	N	N	N	N	N	3
4			N	N	Y	N	N	N	N	Y	N	N	N	N	2
5			N	N	N	Y	N	N	Y	N	N	N	N	N	2
6		✔	N	N	N	Y	Y	N	N	Y	N	N	N	Y	4
7		✔	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	8
8			N	N	Y	N	N	N	N	N	N	N	N	N	1
9			N	Y	Y	Y	N	N	N	N	Y	N	N	N	4
10			N	N	N	N	Y	Y	N	Y	Y	N	N	N	4
11		✔	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	10
12			N	Y	N	N	N	N	N	N	Y	N	N	Y	3
13		✔	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	9
14		✔	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	9
15			Y	Y	Y	Y	N	N	N	N	Y	N	N	N	5
16		✔	Y	Y	N	Y	N	Y	N	Y	N	Y	Y	Y	8
17			N	N	N	N	Y	Y	Y	N	Y	N	N	Y	5

Reference number	Notes	Exhibited at least one indicator in each domain?	Skill-boundary transgression	Self-identified authority	Allocentric bias	Pioneer complex	False Peers	Recognize skill only after exposure	Scrutiny avoidance	Failure to recognize their own lack of skill	Failure to recognize the extent of their inadequacy	Failure to recognize genuine skill in others	Unrecognized competence	Conspiracy claims	Number of Indicators
18	A	✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	11
19	B	✔	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	7
20		✔	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	9
21		✔	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	8
22	C	✔	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
23		✔	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	N	7
24			N	N	N	N	N	N	N	N	N	N	N	Y	1
25			N	Y	N	N	N	N	N	N	N	Y	N	N	2
26			N	N	N	N	Y	N	N	Y	N	N	Y	N	3
27			N	Y	N	N	N	N	N	N	Y	N	N	N	2
28			N	N	N	N	N	N	N	Y	Y	N	N	N	2
29			N	Y	N	N	N	N	N	N	Y	N	N	N	2
30		✔	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	5
Sum			14	19	17	13	15	10	11	14	19	10	6	13	
A: Structural Engineer B: Battalion Fire Chief C: Survivor of 1993 WTC attack /Floor Fire Marshal															

Table 6. Case Study World Trade Center: Sum, and Distribution of Data for Each Indicator

	Indicator	Sum	Percentage (Indicator)	Percentage (Domain)
Illusionary Superiority	Allocentric Bias	17	10.6%	39.1%
	Skill boundary transgression	14	8.7%	
	Self-identified authority	19	11.8%	
	Pioneer complex	13	8.1%	
Lack of Metacognition	False peers	15	9.3%	31.1%
	Scrutiny avoidance	11	6.8%	
	Failure to recognize their own lack of skill	14	8.7%	
	Recognize or acknowledge their own lack of skills only after being exposed to training or experience for that skill	10	6.2%	
Incompetence	Unrecognized competence	6	3.7%	29.8%
	Failure to recognize the extent of their inadequacy	19	11.8%	
	Failure to recognize genuine skill in others	10	6.2%	
	Conspiracy claims	13	8.1%	
Total:		161	100%	100%

C. ANALYSIS

The attacks on the World Trade Center represent decision making of individuals experiencing a human caused disaster, and it also signifies disaster

threat without warning. Thirty interview transcripts of survivors from the World Trade Center terrorist attacks were evaluated and coded for the presence of Dunning-Kruger indicators.[190] Highlights of the data from the case study include:[191]

- The DK effect was present in 14 of the 30 cases (47 percent).
- The indicators most often identified for each domain:
  - Illusionary superiority = Self-identified authority (11.8 percent)
  - Lack of metacognition = False peers (9.3 percent)
  - Incompetence = Failure to recognize the extent of their inadequacy (11.8 percent)
- "Failure to recognize the extent of their inadequacy," and "self-identified authority" tied for the most coded indicators.
- "Self-identified authority" appeared in 86 percent of the cases that met the studies criteria for Dunning-Kruger indicators.[192]
- "Failure to recognize the extent of their inadequacy" appeared in 71 percent of the cases that met the studies criteria for Dunning-Kruger indicators.[193]
- The indicators least often identified for each domain:
  - Illusionary superiority = Pioneer complex (8.1 percent)
  - Lack of metacognition = Recognize or acknowledge their own lack of skills only after being exposed to training or experience for that skill (6.2 percent)
  - Incompetence = Unrecognized competence (3.7 percent)

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[190] Some data was collected from written transcripts of interviews; others were from audio recordings of World Trade Center survivors. In each case, the data obtained were from primary sources of the individual that personally experienced the event.

