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Griffin Thompson April 10, 2023

Why We Choose War: How neuroscience can help explain leaders' toughest decisions

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Abstract

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By Griffin Thompson

As the maxim goes, "with great power comes great responsibility." Well, what happens when those in power neglect their responsibility? World governments afford an incredible amount of power to individual heads of state, and citizens around the world are at the whim of these political leaders. Therefore, it is vital to use new and innovative techniques to analyze leaders' decisions. Neuroscience, with its explanatory power of behavior and choices, can complement many existing models of decision theory. Subsequently, this necessitates the construction of a novel framework that deploys recent findings in neuroscience, relies on established theories in political science, and expands on research from adjacent fields to craft a holistic tool of analysis that examines these decisions. This thesis constructs and proves the utility of such a framework. Set against the backdrop of the War in Afghanistan, this thesis uses former president Barack Obama's decision to increase troops levels in country as a case study to design a framework that both highlights the necessity of including neuroscience in analyzing political decisions and provides improvement on prior frameworks that examine political decision-making. This framework approaches these decisions from four key tenets: uncertainty, prediction, social context, and moral dilemmas. Each tenet comprises a chapter. Each chapter examines a tenet's philosophy, relevant neuroscience, and political application and relevance. Finally, supplemented by recent research in neuroscience, this thesis outlines an effective strategy to examine these decisions and demonstrates improvements that institutions can make to prevent bad decisions and remain resilient against their potential consequences. In all, this thesis proves the utility of the suggested framework for analyzing the decisions of political leaders, while also providing proof that institutions need to remain robust to the dangers of increasing levels of power afforded to leaders.

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Standing on the Shoulders of Giants

In a thesis on war, I want to begin with a man who preached the exact opposite. Throughout his storied time as a civil rights leader, Reverend Dr. Martin Luther King Jr. was perhaps one of the most committed disciples to the notion of nonviolence. For his and other activists' efforts, the United States slowly began the process of terminating legalized forms of racial segregation, providing a more viable pathway for the members of all races to have an equal chance of opportunity in participating in the American Dream.

For his efforts as a civil rights icon and community leader, the Nobel Peace Prize committee awarded Dr. King with the prize in 1964. Then the youngest man to ever win the award, in his acceptance speech, Dr. King noted his commitment to peace and nonviolence:

> I refuse to accept the cynical notion that nation after nation must spiral down a militaristic stairway into the hell of thermonuclear destruction. I believe that unarmed truth and unconditional love will have the final word in reality. This is why right temporarily defeated is stronger than evil triumphant. I believe that even amid today's mortar bursts and whining bullets, there is still hope for a brighter tomorrow.[1]

Without ever taking on public office, Dr. King became a key figure in American political life. The movement he helped organized created bipartisan political action that established some of the most consequential policy in U.S. history. But Dr. King was more than a figurehead for the civil rights movement. After his assassination, Dr. King's absence was deeply felt across the globe.

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[1] "The Nobel Peace Prize 1964," NobelPrize.org, accessed March 15, 2023, https://www.nobelprize.org/prizes/peace/1964/king/acceptance-speech/.

Such an absence is evidence of Dr. King's de facto power, and is an indication of how power, accumulated in the hands of the right person, can be a force for vast progress.

Dr. King's words, wisdom, and actions laid the groundwork for a new American conscious, one that is more tolerant, welcoming, and hopeful. Dr. King's legacy has inspired individuals across the globe, and his work in breaking barriers set the stage for a racial awakening in America. His actions almost directly inspired "the hope of a skinny kid with a funny name who believes America has a place for him too."[2] Nearly half a century later, another Black man from America, an activist, community organizer, and astute politician—a direct consequence of the hope and peace Dr. King preached—ascended to the highest office in the country and received the Nobel Peace Prize.

On January 20th 2009, Barack Hussein Obama became the 44th President of the United States. Obama was ushered into office on a message of hope and change—a message not unlike that embodied by Dr. King's work. The message Obama crafted throughout his campaign and early-on during his first term in office was so powerful and moving that the Nobel Peace Prize committee awarded him the Nobel Peace Prize at the end of 2009. Yet, tasked with solving a wide variety of extremely complex issues, the message of hope and change often took a backseat to practicality and realism. Among the problems the Obama administration inherited were a rapidly growing financial crisis and two intensive wars. But to address such issues, there is no better source of agency and power than that of the U.S. Presidency. Arguably the most powerful person on the planet, the U.S. President has the potential to launch thousands of

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[2] *C-SPAN: Barack Obama Speech at 2004 DNC Convention*, 2008, https://www.youtube.com/watch?v=eWynt87PaJ0.

nuclear weapons at the press of a button, the opportunity to pursue policy instantly impacting millions of Americans, and the possibility to take on virtually any initiative. In short, the U.S. President is powerful. But so too are political leaders across the globe. Their nation's duties require them to be so. But, there is a danger in granting this much power to a single individual. Such danger is best exemplified by the dark history of the world's tyrants and authoritarians. Importantly, each leaders' tenure is unique and based solely on those holding office. Therefore, because we afford leaders so much power, it is vital that we examine them in a more intensive and individual format.

The crux of political leaders' duties and responsibilities is decision-making. Ideally, on behalf of the people they represent, leaders make decisions in the best interest of their constituents. Yet the problems these leaders face often have no clear answer. Moreover, the idiosyncratic differences in decision-making, because of the power afforded to leaders, have the possibility of real-world consequences. For this reason, decisions, and how leaders understand and attempt to resolve them, must be further understood.

The nascent field of behavioral economics and the jointly associated neuro-economics (a field, as its name aptly suggests, incorporating both neuroscience and economics) has brought forth incredible insights into human decision-making. Essentially, this academic area has imposed "doubt on human rationality" and "shakes the foundations of economics, the social sciences, and rational models of cognition."[3] The work conducted in this field provides a solid

[3] Johan E. Korteling, Anne-Marie Brouwer, and Alexander Toet, "A Neural Network Framework for Cognitive Bias," *Frontiers in Psychology* 9 (2018), https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01561.

foundation for understanding leaders' choices in a manner that relies upon the consilience of neuroscience, psychology, and public policy.

This thesis will focus on utilizing a foundation of decision analysis, grounded in neuroscience, psychology, and public policy, to better understand the decisions of political leaders. Moreover, this thesis will provide a framework for analyzing leaders' decisions, and, importantly, address the need for designing institutions to reduce the possibility of bad decisions and their associated dangers.

To accomplish this, this thesis will focus on a decision made during the Obama administration—Obama's decision to send more troops into Afghanistan in last 2009, a choice, ironically, made in the weeks after the president won the Nobel Peace Prize. The decision, made almost because of the president's intensive review on the matter. Spread across three months and consisting of nine intense meetings, the President, leaders from across the chain of command in the U.S. military, top administration officials, and national security officials conducted an extremely in-depth review of the United States' strategy in Afghanistan and its neighbor Pakistan. Throughout the course of this thesis, we will rely on this decision as a case study to explore how the president made his decision and address the possibility where there may have been missteps.

This thesis has four chapters, each examining a different essential component of decision-making. The first chapter discusses uncertainty. More specifically, in this chapter we will ground cognition in the history of evolution, define and characterize the types of uncertainty, highlight how it is embodied in the brain's neural architecture, and address how it may have played a role in Obama's decision to extend the war in Afghanistan. This

understanding of uncertainty will be heavily relied upon in the second chapter of this thesis, which focuses on prediction. This chapter begins with a conversation about causality, temporality, and complexity (three key components of prediction). The chapter then turns to the neuroscience of prediction and examines how the brain crafts predictions. Finally, the second chapter concludes with an examination of Obama's predictive processes. The third chapter is focused on social context and how the influence of others impacts one's decisions. This chapter is composed of sections that characterize Obama's social situation while in the White House while also examining the psychological impacts of social relationships in the context of Obama's decision on Afghanistan. The fourth chapter is all about moral dilemmas. In this chapter, we examine various moral theories, the neuroscience behind selecting between moral theories, and how that selection may have played a role in influencing the president's choices. Finally, we conclude with a brief overview of the importance in designing institutions to be more robust in preventing bad decisions and mitigating their consequences.

Chapter One: Uncertainty

Bob the Turkey, a U.S. President, and David Hume walk into a Thesis

In today's political landscape, perhaps the most celebrated and least partisan aspect of American politics is a uniquely American tradition—the Turkey Pardon Presentation by the U.S.

President that has occurred every Thanksgiving over the past thirty years.[4] [5] During the event, the President often shares some jokes and words of wisdom, adds in a few magical hand-waving motions and suddenly the turkey is pardoned.[6] If such a tradition is confusing, or you are curious to see more, I would suggest watching this video of former President Barack Obama's final turkey pardon—a gracefully whimsical embodiment of an odd tradition.

Regardless, we can glean a few more consequential themes from this bizarrely fantastic event. First and foremost are the broad and wide-ranging powers afforded to the Office of the U.S. President. With a small gesture, a single signature, or a major decision, an American president can pardon a turkey, pass a law, or start a war. To have such immense capability granted to a single individual is a testament to the faith we have in one another, and in our institutions. It is also a characteristic that can confer incredible danger to us all. Therefore, such power—and its wide-ranging implications—necessitates an analysis of those in power on a much more individual level. To accomplish such a task, we need a new framework of analysis (and I mean "we" as in the citizens who hold leaders accountable by their votes, voices, and actions). Such a framework will emerge throughout the course of this thesis.

The second theme is a deeply philosophical concept, one that has challenged philosophers and turkeys alike for years. This concept is formally titled the Problem of Induction, although, given the difficult nature of the question, I prefer the much friendlier term

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[4] "Pardoning the Thanksgiving Turkey - White House Historical Association," The White House Historical Association, accessed December 10, 2022, https://www.whitehousehistory.org/pardoning-the-thanksgiving-turkey.

[5] The history of the annual Turkey Pardon Presentation is weirdly complex, oddly disputed, and frankly irrelevant to the scope of this project. That said it is an interesting reading about the chaotic nature of American traditions.

[6] Amanda Stone, "President Obama's Final Turkey Pardon," whitehouse.gov, November 23, 2016, https://obamawhitehouse.archives.gov/blog/2016/11/22/president-obama-final-turkey-pardon.

"The Turkey Problem."[7] Originally formulated by the philosopher David Hume in his magnum opus *A Treatise of Human Nature*,[8] the Problem of Induction questions the nature of "how to explain why we form any conclusions that go beyond the past instances of which we had experience."[9] As I said earlier, it is a complicated question. It is so challenging that philosophers do not have a conclusive answer, and some think it to be insoluble. As poetic as Hume's reasoning might be, I believe his question is most easily understood when described from the perspective of a turkey named Bob.

For the past 364 days, Bob the Turkey's days have been the same. He and his flock-mates wake up, graze, eat three square meals of turkey feed, socialize, and finally doze off to sleep, only to repeat it again the next day. It is a simple existence, and Bob likes it that way. Day 365 starts off no different, Bob wakes up at sunrise due to the caw-cawing of the local rooster. He and his flock graze out on the pasture, until, suddenly, a strange noise begins. It is faint whirring that gets louder as he and his gaggle come near the silvery barn. Dogs and humans herd them inside where they are all placed onto a conveyer belt. Little does Bob know that today is Thanksgiving. I think we all know what happens next.

For the entirety of his life, Bob's daily existence consisted of the same routines. Under the not unreasonable assumption that the 365th day would be like all the rest, he had no reason to believe that his last day would be any different. In fact, it is important to note that on his last day, when he was at his highest risk of being killed, Bob also had the highest level of certainty in

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[7] Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, 1st Edition (Random House, 2007).
[8] David Hume, *A Treatise of Human Nature* (Oxford: Clarendon Press, 1739).
[9] Leah Henderson, "The Problem of Induction," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta and Uri Nodelman, Winter 2022 (Metaphysics Research Lab, Stanford University, 2022), https://plato.stanford.edu/archives/win2022/entries/induction-problem/.

his safety (as dictated by his past experiences). Such a paradox is curiously characteristic of Hume's Problem of Induction.

While I cannot offer an answer, I can certainly share an insight: this problem tells us that it is difficult—nay, impossible—to be certain of an event. While you likely did not need this long story for me to tell you that we cannot tell the future, the presence of uncertainty is an important consideration we need to conceptualize to understand human nature. More specifically within the scope of this thesis, looking at how we engage with uncertainty is an essential foundation needed to examine decisions.

In this chapter, I discuss the evolutionary history of uncertainty, define and characterize the types of uncertainty, highlight the psychology behind uncertainty, describe the neural correlates when humans engage with uncertainty, and finally offer a bridge between neuroscience and behavior to examine how uncertainty alters our decision-making. Given uncertainty's undeniably ubiquitous presence, it is vital that we consider it as the first of four cornerstones that will ultimately make up our analytical framework. More tangibly, because of the power we afford to political leaders, the variation in how leaders deal with the existence of uncertainty have profound consequences. To successfully develop this framework, this chapter will first highlight both the necessity and value in including uncertainty. This will be accomplished by demonstrating that humans understand and conceptualize uncertainty through evolutionarily conserved mechanisms. From there, we will discuss what exactly uncertainty is, its various forms, and how it manifests itself in neural circuitry. Next, we will explore how the interface between uncertainty and neural circuitry enables the emergence of unique behavior–especially with uncertainty-related biases. Finally, we will discuss former

president Barack Obama's experience in dealing with uncertainty throughout the 2009 Af-Pak strategy review.

Relying on Theory

Humans have long been captivated and mystified by the chaotic order that seems to characterize the universe. The uncertainty of our reality has often translated into feelings of awe, curiosity, and fear. To engage these feelings, humans have long attempted to explain this experiential chaos in hopes they can placate their emotions, particularly fear, to a level in which it becomes useful. Throughout the years, countless theories, beliefs, and hypotheses have been developed in hopes they can provide some solace and a sense of understanding. Sometimes these structures last for a longtime, others are quite short lived. In essence, awash in a universe of chaos, humanity uses knowledge structures to organize and better understand reality. The first part of this chapter relies on some of our most fundamental structures, like the theory of evolution, to highlight how understanding uncertainty is quite literally ingrained in our DNA.

The Theory of Evolution

For the past two centuries, the theory of evolution has managed to withstand countless challenges presented to it by the scientific method. This is especially important given the theory's wide-ranging implications on our understanding of natural history. Charles Darwin, the Englishman often attributed with first presenting a fully fleshed out ultimate explication of animal and human behavior, shared this theory with the intention of explaining the relationship between past, present, and future of all living organisms. In the theory of evolution, he shared how humanity's presence could be explained not by divine providence, but the consilience of

mathematics, biology, and various other scholarly disciplines that explain how humans evolved. In essence, the theory of evolution describes how organisms, and their unique characteristics, emerge because of a process called natural selection. Natural selection is the survival pressure imposed by ecosystems onto individual organisms. Those that survive propagate their genes. Those that do not…well, their specific genetic lineage ends with them.

If we are to accept the lessons Darwin attempted to instill into future generations, we must also understand the limitations such a theory imposes. By establishing a structure to understand the history of life, Darwin simultaneously created boundaries and rules that govern human behavior and our understanding of that behavior. Most important evolution is not a path that has been created, but rather a journey that can only be examined after it has occurred. Therefore, there is no concept of progression in the light of evolution. Such a maxim explains a variety of ideas. First and foremost, there is no hierarchy of organisms. A bacterium is just as "evolutionarily advanced" as a frog which is on the same level as a human. Eliminating such a hierarchy underscores the notion that humans evolved, just as every other organism on Earth. Moreover, deconstructing such a hierarchy simultaneously enables the notion that humans did not evolve to become capable of constructing civilizations—rather their genes, behaviors, and foundational biology were co-opted in creating human civilization. In fact, this line of logic easily lends itself to the argument that civilization is simply an emergent property of the complex systems described in the theory of evolution. All this is to say that the theory of evolution serves as a resilient and robust foundation off which we can examine the human brain and behavior. But, as mentioned time and time again, to conduct such an analysis, we must first recognize and observe the limitations imposed by the theory of evolution. To

summarize the past few paragraphs, these limitations denote that evolution is a process of biology not divine providence and that processes like natural selection serve as the mechanism through which traits ultimately emerge across populations. Steeped with this groundwork, we can begin to construct an analysis of uncertainty in decision-making—first by understanding the environment humans arose from.