[191] It is possible that the total may not equal 100 percent due to a rounding discrepancy.

[192] This indicator presented in 12 of the possible 14 cases that coded positive for Dunning-Kruger influences.

[193] This indicator presented in 10 of the possible 14 cases that coded positive for Dunning-Kruger influences.

- The least coded indicator, “unrecognized competence,” appeared in 35 percent of the cases that met the studies criteria for Dunning-Kruger indicators.[194]
- Each domain represented roughly one third of the indicators, with Illusionary Superiority displaying a marginally dominant distribution:[195]
  - Illusionary superiority = 63 coded identifiers (39 percent)
  - Lack of metacognition = 50 coded identifiers (31 percent)
  - Incompetence = 48 coded identifiers (30 percent)
- In every case reviewed, at least one indicator was identified.
  - Illusionary superiority: An indicator was identified in 25 of 30 cases
  - Lack of metacognition: An indicator was identified in 21 of 30 cases
  - Incompetence: An indicator was identified in 25 of 30 cases
- Three respondents self-identified as an authority capable of directing others. In each case the respondent exhibited Dunning-Kruger effects (at least one indicator in each domain.)

D. DISCUSSION

The human-caused disaster case study yielded interesting results. First, less than half of the testimonies coded positive for experiencing Dunning-Kruger effects. It is possible that given less time to rationalize the decision to remove oneself from threat may also decrease seemingly irrational decision making. This is congruent with the fear-appeal theory as described by Williams.[196] Studies by Matthew Hunsinger correlate fear perception with an increased decision-making

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[194] This indicator presented in five of the possible 14 cases that coded positive for Dunning-Kruger influences.

[195] It is possible that the total may not equal 100 percent due to a rounding discrepancy.

[196] Williams, “Fear Appeal Theory.”

bias behavior.[197] Another explanation could be that many of the occupants had been trained to evacuate when fire alarms, a form of perceived threat, sounded. In one report that studied WTC evacuation, 98 percent of those who worked in the towers reported they participated in at least one WTC fire drill within the previous 12 months before the attack. [198] Thus, obtaining skills necessary to safely evacuate the building during an emergency and minimizing the Dunning-Kruger effect.

For the human-caused disaster case study, represented by the terrorist attacks on the World Trade Center, two indicators tied for most prevalence (self-identified authority and failure to recognize the extent of their inadequacy). Individuals who self-identify or make the personal claim of having sufficient authoritative competence (unsubstantiated by facts) in an area or subject outside their expertise are said to exhibit self-identified authority.[199] However, according to Dunning and Kruger, unaccomplished individuals sometimes lack the metacognitive skills necessary for accurate self-assessment to establish reasonable authority.[200] Furthermore, favorable outcome is not dependent on competent decision making.[201] Unsubstantiated overconfidence may manifest itself as authoritative behavior, capable of influencing others.[202] This research did not establish legitimate authority, but it did recognize individuals that self-

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197 Matthew Hunsinger, "Threat on the Mind: The Impact of Incidental Fear on Race Bias in Rapid Decision-Making" (Ph.D. diss., University of Massachusetts Amherst, 2010), 6.

198 Gershon et al., "The World Trade Center."

199 Kruger and Dunning, "Unskilled and Unaware of It," 1122.

200 Ibid.

201 Robert C. Giambatista and J. Duane Hoover, "An Exploration of Overconfidence in Experiential Learning of Behavioral Skills among MBA Students," *Developments in Business Simulation and Experiential Learning* 41 (2014): 296, https://absel-ojs-ttu.tdl.org/absel/index.php/absel/article/view/2126.