From the Inuit communities in the Arctic to the nomadic communities in Southern Africa to the first documented cities in the Middle East, modern humans have showcased a broad tolerance for adaptation to a wide variety of habitats and environments. While the species has been globally dispersed for thousands of years, the modern human first evolved in the African Savannah—an ecosystem of intense beauty that exhibits the awe and variability of nature. It is thought that these ancient modern humans roamed the plains as part of small groups of hunters and gatherers, coordinating and collaborating to live and thrive alongside each other.[10] This environment is where the drama of evolution played out over eons, with the environment shaping humans to fill ecological niches. Such an idea, called natural selection, is essential to Darwin's theory of evolution. As mentioned earlier, natural selection is the pressure that the ecosystem places on individuals to survive. Importantly, this selection pressure works "not only on anatomy and physiology but on behavior as well."[11] An organism's ability to survive and produce offspring is called its fitness. Over time, the individuals and their descendants that have a sufficient level of fitness reproduce and populate these dynamic environments. It is

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[10] "Introduction to Human Evolution," The Smithsonian Institution's Human Origins Program, accessed March 17, 2023, http://humanorigins.si.edu/education/introduction-human-evolution.
[11] *Behave* by Robert Sapolsky (pg. 331)

challenging to accurately describe the precise environment humans faced during that time, but disciplines like archaeology, anthropology, and evolutionary biology can tell us more. While understanding the limitations that examining the past imposes on these analyses, we can utilize various theories developed by scholars across fields to construct a more concrete idea of how humans evolved. Importantly, it is vital to remember that this reconstruction of the past will be conducted throughout this thesis. Evolution is our guiding light, and the development of human decision-making is only understood in the light of evolution.

The Three Complementary Hypotheses about Human Cognition

To understand human cognition, we can look to various theories about how the human brain evolved, especially as it relates to the ecosystem from which such changes emerged. Although, it is important to note that these three hypotheses are simply hypotheses. They are far from a holistic and complete answer that accurately describes the selective pressures humans encountered throughout their evolutionary history. To that end, these three hypotheses can provide a comprehensive picture, with the occasional contrasting viewpoint, that helps to paint a picture of human evolution. These hypotheses are the social brain hypothesis, expensive tissue hypothesis, and the critical brain hypothesis. Each one focuses on a different explanation on how the human brain evolved by addressing characteristics, like encephalization, that are important for improved cognitive capacity.[12] Notably, these

[12] Javier DeFelipe, "The Evolution of the Brain, the Human Nature of Cortical Circuits, and Intellectual Creativity," *Frontiers in Neuroanatomy* 5 (2011), https://www.frontiersin.org/articles/10.3389/fnana.2011.00029.

hypotheses are not mutually exclusive; they each provide different avenues of understanding the same underlying phenomenon. Most importantly, they provide valuable insights that serve to help explain how humans conceptualize uncertainty.

The Social Brain Hypothesis

First introduced by Robin Dunbar in 2009,[13] the social brain hypothesis examines the mysterious evolutionary emergence of the human brain from a social perspective. Dr. Dunbar, a British anthropologist who serves as a professor of evolutionary psychology at the University of Oxford,[14] put forth the hypothesis as a potential mechanism that linked social group size with larger relative brain sizes. More specifically, the hypothesis was "borne out of evidence that a number of indices of behavioral complexity also correlate with relative brain size in primates."[15] Beyond those observations, the elegance of the hypothesis "lies in the subtleties of behavior,"[16] and how those same subtleties serve as evidence of the central role the brain plays in human sociality. Specifically, Dunbar's argument centralizes around the point that social behavior, particularly focusing on group size, is "an emergent property of animals' ability to manage their social relationships."[17] Supplemental evidence suggests that development (and the associated increase in relative brain size) is associated with increased socialization, especially amongst primates.[18] More broadly, such a theory implicates the role of social experience in the lives of

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[13] R.I.M. Dunbar, "The Social Brain Hypothesis and Its Implications for Social Evolution," *Annals of Human Biology* 36, no. 5 (January 1, 2009): 562–72, https://doi.org/10.1080/03014460902960289.
[14] "Robin Dunbar," accessed December 10, 2022, https://www.psy.ox.ac.uk/people/robin-dunbar.
[15] R. I. M. Dunbar, "Social Brain: Evolution," in *Encyclopedia of Neuroscience*, ed. Larry R. Squire (Oxford: Academic Press, 2009), 21–26, https://doi.org/10.1016/B978-008045046-9.00957-8.
[16] Dunbar.
[17] Dunbar.
[18] Christine J. Charvet and Barbara L. Finlay, "Chapter 4 - Embracing Covariation in Brain Evolution: Large Brains, Extended Development, and Flexible Primate Social Systems," in *Progress in Brain Research*, ed. Michel A. Hofman

humans. This hypothesis therefore focuses on the role of sociality, social context, and socialization as playing a major role in introducing a relatively heavy selective pressure onto relative brain size.[19] Subsequently, many of the brain's capabilities should be evolutionarily examined with a consideration towards their impacts on interpersonal interactions. If socialization played such a large role in defining our evolution, it only makes sense that many fundamentally human characteristics,[20] like language, empathy, and consciousness, may be co-opted by systems that were selected for their favorability in improving one's sociality. If we are to accept this hypothesis, and use it as a means for analysis, we must ensure that we fully consider the role that sociality played in that evolution–especially as it relates to behavior dealing with uncertainty arising from social behavior.

Importantly, for the scope of this thesis, this hypothesis is particularly pertinent for analyzing the decisions of a U.S. President. If socialization and being able to develop community with others is an essential function of human life (as dictated by evolution), then we must consider the inherently anti-social lifestyle of a politician. As Obama frequently noted, he and the former First Lady "found the sudden loss of anonymity disconcerting" for their family.[21] Beyond that, the President often hinted at the paradox between how the White House granted him incredible capabilities while taking away the simplest freedoms. Such a loss of natural

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and Dean Falk, vol. 195, Evolution of the Primate Brain (Elsevier, 2012), 71–87, https://doi.org/10.1016/B978-0-444-53860-4.00004-0.

[19] It is important to delineate between sociality and socialization. Sociality will discuss the degree to which an individual in a population interacts with others, while socialization will refer to social experience more broadly.

[20] Human characteristics in the sense that they are fundamental to human experience. This does not mean that these characteristics are exclusive to humans.

[21] Barack Obama, *A Promised Land* (Random House, 2020, 58).

socialization may have wide-ranging consequences, which is why this is a topic we will deeply delve into in the third chapter.

The Expensive Tissue Hypothesis

The expensive tissue hypothesis was first proposed in 1995 by Leslie Aiello and Peter Wheeler. This hypothesis suggests that the evolutionary expansion of the brain (a trend called encephalization; generally in the regions that are often associated with more complex thinking and planning—also known as cortical regions), is correlated with reductions in gut sizes to compensate for the increased energy demands that an energetically "expensive tissue" creates.[22] To account for this slow reduction in the size of the digestive system, the hypothesis proposes that the diets of early humans needed to slowly shift to incorporate foods with higher caloric values, generally by introducing increasing amounts of animal products. That said, it is difficult to assess how these two trends emerged, and whether one instigated the other, although they likely shifted together over long periods of time. Importantly, these correlations were almost certainly associated with an increased amount of animal products in early humans' diets because there were the only types of food with a high enough energy content to satisfy the energy needs of ancient humans. This means that these early humans needed to begin to develop behaviors akin to hunting, a necessary foundation to the "hunting and gathering" behavior that would later become characteristic of humans at this time.[23] Beyond the developmental considerations, this hypothesis highlights the intensive amount of energy that

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[22] Leslie C. Aiello and Peter Wheeler, "The Expensive-Tissue Hypothesis: The Brain and the Digestive System in Human and Primate Evolution," *Current Anthropology* 36, no. 2 (1995): 199–221.
[23] Aiello and Wheeler.

the brain uses in order to function. This demand also implies that the brain only has access to a finite amount of energy within the body. As we will discuss later, the brain's modularity enables it to optimize its performance, but, importantly, optimization does not mean maximization. This is an important concept for examining how the brain deals with uncertainty. Because the human brain has energy limits, natural selection favors characteristics that resemble effective strategies (like biases and heuristics) for optimizing the brain's energy use. Therefore, expensive tissue hypothesis is evidence of the energy constraints imposed onto the human nervous system, as well as their consequences.

To summarize, the expensive tissue hypothesis states that humans started eating animal products (which are more calorically dense foods) to accommodate increases in brain volume. This expanded size, and presumed increase in cognitive capacity, was likely utilized to help humans become better hunters. More importantly, this hypothesis lays down two vital ideas for this chapter. The first is the notion that selection pressures selected for bigger brains which were useful in hunting. The second is that the brain is constrained by energy, and natural selection favors individuals that can optimize that energy use. The latter of these two themes have massive implications on how the brain engages with uncertainty.

The Critical Brain Hypothesis

The last of the three essential hypotheses is the critical brain hypothesis. This is a theory discussing neural networks, which are collections of neurons that interact directly or indirectly with one another to create synergistic effects (the brain can be viewed as one large neural network encompassing many smaller neural networks). The critical brain hypothesis suggests that the brain's neural networks are organized in a fashion that favors criticality. Simplistically,

criticality means that a single neuron can affect less than one neuron (creating a dampened effect), more than one neuron (creating an amplified effect), or exactly one neuron (the critical point).[24] This means that a neural network which favors criticality can creating cascading avalanches of circuit activation or, alternatively, dampen stimuli into a trickle of neuronal activity. Importantly, criticality enables global activity in the brain. Such widespread stimulation is believed to enable consciousness, language, critical thinking, and, particularly relevant for this thesis, abstract decision-making. Importantly, this feature is not exclusive to humans, which means that this feature developed through convergent evolution (evolution that occurred independently but arrived at similar features—like the development of flight in birds and bats), or through a common ancestor. Additionally, the latter of these two options would suggest that the mechanism is so important that it has been conserved for millions of years. Regardless, criticality is an essential characteristic of the human brain, one that enables many of the features that we will analyze throughout the course of this thesis.

In all, these three hypotheses exhibit a variety of selective pressures that have impacted the evolutionary history of humans. Importantly, these hypotheses serve to provide insight into various processes within the human brain. Throughout various points in this thesis, we will rely on the collected insights from the theory of evolution and these hypotheses. In doing so, we will come to a much clearer explication of how the brain interacts and engages with its surroundings, especially when dealing with uncertainty.

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[24] John M. Beggs, "Addressing Skepticism of the Critical Brain Hypothesis," *Frontiers in Computational Neuroscience* 16 (2022), https://www.frontiersin.org/articles/10.3389/fncom.2022.703865.

What is Uncertainty?

The war in Afghanistan and, more explicitly, the war in Iraq were largely started out of concern for the consequences of being unable to mitigate the possibility of the uncertain. A line, famously quipped by the Secretary of Defense Donald Rumsfeld in 2002, highlights how uncertainty played a central role in the decision to invade Iraq. The quote, which came in response to whether the Iraqi dictator Saddam Hussein had nuclear weapons and was supplying them to terrorists, is as follows:[25]

> "As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know."

While Secretary Rumsfeld was mocked for his answer, it accurately and adequately provides a basis for examining uncertainty, while also highlighting how uncertainty effects human decision-making. That said, while uncertainty may be well conceptualized by most humans, bringing about an effective definition of it remains quite challenging. The Cambridge English Dictionary describes uncertainty as "a situation in which something is not known, or something that is not known or certain."[26] Yet, such a definition fails to sufficiently describe a

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[25] David A. Graham, "Rumsfeld's Knowns and Unknowns: The Intellectual History of a Quip," The Atlantic, March 27, 2014, https://www.theatlantic.com/politics/archive/2014/03/rumsfelds-knowns-and-unknowns-the-intellectual-history-of-a-quip/359719/.

[26] "Uncertainty," accessed December 10, 2022, https://dictionary.cambridge.org/us/dictionary/english/uncertainty.

mental state of uncertainty beyond it being "not known or certain."[27] Therefore, while the dictionary can describe uncertainty from an objective point of view, we need a supplemental definition to describe it from a psychological perspective, i.e., to feel uncertain in one's own mind.

To that end, Anderson, et. al, have constructed a viable definition of uncertainty that relies on its utility as a type of "meta-cognition." [28] In the paper, "The Relationship Between Uncertainty and Affect," Anderson et. al explain the relationship between uncertainty and affect. [29] The authors summarize the latest findings that communicate the connection between these two areas, and they put forth a unique definition and explication of uncertainty. The authors begin by describing uncertainty as a "subjective, cognitive experience of human beings," implying that it is not a "feature of the object, material world."[30] The authors further elaborate that uncertainty is a type of "meta-ignorance," or "the conscious awareness, or subjective experience of ignorance."[31] A key characteristic of this definition of uncertainty is the aspect of conscious awareness. Importantly, as the authors note, there are perceptual uncertainties that exist below the level of conscious awareness, phenomena that are dealt with via unconscious processes. To describe uncertainty as a conscious experience effectively captures that uncertainty is not a feature of reality, but rather an emergent property in how humans perceive the world. Subsequently, because conscious awareness is a key condition to

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[27] "Uncertainty."
[28] Eric C. Anderson et al., "The Relationship Between Uncertainty and Affect," *Frontiers in Psychology* 10 (2019), https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02504.
[29] Anderson et al.
[30] Anderson et al.
[31] Anderson et al.

uncertainty, the authors go on to describe three sources of uncertainty: probability, ambiguity, and complexity. Uncertainty arising from probability is attributed to "the randomness or indeterminacy of the future."[32] Secondly, uncertainty due to ambiguity "arises from limitations in the reliability, credibility, or adequacy of…risk…information."[33] Finally, uncertainty arising from complexity is attributed to the notion that certain systems and scenarios may be difficult to fully encapsulate, subsequently impacting uncertainty. These three sources contribute to the overall experience of being uncertain and can coexist with one another to affect one's level of uncertainty.

Clearly, uncertainty is a very complex concept. It can both be an objective experience and psychological one. For that reason, it is necessary to craft a characterization that enables the assessment in both its objective value of uncertainty and its perceived value of uncertainty.

Foundational Pieces for Characterizing Uncertainty

Before we begin with my characterization of uncertainty, a bit of background on describing the various epistemological values of uncertainty is in order. Much of literature on uncertainty creates a distinction between three groups of uncertainty: known, unknown, and unknowable. In a seminal paper, entitled "Known, Unknown, and Unknowable Uncertainties," researchers Drs. Rakesh Sarin (UCLA) and Clare Chua Chow (University of Toronto) elaborate on the difference between the three areas of uncertainty, and how each type of uncertainty has a unique impact on human decision-making. This paper is grounded in normative decision theory,

[32] Anderson et al.
[33] Anderson et al.

which is an area of study that concerns itself with how an agent should act when facing a decision, and relies on key theorists like John Maynard Keynes, Frank Knight, Bruno de Finetti, and Daniel Ellsburg. Importantly, one area of normative decision theory focuses on expected utility, with agents (the people making decisions) being expected to maximize utility in the decisions they make. This concept is best explained in the setting of a game show. A contestant, who in this case is the agent, is presented with two doors. Door A is a guaranteed award of $40,000, while behind Door B there is a 10% probability of being $500,000. Normative decision theory tells us the contestant should select Door B, given that the expected reward is $50,000.

While certain parts of normative decision theory provide the foundation for examining decisions, Sarin and Chua Chow note how the theory fails to fully explicate the role uncertainty plays in decisions. The authors highlight that "uncertainty about probabilities (ambiguity or vagueness) can affect peoples' decision-making behavior."[34] Sarin and Chua Chow go further to highlight research that shows individuals will avoid ambiguous decisions, suggesting that it plays a clear role in individuals' choices—with later research highlighting how agents are willing to incur a cost to avoid uncertainty.[35] Importantly, these findings stand in direct contrast to normative decision theory, which argues that "the attractiveness of a bet (overall value function) depends only on the probabilities of events and the utilities associated with payoffs."[36] This is the foundation to Sarin and Chua Chow's research experiments.

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[34] Clare Chua Chow and Rakesh K Sarin, "Known, Unknown, and Unknowable Uncertainties," n.d., 18.
[35] Daniel Kahneman, *Thinking, Fast and Slow*, 1st edition. (New York: Farrar, Straus and Giroux, 2011, 317).
[36] Chow and Sarin, "Known, Unknown, and Unknowable Uncertainties."