202 Jaap van Ginneken, *Collective Behavior and Public Opinion: Rapid Shifts in Opinion and Communication* (Mahwah, NJ: Lawrence Erlbaum Associates, 2003), 8–10, 31–37.

identified as an authority. In 86 percent of cases displaying Dunning-Kruger effects, the self-identified authority indicator was present.[203]

In no instance of case study review did the researcher identify an individual who chose to face the threat of disaster alone. Instead, each formed groups to give and receive support and encouragement to evacuate, and some individuals assumed the role of a self-identified authority capable of making group decisions. It is important to note that the majority of respondents indicated that others influenced their decision(s), at least in part. Groups affect individual behavior and social in-groups can sway choices made by the individual.[204] This assertion is supported in other WTC evacuation studies that revealed up to 59 percent of the studies' respondents reported delaying evacuation to seek others, and another eight percent waited for directions from others or permission to leave.[205]

Immediately following the first airplane impacting the north tower, many respondents reported hearing the Port Authority making announcements to shelter-in-place. Individuals and groups who decided to begin evacuation, against recommendations aired on loudspeakers by the Port Authority, rightly self-identified as having authority for self-preservation despite risking scrutiny for their evacuation actions. Some respondents indicated their self-identified authority in their testimony. One survivor recalls hearing:

> Building Two is secure. There is no need to evacuate Building Two. If you are in the midst of evacuation, you may return to your office by using the re-entry doors on the re-entry floors and the elevators to return to your office. Repeat, Building Two is secure....[206]

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203 Self-identified authority was recognized in 12 of 14 cases testing positive for Dunning-Kruger indicators.

204 O'Neill, "A Dunning-Kruger Detection Kit."

205 Gershon et al., "The World Trade Center Evacuation Study."

206 Brian Clark, "A Twin Towers' Survivor Story," *NOVA, PBS*, April 30, 2002, http://www.pbs.org/wgbh/nova/tech/twin-towers-survivor-story.html.

This respondent indicated he decided to ignore these requests and chose to continue evacuation efforts. Another respondent reported hearing, "…the incident is confined to Tower 1 and it is safe to return to work." But then stated:

> At the next landing, a few people left the stairwell and I assumed they went to the elevators and went back to work. I was going to get out of the building with most everybody else. I'd assess the situation and call back to my office. I was not going back to work until I was sure of the situation.[207]

In each of these instances, the individual self-identified as having sufficient authority to decide to evacuate and disregard the initial advice of the Port Authority.

Equally predominant in the WTC study was an individuals' failure to recognize the extent of their inadequacy.[208] The adverse effects of human decision making have been extensively researched, published, and recognized are the. Whether due to inadequate risk perception or overconfidence due to illusionary superiority, the failure of a person to recognize the extent of her or his inadequacy adversely affects situational awareness of threat.[209] For example, the National Transportation Safety Board indicated that degraded situational awareness could lead to inadequate decision making and inadequate decision is the leading contributor (74 percent) of untoward air events.[210]

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[207] Sean Linnane, "Twin Towers 9-11: A First-hand Account," *Stormbringer* [blog], September 8, 2009, http://seanlinnane.blogspot.com/2009/09/twin-towers-9-11-first-hand-account.html.

[208] Most inadequacies identified in transcripts were physical in nature (fatigue, injury, footwear), but in a few instances, mental inadequacies were noted.

[209] Samuel Pavel, Michael Robertson, and Bryan Harrison, "The Dunning-Kruger Effect and SIUC University's Aviation Students," *Journal of Aviation Technology and Engineering* 2, no. 1 (2012): 125–129, doi:10.5703/1288284314864.

[210] Stuart Mathews, James S. Waugh Jr., and Carl Vogt, "Flight Safety: Killers in Aviation FSF Task Force Presents Facts about Approach-and-Landing and Controlled-flight-into-Terrain Accidents," *Flight Safety Foundation* 17, no. 11–12 (1988): 288, http://flightsafety.org /fsd/fsd_nov-feb99.pdf.