To assess the impacts of different types of uncertainty on decision-making, Sarin and Chua Chow distinguish between three areas of uncertainty, each with varying levels of ambiguity. First, the authors describe known uncertainty, which is an uncertainty where the agent knows about the probabilities associated with a choice (like the probabilities associated with flipping a coin). The second type of uncertainty is unknown uncertainty. Here the authors described this type of uncertainty as one where an experimenter may have information about the probabilities, but the agent does not, placing them into an information deficit in comparison with the experimenter. The final type of uncertainty the authors list is unknowable uncertainty. The authors describe unknowable uncertainty as a type of uncertainty where both the agent and experimenter do not have access to information that will inform them of the probabilities associated with a choice. This final type of uncertainty means that the agent is not subjected to an information deficit (in comparison to the experimenter).

In the experiments that Sarin and Chua Chow conducted, it was found that bets with known probabilities received the highest willingness from participants, followed by the unknowable and unknown bets, respectively. Such results suggest that people prefer to make decisions with unknowable probabilities than unknown probabilities, a finding that is consistent with the expected result per the Comparative Ignorance Hypothesis. This hypothesis, first proposed by Amos Tversky and Craig Fox in 1995,[37] proposes that "comparative ignorance effects are weaker in situations for which counterfactual states of knowledge (probabilities) are

[37] Craig R. Fox and Amos Tversky, "Ambiguity Aversion and Comparative Ignorance," *The Quarterly Journal of Economics* 110, no. 3 (1995): 585–603, https://doi.org/10.2307/2946693.

less available."[38] This means that agents are more tolerant of uncertainty if they know others are unaware of the probabilities as well. Such a hypothesis has profound impacts, some of which we will address later in this chapter.

Nonetheless, Sarin and Chua Chow's research provides an organized and important distinction between the various types of uncertainty—known, unknown, and unknowable. This categorization of the types of uncertainty is unique, and I relied upon it in crafting my own understanding of uncertainty.

Comprehensively Characterizing Uncertainty

Sarin and Chua Chow's paper, along with the adjacent research, highlight the complexity associated with uncertainty. Such complexity necessitates a more comprehensive characterization of uncertainty. To that end, **Figure 1** distinguishes uncertainty into four distinct categories: known knowable uncertainty, unknown knowable uncertainty, known unknowable uncertainty, and unknown unknowable uncertainty. These categories are essential in differentiating the various types of uncertainty, namely because they impact decision-making in unique ways.

To further elaborate on the types of uncertainty, known knowable uncertainty specifically relates to the type of uncertainty that occurs because of a known variable producing a result which exhibits some degree of uncertainty or imprecision. For example, known knowable uncertainty is exemplified through the use of significant figures in physical

[38] Chow and Sarin, "Known, Unknown, and Unknowable Uncertainties."

measurements. Importantly, this type of uncertainty can be reduced given more precise measurements. Moreover, as it relates to Obama in his 2009 Afghanistan decision, this type of uncertainty manifests itself in the indeterminacy of various actors. In this instance, Obama was enabled and limited by the existing uncertainty assessments in the material presented to him. Known knowable uncertainty plays a big role in the decision-making process of a president.

The next type of uncertainty that affects one's capability to choose is unknown knowable uncertainty. Unknown knowable uncertainty is like being asked to determine how red toys are in a toy room you just walked into. You may not know yet, but it is possible—given time and an ability to count. Unknown knowable uncertainty is similar to evolution or gravity, albeit on a much smaller and more simplistic scale. Prior to Darwin's or Newton's writings, the phenomena of evolution and gravity were misunderstood and complex, but given time and capability, they could be distilled into overarching theories or information, each with well-defined areas of uncertainty. More broadly, this type of uncertainty is best described by phenomena that affect outcomes, but agents are unaware of how its inputs are organized and interact with one another. This leads to a type of uncertainty that can be further understood given further investigation into the available information. Importantly, this type of uncertainty distinguishes itself from known knowable uncertainty by being the epistemological precursor to known knowable uncertainty. As it relates to Obama and his decision in 2009, this type of uncertainty is best characterized by the level of uncertainty in predictive models that remained as Obama and his team argued their various perspectives.

These types of uncertainty stand in stark contrast to the remaining two—known unknowable uncertainty and unknown unknowable uncertainty. These types of uncertainty can

be characterized by phenomenon like Heisenberg's uncertainty principle and the existence of a multiverse, respectively. To expand further, known unknowable uncertainty is akin to Heisenberg's uncertainty principle because it describes a phenomenon whose uncertainty cannot be known, but its existence can be known. Alternatively, unknown unknowable uncertainty is seen as a type of uncertainty that cannot be understood, nor do we know about its existence, much like the potential presence of a multiverse. We can speculate about its presence, but, in the end, phenomena like the multiverse is a concept that can never be known (as far as we can tell). To that end, unknown unknowable uncertainty is the type of uncertainty derived from events we do not know about nor can we discern their level of uncertainty. Both types of uncertainty play a role in establishing the boundaries in how humans perceive the world. Subsequently, this creates an indirect impact on human decision-making. Therefore, these types of uncertainty need to be considered when crafting a framework that examines how uncertainty impacts the brain.

These four types of uncertainty are organized in **Figure 1**. Distinguishing between the various types of uncertainty help delineate between the objective experience of uncertainty and the psychological experience of feeling uncertain. While these are the types of uncertainty we will incorporate in leaders' analysis, we cannot fail to note there is an additional lever of uncertainty that should be captured. Within the brain, uncertainty manifests itself in the brain in two different forms. The first is the type of uncertainty that exists in external situations, a type of information that is later embodied and integrated into the brain's processing functions. The second is the type of uncertainty that emerges because of the signal mechanism. This latter form of uncertainty exists as noise, disguising the true signal that neurons are designed to

communicate. In biological terms, this second type of uncertainty manifests itself as the threshold for action potential. Neurons largely exist in an on or off state, and the action potential is the change in voltage that a neuron's dendrites. For the sake and scope of this paper, we will largely focus on the former type of uncertainty, examining how the brain assesses, integrates, and utilizes uncertainty present in the external world.

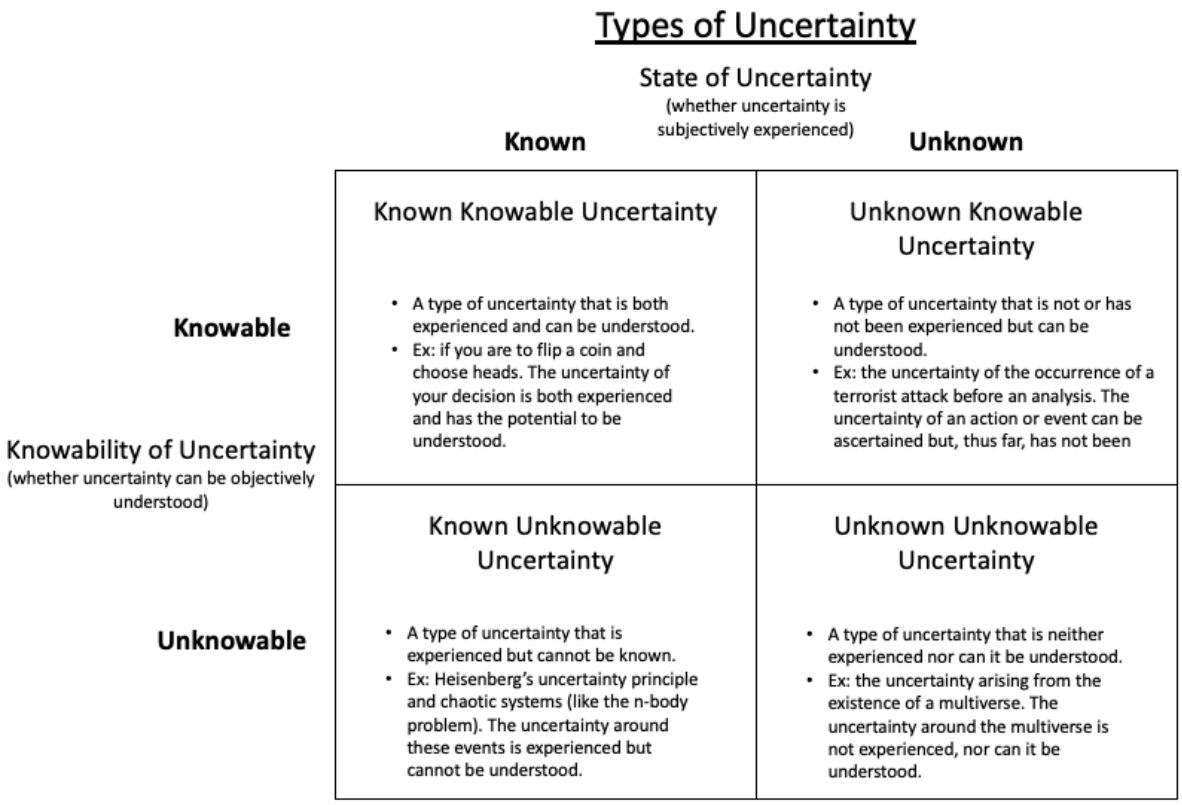

Figure 1*: This is a visualization of the four types of uncertainty. On the left axis is a delineation between the objective state of uncertainty—it possible to be known, while the top axis is a description of whether the uncertainty is felt, understood, or known to the decision agent. Along with each type of uncertainty comes a brief example of a manifestation of that uncertainty.*