The Dunning-Kruger effect can help explain observed behaviors of ineffectively assessing threat. Individual accounts from survivors identifying the inadequacies of themselves and of others were evident when recounting their 9/11 experiences. One respondent stated, "I was surprised when the clerk charged me $1.59, since I was covered from head to toe with soot and ash" when he recalled stopping for a drink before evacuating tower two.[211] Another survivor indicated that, as he was exiting, he passed a Starbucks. In a surreal scene, "people were still lined up waiting for lattes as thousands scrambled away from the complex."[212] Yet another survivor commented on how "tenants of the towers had never been required to do evacuation drills, and they didn't know the quickest ways down." This survivor added, "More puzzling is that people who got to the lobby were sent back up," which indicates these individuals did not fully appreciate the grave and imminent danger.[213] Mere feet from safely evacuating the hazards of the towers, some survivors recounted the choice others made to head back up the stairs. Ultimately, this decision proved deadly for many as evidenced by a different survivor: "Either you were outside and lived, or you were inside and died; this was the grim reality of the Twin Towers."[214]

Other studies suggest individuals failed to recognize the extent of their inadequacy relating to simple evacuation drills, thus contributing to the large death toll. For example, one study reported, "Many permanent workers, even those with years of experience in the buildings, also reported they did not know how to evacuate via routes that deviated from their normal paths."[215] Another

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211 Richard Fern, "Accounts from the South Tower," Neil Mishalov's Web Site, May 26, 2002, http://www.mishalov.com/wtc_southtower.html.

212 Terry Reilly, "9/11 Survivor Tells Story of Tower Escape," *Wilmington Star News*, April 22, 2014, http://www.starnewsonline.com/news/20140422/911-survivor-tells-story-of-tower-escape.

213 "Response on the Ground," American Radio Works, accessed July 24, 2016, http://americanradioworks.publicradio.org/features/911/c1.html.

214 Linnane, "Twin Towers 9-11."

215 Gershon, Hogan, and Qureshi, "Preliminary Results."

study found that there was a "widespread lack of familiarity and knowledge of the building, including the fire safety features of the building and the evacuation plan and procedures" by those who called the World Trade Center towers their workplace.[216] Other WTC evacuation studies suggest individual inadequacy played a significant role. One study detailed, "Progress was reportedly slowed for some persons because of poor physical condition or inadequate footwear (e.g., high-heeled shoes or 'flip-flops')."[217]

It is important to note that, despite lacking formalized training to evacuate, the vast majority (99 percent of those below the area of plane impact) successfully egressed the World Trade Center towers. This discovery correlates well with the researches empirical presentation of *unrecognized competence* as the least coded indicator. Suggesting that in the case of human-caused disaster, most survivors possessed the skills necessary to safely remove themselves from danger.

E. SUMMARY

This chapter examined the indicators of the study associated with the Dunning-Kruger effect in the domain of a human-caused disaster, measuring decision making to evacuate from threat without warning. A methodological multi-case study approach, centered on indicators of the Dunning-Kruger effect theory, was the qualitative taxonomy used. The research focused on 12 indicators to associate traits of the Dunning-Kruger theory with individuals who successfully removed themselves from the human caused threat created when terrorists flew commercial airliners into the World Trade Center towers.

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[216] Robyn R. M. Gershon et al., "Factors Associated with High-Rise Evacuation: Qualitative Results from the World Trade Center Evacuation Study," *Prehospital and Disaster Medicine* 22, no. 3 (2007): 165–173, doi:10.1017/S1049023X0000460X.

[217] Gershon, Hogan, and Qureshi, "Preliminary Results."

VI. DISCUSSION AND FINDINGS

Are there indicators of Dunning-Kruger effects on individuals who encountered natural or anthropogenic disasters?

A. DISCUSSION OF HURRICANE KATRINA AND WORLD TRADE CENTER CASES

Two cases were identified for this research. The case of Hurricane Katrina represented threat with warning while the attacks on the World Trade Center coded for human-caused threat that offered little or no warning. In both cases, a total of 30 publicly available survivor interview transcripts were randomly chosen for qualitative coding. The study utilized binary computation to record a presence or absence of the indicator. Depth of effect was not researched for this thesis. Table 7 denotes the total number of times an indicator was identified. For coding purposes, the indicator was recorded as either present or not.

Table 7. Coded Indicators of Hurricane Katrina and WTC Respondent Data

Codes	Katrina	WTC	Average
Allocentric bias	16	17	16.5
Pioneer complex	14	13	13.5
Self-Identified authority	18	19	18.5
Skill boundary transgression	18	14	16
False peers	20	15	17.5
Recognize skill only after exposure	18	10	14
Scrutiny avoidance	15	11	13
Failure to recognize their own lack of skill	18	14	16
Failure to recognized the extent of their inadequacy	23	18	20.5
Failure to recognize genuine skill in others	11	10	10.5
Unrecognized competence	15	6	10.5
Conspiracy claims	14	13	13.5
Total codes recognized for all domains	200	160	180

From the data collected, it becomes apparent that indicators were more frequently identified in the Katrina case study. A potential reason for this is because the natural disaster interview transcripts were slightly longer, suggesting the interviews in general provided more opportunity for an indicator to appear. Another possibility is that given warning, individuals may believe they possess the necessary skills to effectively manage this type of threat and therefore be less apt to evacuate.

The indicators characterized three domains necessary for Dunning-Kruger effects. Table 8 evaluates the number and percentage of times at least one indicator in each domain was identified along with the average. The illusionary superiority and incompetence appeared more often in the WTC case while a lack of metacognition prevailed in the Hurricane Katrina case study.

Table 8. Times at Least One Indicator Was Identified

Domain	Hurricane Katrina (30 possible opportunities for an indicator)	World Trade Center (30 possible opportunities for an indicator)	Combined (60 possible opportunities for an indicator)
Illusionary Superiority	23 (76.6%)	25 (83.3%)	48 (80%)
Lack of Metacognition	23 (76.6%)	22 (73.3%)	45 (75%)
Incompetence	24 (80%)	25 (83.3%)	49 (82%)

For each case and every transcript, the researcher used the same criteria and scrutiny to code for 12 indicators. The researcher reviewed 942 pages of transcripts for natural threat and 858 pages for human caused threat. It is important to note that in each of the 60 transcripts surveyed, a human being

endured and survived a large-scale disaster; many others were not as fortunate and perished during the incident.

B. SUMMARY

This thesis began with what the author thought would be a simple question: why do people not remove themselves from perceived or realized disaster threats when they have a choice? Quickly, it became apparent that there are a multitude of factors that can influence human behavior and decision making during times of peril. This research was focused to determine if Dunning-Kruger effects are present in threat decision making using two case studies for qualitative review. Hurricane Katrina represented natural threat, and the terrorist attacks against the World Trade Center are human caused. Additionally, these case studies provided opportunity to compare the impact of warning on the DK effect. Pre-event warning up to seven days was present in Hurricane Katrina; the WTC study had little to no warning of impending threat.

It is not necessary to demonstrate every indicator for the Dunning-Kruger effect to be present. Because the Dunning-Kruger effect is a cognitive bias wherein the individuals lack metacognitive ability (knowledge about their knowledge) in a specific domain, as they develop their comprehension, skill, or awareness, the effect becomes diminished. In a similar fashion, those on the upper knowledge or skill spectrum for a domain may assume that everyone has the same comprehension or capability as them and therefore believe others share similar competency.[218]

The qualitative research yielded some surprising results, such as Dunning-Kruger indicators were prevalent in both cases studied. For the natural disaster study, more time (prior warning) was afforded for the decision-making process, and research results yielded a higher recording of DK indicators. The research identified 73 percent of those respondents who chose to not evacuate

[218] Kruger and Dunning, “Unskilled and Unaware of It.”

to safety prior to landfall of Hurricane Katrina showed positive indicators for Dunning-Kruger effects. In contrast, only 47 percent of the respondents associated with human caused disaster (World Trade Center attacks) met the criteria of presentation of at least one Dunning-Kruger indicator in each of the three domains (incompetence, lack of metacognition, illusionary superiority) established for the study. Since this research only identified the absence or presence of DK indicators, additional research is necessary to determine the extent these effects impacted decision making. As identified in Chapter III, challenges the decision makers faced included discerning the usefulness of incomplete, inaccurate, or inconsistent information. It is possible that had consistent, reliably accurate, and complete information been available, the decision makers' choices may be different. Previous studies have identified that there are always factors, such as recency bias, in complex decision making, and these may influence the behavior of individuals when presented with threat.[219]

Another interesting outcome from the research was that respondents that self-identified as an authority (governmental or institutional) for natural disaster displayed indicators exhibiting Dunning-Kruger influences. The Dunning-Kruger effect postulates that individuals lack the necessary skill, and therefore the metacognitive abilities, to recognize their deficiency of skill, and subsequently, the individuals exhibit overconfidence. In the case of natural disaster, a reason for this revealed behavior could be because of a sense of duty to act. Since individuals identified as someone having authority, it could be that they also believed their duty to act outweighed the need to evacuate. Instead, they were challenged with performing their duty in the face of what proved to be overwhelming realized threat from a natural event. As one Mississippi mayor stated, "You can go ahead and write us off, we're done for."[220] The human-

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[219] Arnold et al., "The Effect of Experience."