An Examination of the Neurophysiology of Uncertainty

In crafting a broad definition of uncertainty, while also further understanding its various sources, we can finally construct a more comprehensive and interdisciplinary understanding of

how uncertainty manifests itself within the brain. Before we begin, it is necessary to note that the brain does not "understand uncertainty," nor is there a specific part of the brain where uncertainty is conceptualized and perceived. The brain exhibits cognitive properties because they are emergent from a complex system. This means that there is no singular network of cells assigned to conceptualize uncertainty. Such a consideration is essential to note, especially as we begin to embark on an exploration of areas implicated in perceiving, understanding, and integrating uncertainty.

Given that uncertainty is a property of a distributed network relying upon connections spread throughout the body and brain, it only makes sense to begin within the thalamus—effectively seen as "a veritable Grand Central Station."[39] One of two constituent parts of the diencephalon (with the hypothalamus being the other), the thalamus plays an essential role in facilitating connections between the cortex and the various sensory modalities (beyond olfaction). In addition to its role as a sensory relay, the thalamus is often implicated in motor activity, emotion, memory, arousal, and other sensorimotor functions.[40] The counterpart to the thalamus, the hypothalamus, serves as "the main link between the nervous system and endocrine system." [41] This means that the hypothalamus is closely associated with behavior directly and indirectly rising out of the interaction between hormones and other chemicals contained within the endocrine system. Regardless of the cognitive activities in which it is implicated, the thalamus plays a major role in integrating and transferring information to and

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[39] Michael Gazzaniga, Richard Ivry, and George Mangun, *Cognitive Neuroscience: The Biology of the Mind*, 5th Edition (W.W. Norton & Company, 2019).
[40] "Thalamus | Definition, Anatomy, Function, & Disorders | Britannica," accessed November 9th, 2022, https://www.britannica.com/science/thalamus.
[41] Gazzaniga, Ivry, and Mangun, *Cognitive Neuroscience: The Biology of the Mind*.

from disparate parts of the brain. However, it is important to note that the thalamus is hardly the only place where neuronal projections can be found. Connections are interspersed throughout the brain, subsequently creating a much more complex system. Despite those features, we will focus here on specific parts of the thalamus because of its close relationship in dealing with uncertainty—specifically the mediodorsal thalamus.

Located in the upper, most-central part of the thalamus, the mediodorsal thalamus (MDT) is implicated in the elevation of sensory information. More specifically, recent research from the Halassa Lab at the Massachusetts Institute of Technology demonstrates that the MDT has specific cells that are "especially active when animals were presented conflicting sound cues."[42] The connection between these cells and the prefrontal cortex suggest that they play a role in modulating input from conflicting auditory signals.[43] Most notably, these cells were found to produce an inhibitory effect on the initial stimulus—meaning that the MDT has the potential to alter the likelihood that a stimulus is brought into conscious awareness.

The role of the MDT indicates that this area of the brain is essentially a bridge between first-order processing (sensory inputs) to higher level (second and third orders) processing. This evidence and model of MDT is essential to better understand how the brain engages with uncertainty. Most notably, it means that there are processes occurring at pre-conscious neurological levels that select out stimuli that are not deemed to be systematically important. This translates to the fact that greater amounts of cognitive resources are devoted to stimuli

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[42] "How the Brain Deals with Uncertainty," MIT News | Massachusetts Institute of Technology, accessed December 10, 2022, https://news.mit.edu/2021/how-the-brain-deals-with-uncertainty-1014.
[43] "Project 1 | Halassa Lab," accessed December 10, 2022, https://halassalab.mit.edu/project/1/; "How the Brain Deals with Uncertainty."

that are particularly salient. Essentially, this research suggests that the MDT reduces uncertainty by limiting the amount of information that comes under cognitive control. In this way, pre-conscious processing is already working to reduce uncertainty of incoming information. More broadly speaking, such research appears to suggest that the thalamus plays an essential role in modulating this type of information, with "recent neuroanatomical and neuromodulatory studies highlight[ing] how the thalamus is providing a critical role in integrating communication between the basal ganglia, thalamus, and cortex."[44] This model stands in contrast to previous models "related to the passive role of the thalamus."[45]

Clearly, assessing uncertainty is an essential function of the brain. When the brain becomes unable to discern signal from noise, individuals develop difficulties in discerning the real from the imaginary. Such a difficulty is labeled as hypersalience, which describes a hyperactivity in sensory modalities when it comes to perceiving external stimuli. Those experiencing hypersalience often do so in the form of delusions. One syndrome that is generally characterized by such delusions is schizophrenia. An incredibly debilitating disease, schizophrenia can often leave patients with an inability to experience unencumbered reality. Schizophrenic patients often have a wide range of symptoms that can include various forms of psychosis (hallucinations, delusions, movement disorder), declines in motivation, and challenges processing new information to make decisions.[46] Notably, this hypersalience emerges in well-studied behaviors characteristic to patients with schizophrenia. These

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[44] "Frontiers | What Does the Mediodorsal Thalamus Do?," accessed December 10, 2022, https://www.frontiersin.org/articles/10.3389/fnsys.2013.00037/full.
[45] "Frontiers | What Does the Mediodorsal Thalamus Do?"
[46] "Schizophrenia," National Institute of Mental Health (NIMH), accessed January 31, 2023, https://www.nimh.nih.gov/health/topics/schizophrenia.

individuals tend to over-rely on individual pieces of evidence to inform their world views. This manifests itself in reasoning biases like "jumping to conclusions" and "over-adjustment of probability estimates following a single instance of disconfirmatory evidence."[47] The influence of outlier datapoints is indicative of hypersalience.

While it is unlikely that elected officials exhibit schizophrenic characteristics (although not impossible),[48] understanding these disorders and especially how they manifest themselves in the brain can provide insight into how the brain deals with uncertainty. Schizophrenia is a syndrome seemingly caused by various deficiencies within the complex small-world networks in the brain. More broadly, the apparently embodied existence of schizophrenia highlights a key understanding of this thesis—behaviors and abstract cognition are heavily reliant upon and, arguably, ingrained in our neural networks. Conditions like schizophrenia and other similar disorders that fail to fully translate objective uncertainty into feelings of uncertainty, highlight the need for bridging the gap between neurophysiology and behavior.

A Bridge to Behavior

So, let's build a bridge. More than anything else, the past section underscores the fact that our understanding and perception of uncertainty is ingrained in our neurological physiology. To understand the mechanism between physiology and psychology, we will rely on the psychologically-based theoretical construct of System 1 and System 2 forms of thinking.

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[47] William J. Speechley, Jennifer C. Whitman, and Todd S. Woodward, "The Contribution of Hypersalience to the 'Jumping to Conclusions' Bias Associated with Delusions in Schizophrenia," *Journal of Psychiatry and Neuroscience* 35, no. 1 (January 1, 2010): 7–17, https://doi.org/10.1503/jpn.090025.

[48] Nassir Ghaemi, *A First-Rate Madness: Uncovering the Links Between Leadership and Mental Illness* (Penguin Books, 2012), 265-266.