[220] Hurricane Digital Memory Bank, "Brent Warr" [audio recorded transcript], accessed May 10, 2016, http://hurricanearchive.org/items/show/45877, 10.

caused disaster case study also provided insight to this duty to act notion as evidenced by a remark made about Mr. Rick Rescorla, the Morgan Stanley Director of Security. Mr. Rescorla perished in the 2001 World Trade Center attacks; however, one of the responses elicited from a survivor referenced this notion, stating: "You'd have to be slightly abnormal—abnormally selfless, abnormally patriotic—to do what he [Rescorla] did."[221] Indications of this duty to act are evident from a conversation Mr. Rescorla had with his wife on September 11, 2001 when he told her, "Stop crying. I have to get these people out safely. If something should happen to me, I want you to know I've never been happier."[222]

Perhaps most importantly, this research only coded indicators of the Dunning-Kruger theory and consequently only yielded an affirmation or absence of the effect. Therefore, it did not show the depth of effect individuals experienced. However, the distribution of data suggest Dunning-Kruger effects were present, and therefore individuals suffered from cognitive bias related to disaster threat to an extent significant enough to be measured.

C. RECOMMENDATIONS

This research should serve more so as a beginning to a vein of research rather than as any sense of termination. Since the Dunning-Kruger theory is still a relatively newly identified cognitive bias, more study is warranted, especially in the domain of disaster human behavior. A prospective research strategy improves study reliability since the researcher can design the variables and controls. Another advantage of prospective studies is the researcher can also account for unforeseen factors influencing the research. This research was retrospective in nature and therefore, it was impossible to control for all perturbations. Ideally, research design similar to the original Dunning-Kruger

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[221] Rebecca Liss, "The Marine Who Found Two WTC Survivors," *Slate Magazine*, September 11, 2015, http://www.slate.com/articles/news_and_politics/this_just_in/2002/09/an_unlikely_hero.html.

[222] Amanda Ripley, *The Unthinkable: Who Survives When Disaster Strikes and Why*, 1st ed. (New York: Three Rivers Press, 2009), 209.

study, but in the domain of perceived disaster threat would be constructed to measure for the effect, including depth of the effect. Further analysis focused on exploring group dynamics influencing Dunning-Kruger effects and decision making during natural and human caused threat should be pursued.

Similarly, there is a research opportunity to explore the time-to-realized threat decision-making process. This research revealed Dunning-Kruger effects were more apparent when more warning time was afforded. If the results are true and can be replicated (perception of threat decreases as the time to realized threat increases), then this could significantly impact the policy decisions of governmental agencies responsible for dissemination of information and warnings.

Finally, this research identified a potential pitfall as it relates to authority decision making. Specifically, in the cases studied, some of those whom identified as having authority also exhibited indicators consistent with the Dunning-Kruger effect. As previously mentioned, a person can influence others. If the individual is experiencing DK effects, then this influence may transfer to others in a group.[223] A significant portion of disaster planning includes anticipatory consequence probability forecasting. However, if an individual charged with safeguarding and forecasting worst case planning lacks sufficient skills, then ultimately the plan itself can be flawed. Some critics use the governmental response to Hurricane Katrina as confirmation, with those assuming authoritative roles accused of being unskilled and unaware, thereby also possessing an error in confidence to response capabilities.[224]

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[223] Tsai defines allocentric people as those who tend to define themselves according to the in-group with which they identify and become interdependent and sharing beliefs. Shu-Chen Tsai, "The Ethnic Transference of Feminist Thought Involving Colonialism: A Metacognitive Examination of Multi-cultural Learning," *Open Journal of Social Sciences* 3, no. 1 (2015): 94–103, doi:10.4236/jss.2015.31011.