This type of research emerges out of a considerable amount of psychological work (notably from individuals like Daniel Kahneman, Amos Tversky, Keith Stanovich, and Richard West).[49] In this vein of psychology, the brain is comprised of two major systems of thinking. The first, System 1, is labeled as fast thinking, which is often thought of as unconscious processing. System 1 is characterized as automatic, and "continuously generates suggestions for System 2: impressions, intuitions, intentions, and feelings."[50] Alternatively, System 2, is labeled as slow thinking. It is typically construed as more computationally costly than System 1. Notably, this means that System 2 is traditionally seen as being under conscious control. Broadly speaking, System 2 is seen as "the conscious, reasoning self that has beliefs, makes choices, and decides what to think about and what to do."[51] The theory of these two systems was designed to describe most forms of cognition, and while they may interface with one another, they generally each encompass different, non-overlapping aspects of thinking. Most notably, the relationship between the two forms of thinking leads to biases and heuristics. In this thesis, we will define heuristics as "systematic simplifications and deviations from the tenets of rationality" and biases as "suboptimal decisions."[52] Importantly, System 2 is entirely reliant on the information presented to it by System 1. This means that all the processes that System 1 completes automatically matriculate into process for System 2. Psychologists have found that such heuristics have led to biases, a key aspect behind suboptimal decisions. Most importantly,

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[49] Korteling, Johan E, Anne-Marie Brouwer, and Alexander Toet. "A Neural Network Framework for Cognitive Bias." Frontiers in psychology 9 (2018): 1561–1561. Web.
[50] Kahneman, *Thinking, Fast and Slow*, 24.
[51] Kahneman, 21.
[52] Korteling, Brouwer, and Toet, "A Neural Network Framework for Cognitive Bias."

the neural network framework for cognitive bias, a theoretical concept that highlights how the brain and its emergent forms of cognition, are closely interrelated, serves as an essential bridge connecting the neural circuitry to behavior. For example, Drs. Korteling, Brouwer, and Toet, the acrhitects of the Neural Network Framework share that:[53]

> "the brain (like all neural networks) functions in a highly associative way. Correlation and coincidence detection are the basic operations of neural functioning…As a result, the brain automatically and subconsciously 'searches' for correlation, coherence, and (causal) connections: it is highly sensitive to consistent and invariant patterns."

Such associative patterns are best seen in System 1, underscoring the highly related nature between the two theoretical concepts. This form of thinking is vital, especially for dealing with uncertainty. As discussed earlier, the MDT and sensory areas associated with schizophrenic patients' degrading sense of reality, are involved in the elevation of sensory information—a key function of System 1. The close relationship between these brain areas, uncertainty, and System 1 highlights the need to examine the relationship between biases and uncertainty.

More broadly, this formulation of thinking (that neural networks beget cognitive systems like System 1 and 2) serves as an example of how neuroscience directly informs behavior (from a theoretical standpoint). Most importantly, the relation between cognitive processes and neural networks is a concept that applies to the entirety of the thesis and a key link that connects neurophysiology and behavior.

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[53] Korteling, Brouwer, and Toet.

A President's Welcome

On December 2nd, 2009, the speakers at the U.S. Military Academy in West Point, NY blared out:

Please welcome to the stage the 44th President of the United States, Barack Obama

Per longstanding tradition, the emergence of the President spurs the beginning of the song "Hail to the Chief." As the music resonates throughout the chamber, West Point cadets, dressed in their irrepressibly gray uniforms, watch as their Commander-in-Chief emerges from the side of the stage. President Obama, inaugurated less than a year earlier appears burdened from the challenges he inherited—a global financial crisis, two devastating wars, and growing existential crises in climate change and the widespread rise of authoritarianism. Nonetheless, Obama marches onstage to resolve one of the most intractable problems of the 2000s, the war in Afghanistan.[54] In his somber speech, Obama announces an increase of thirty thousand American troops operating in Afghanistan in an effort to combat the rise of the Taliban and secure a foundation that can sustain the new Afghan government. As Obama succinctly describes the aim of the new measures, the "overarching goal remains the same: to disrupt, dismantle, and defeat al-Qaeda in Afghanistan and Pakistan and to prevent its capacity to threaten America and our allies in the future."[55] Yet, coming to this conclusion was far from certain for the Obama administration. The president's choice was the culmination of a months-long strategic review that explored every facet of America's involvement in Afghanistan and

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[54] *President Obama on the Way Forward in Afghanistan and Pakistan*, 2009, https://www.youtube.com/watch?v=oZLVqhsLgIw.
[55] *President Obama on the Way Forward in Afghanistan and Pakistan*.

Pakistan. Throughout the entirety of the review process, the president and his team faced considerable uncertainties—factors that ultimately impacted the president's decision. To that end, we will discuss known knowable uncertainty (based on the characterization described earlier), how this uncertainty manifested in the Afghanistan strategy, and how the decision may have been susceptible to heuristics and, ultimately, bias because of this type of uncertainty.

Known Knowable Uncertainty—A Question of Quantity

After having already deployed an additional 21,000 troops, in both support and combat capacities, in the first three months of his presidency, the Obama administration faced considerable concerns regarding additional troop surges. These added troop deployments, coupled with an increasingly weary public sentiment for the Afghanistan war, forced President Obama to remain especially wary prior to sending more soldiers into the war. For this reason, even prior to his election, Obama tasked the generals leading the wars in Iraq and Afghanistan to ask him "for everything [they] need and more to ensure [their] success," describing "that's what [they] owe the troops who are under [their] command."[56] The president then outlines his own role: "[Obama's] job, then, which in some ways is more difficult, is [Obama has] to choose."[57] Therefore, during the Af-Pak strategy review, the generals played a central role in telling the president precisely what resources they needed to succeed in the Middle East. Thus, Obama was pitted in a struggle between providing his generals with enough support to remain successful, while also ensuring that the military does not commit mission overreach. The uncertainty regarding this decision is indicative of a known knowable uncertainty. The number

[56] Bob Woodward, *Obama's Wars* (Simon & Schuster, 2011), 15.
[57] Woodward, 15.

of necessary troops is uncertain, but this uncertainty is experienced by the president, and due to the analyses conducted by the military, the president understands the impact of troop levels. Importantly, in this situation, the president is biased to include more troops rather less. A failure to provide the support his generals need would likely result in a resounding defeat in Afghanistan. Therefore, the president, in this risky situation, is more inclined to act in a risk-averse manner, thus shying away from the dangers of known knowable uncertainty. This bias may have resulted in the deployment of an unnecessary number of troops to Afghanistan. Nonetheless, the impact of known knowable uncertainty shows the extent to which the president is affected by biases and heuristics in the decisions he makes.

Chapter Two: Prediction

The Art of "Strategery"

The *Art of War* by the famed military tactician Sun Tzû is a masterpiece that many label to be an essential foundation for the study of strategy in modern civilization. Sun Tzû's wisdom come in the form of succinct lessons, many of which have utility beyond military applications.[58] In short, *The Art of War* has left an indelible mark on history. Take, for example, this lesson where Sun Tzû describes that "the general who advances without coveting fame and retreats without fearing disgrace, whose only thought is to protect his country and do good service for his sovereign, is the jewel of the kingdom."[59] This prescient knowledge encapsulates essential

[58] "The Internet Classics Archive | The Art of War by Sun Tzu," accessed March 17, 2023, http://classics.mit.edu/Tzu/artwar.html.
[59] "The Internet Classics Archive | The Art of War by Sun Tzu."

military principles, life lessons, and tacit political advice. But, not all leaders are as well-endowed for their strategic prowess and bits of wisdom as Sun Tzû. Arguably, one of those is George W. Bush. As cast members on the comedy show *Saturday Night Live* quipped during a skit in late 2000, George W. Bush's defining trait as a presidential candidate is his "strategery."[60] Yet, much like the word "strategery," the younger Bush administration's military strategy in Iraq and Afghanistan seemed to be nonexistent.[61] With the failure to develop a coherent set of objectives,[62] the Bush administration set the U.S. on a long engagement in nation building in Iraq and Afghanistan. These actions have had wide ranging implications on America's foreign policy. The Bush administration's policy in Iraq and Afghanistan underscores the importance of examining predictive capabilities of leaders.

As evidenced by America's variable success in wars and subsequent occupations and nation-building in the Middle East in the early 2000s, it is incredibly challenging to navigate and successfully anticipate the consequences emerging from the complex machine that is war and its aftermath. Because of these difficulties, it remains an essential function of leaders to appropriately and adequately predict the consequences of their actions. Given that prediction is a key aspect for leaders in making decisions, prediction, as a concept, warrants examination.