[224] Russell S. Sobel and Peter T. Leeson, "Government's Response to Hurricane Katrina: A Public Choice Analysis," *Public Choice* 127, no. 1–2 (2006): 55–73, doi:10.1007/s11127-006-7730-3.

D. CONCLUSION

This research identified that Dunning-Kruger indicators are present in human caused and natural disasters; however, it did not measure the extent of the effect. Further exploration of the Dunning-Kruger theory as it relates to human decision making in the domain of disaster threat should ensue. Specifically, investigation of the individual, group dynamics and authoritative personnel ought to be explored in an effort to minimize this cognitive bias, minimize chaos during disasters and maximize competent decision making in the context of disaster threat. The cure to resolving Dunning-Kruger effects is through acquisition of skills and knowledge.[225] As Dr. Dunning suggests, "Get competent. Always be learning."[226]

[225] Kruger and Dunning, "Unskilled and Unaware of It."

[226] Dunning, "Science AMA Series."

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APPENDIX. INDICATORS OF THE DUNNING-KRUGER EFFECT

Indicators of the Dunning-Kruger effect are not those of this author. Rather, they are derived from Dr. David Dunning who confirmed the indicators in a Reddit on-line conversation.[227] Dunning-Kruger indicators are also taken directly from the original works of Dr. Justin Kruger and Dr. Dunning.

- Skill-boundary transgression: "The individual is seeking to operate as an authority or qualified individual, in a field beyond their personal level of academic and professional qualification."[228]
- Self-identified authority: The individual identifies himself or herself as sufficiently competent to act authoritatively on the subject.[229]
- Unrecognized competence: "The individual's self-assessed competence is not recognized by those who are academically and professional competent."[230]
- False peers: "The individual believes that the favorable commentary of other unskilled and non-professional individuals indicates they themselves are sufficiently qualified."[231]
- Scrutiny avoidance: "The individual fails to submit their work for professional scrutiny (such as in the relevant scholarly literature), for review by those genuinely qualified."[232]
- Pioneer complex: The individual self-identifies as a pioneer uncovering previously unknown or unrecognized facts, a Copernicus or Galileo.[233]

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[227] Ibid.

[228] Kruger and Dunning, "Unskilled and Unaware of It," 1122.

[229] Ibid.

[230] Ibid.

[231] Kruger and Dunning, "Unskilled and Unaware of It," 1131; Einhorn, "Learning from Experience," 268–284.

[232] Kruger and Dunning, "Unskilled and Unaware of It," 1131; Chen and Bargh, "Nonconscious Behavioral Confirmation Processes," 541–560.

[233] Atle Næss, "Galileo Galilei," 131.

- Conspiracy claims: “The individual explains opposition by qualified professionals as a coordinated attempt to suppress truth, in order to defend the existing scholarly consensus.”[234]
- Allocentric claims of bias: “The individual explains the difference between their views and those of qualified professionals, as the result of inherent bias on the part of the professionals; accusations of bias are directed at anyone other than themselves, and they claim objectivity.”[235]
- Failure to recognize their own lack of skill: The individual is deficient of necessary metacognition to adequately assess if they are truly qualified in the skillset.[236]
- Failure to recognize the extent of their inadequacy: Inadequate identification of internal and external factors to appreciate an accurate understanding of skill, or lack thereof.[237]
- Failure to recognize genuine skill in others: Recognition of another person’s skills as useful first requires an individual to recognize or distinguish competence. Thus, if people lack the skills to produce correct answers, they are also cursed with an inability to know when their answers, or anyone else’s, are right or wrong.[238]
- Recognize and acknowledge their own lack of skills only after they are exposed to training or experience for that skill: According to Dunning and Kruger, the only way to recognize proper skills for a domain is to train individuals so they understand what good performance is and then show them examples of their own inferior actions.[239]

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234 O’Neill, “A Dunning-Kruger Detection Kit.”

235 Ibid.

236 Kruger and Dunning, “Unskilled and Unaware of It,” 1122.

237 Halpern, “Teaching Critical Thinking.”

238 Kruger and Dunning, “Unskilled and Unaware of It,” 1121–1134.

239 Ibid.

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