In this chapter, we will travel to the past and the future, examine the minute and the global, and attempt to understand the simple and the complex. To begin, we will examine key components in the behavior of making predictions, focusing on human's relationship with

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[60] *First Presidential Debate: Al Gore and George W. Bush - SNL*, 2013, https://www.youtube.com/watch?v=zDgRRVpemLo.
[61] Woodward, *Obama's Wars*, 34.
[62] "Bush Must Find Exit Strategy from Iraq | Cato Institute," October 1, 2003, https://www.cato.org/commentary/bush-must-find-exit-strategy-iraq.

temporality, causality, and complexity. From there we will explore the neuroscience of probability and prediction, highlighting how the brain embodies possible states. Finally, we will conclude by looking at the role that prediction played in Obama's Af-Pak strategic review.

I know this is quite daunting—trust me, I'm the one writing it—but fortunately we have two guides, Stephen Hawking and Albert Einstein, to help us embark on this journey, both of whom are intimately familiar with the conception of time.

Humans and temporality, causality, and complexity

A Comment on Temporality

In a chapter examining the future, where is it more fitting to start than the very beginning—the Big Bang. The Big Bang was a cosmically chaotic event that, simply put, signified the start of the universe. The idea of the Big Bang came from Stephen Hawking's seminal work, entitled "The Large Scale Structure of Space-Time,"[63] discusses the progression of time and its impact on the universe. To simply explain this extremely complicated theory, please indulge me for four sentences. Hawking, in all his wisdom, recognized that the universe must have a beginning. He labeled this mysterious birth a singularity, which, prior to expanding, contained the entirety of the material in the universe. Most importantly (at least for this thesis), Hawking discusses the distribution of material within the singularity—and how, when the singularity

[63] Stephen W. Hawking and George FR Ellis, *The Large Scale Structure of Space-Time* (Cambridge university press, 2023).

expanded, the various idiosyncrasies within essentially structured the universe as it is today, with its vast distances between pockets of galaxies.

While this theory has profound implications on the study of physics, it also presents considerable philosophical considerations. While I will not postulate on the beginning of the universe and what consequences that creates for religious views, Hawking's conception of time's history presents us with two vital themes: temporality and causality, both of which are essential to this chapter.

The first, temporality, is (obviously) a crucial dimension (literally) of the space-time continuum. This means that human experience is defined by intrinsic dynamism of time. Simply put, human reality is dictated by an incessant flow of time that, at least as far as humans can tell, is irreversible. That is to say, today is not yesterday, and tomorrow will not be today. For that reason, humans have their entire lives dictated by the flow of time. Remarkably, time can be perceived in many different ways. Please welcome our second guide, Albert Einstein. Einstein's theory of relativity highlighted that there were physical restrictions on the experience of time as dictated by the laws of reality. This proposition, that time is not necessarily a constant experience, gave physical evidence to suggest a subjective experience of time. This notion proved to be key in devising and developing a new construction for the psychological and neurological understanding of time.

When not traveling at or near the speed of light, it can be challenging to comprehend such a tangibly subjective experience of time. But we all have experienced brief moments that feel as if they took forever or hours that felt like a second. For example, a bored child in class may experience time at a much slower speed than someone waking up from what was

seemingly a brief nap, but in reality was a prolonged slumber. Research suggests that a variety of factors influence our unique perception of time (which can change moment to moment even within individuals), some of these elements include cognitive functions like "attention, working memory, as well as long-term memory," as well as "moods and emotions…, factor of personality."[64] While the precise neural correlates behind cognitive time-keeping remains a mystery (some research suggests that dopamine pathways—and their modulation—in the right prefrontal cortex "might be the basis for a primary timekeeping mechanism"), the implications of an individual's variable perceptions of time can be wide-ranging—especially if that person is in a position of power.[65] Therefore, in this chapter, it is essential we acknowledge that time is a perceived reality, variable amongst individuals, which then lays the foundation for prediction.

A Comment on Causality

While considering how vital the perception of time is to more comprehensively understanding the neural basis of prediction, we must also turn to the second aspect of Hawking's reality to better discern humanity's relationship with the future—causality. As Hawking highlighted in his treatise, the variability in the singularity's distribution of material in the immediate moments after its initial expansion has had profound impacts on the location of matter across space-time.[66] For this reason, it is imperative to recognize the role that causal relationships play in dictating events. While this might be an obvious assertion, its implications are wide ranging,

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[64] Marc Wittmann, "The Inner Experience of Time," *Philosophical Transactions of the Royal Society B: Biological Sciences* 364, no. 1525 (July 12, 2009): 1955–67, https://doi.org/10.1098/rstb.2009.0003.
[65] Wittmann.
[66] Hawking and Ellis, *The Large Scale Structure of Space-Time*.

especially in relation to decision-making. Yet, much like time, causality is a process that is under the guise of perception. Those with compromised abilities to create causal connections can be diagnosed with autism, obsessive-compulsive disorder, and schizophrenia.[67] Similar to the neural correlates of time perception, the neural underpinnings of causal abilities are largely unknown. However, in recent years, research suggests that within decision-making situations, the right interior frontal gyrus (RIFG) and anterior insular experienced higher levels of activation.[68] This is particularly notable because "the RIFG is broadly implicated in perceptual decision-making" and "the anterior insular cortex plays roles in cognitive control and salient stimulus detection."[69] The potential intersection between physiological areas that harbor the abilities of crafting predictions and formulating causalities indicates a broader relationship between the two capabilities. Much like Hawking noted in his theory about the singularity, this relationship emphasizes the intertwined nature of causality and temporality. More specifically, causes must precede effects; causality can only move forward, never backward, in time.

A Comment on Complexity

Identifying, analyzing, and updating causal relationships is central to making adequate predictions, thereby making it a quintessential skill of leaders. Importantly, these causal relationships form the foundation of the complex events that leaders are tasked with resolving. As will become evident throughout the course of this thesis (if it is not already), the job of a

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[67] Adam J. Woods et al., "Space, Time, and Causality in the Human Brain," *NeuroImage* 92 (May 15, 2014): 285–97, https://doi.org/10.1016/j.neuroimage.2014.02.015.
[68] Woods et al.
[69] Woods et al.

president, or any political leader for that matter, is challenging. They are expected to solve the most challenging issues the globe faces. Ultimately, the combination of numerous variables, various dimensions, and considerable caveats points to the fact that all these issues are not simply challenging but are simultaneously complex.

For that reason, I'd like to take a moment to discuss complexity. Far from it describing a difficult to solve issue, complex systems are unique in that "some systems display behavioral phenomena that are completely inexplicable by a conventional analysis of the systems' constituent parts."[70] Additionally, complex systems are attributed with a considerable degree of embodied adaptability. These systems, in the face of possible solutions, can adapt and change over time. Broadly speaking, this adaptivity serves to create the unique phenomena that is generally attributable to complex systems. These phenomena emerging from these systems are generally categorized as emergent behavior, which is a type of counterintuitive behavior that is the output of these types of systems. These behaviors can emerge from "five sources: paradox/self-reference, instability, incomputability, connectivity, and emergence."[71] Importantly, because of the various mechanisms that comprise these types of systems, emergent behaviors are incredibly challenging to predict. These types of behavior are hidden "through nonlinearity, randomness, collective dynamics, hierarchy, and emergence."[72] This is akin to other types of systems, like chaotic systems, which are highly attuned to variations in

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[70] "Complexity | Definition, Theory, & Facts | Britannica," accessed March 17, 2023, https://www.britannica.com/science/complexity-scientific-theory.
[71] "Complexity | Definition, Theory, & Facts | Britannica."
[72] David Krakeur, "Home | Santa Fe Institute," accessed March 17, 2023, https://www.santafe.edu/what-is-complex-systems-science.

initial conditions. Because of these challenges in ultimately realizing the solutions to complex problems, those facing them are encumbering a mighty challenge.

The issues that leaders face, especially those occupying the Oval Office, are complex. Therefore, crafting adequate solutions to these challenges have a considerable degree of difficulty. John Casti, the American mathematician, believed that complex systems were best addressed by first accepting an "inherent subjective component."[73] Albert Einstein, a master at structuring seemingly chaotic natural observations, shared a similar belief in examining such furtive behaviors. Yet, despite such challenges, Einstein describes these mysterious problems as "the most beautiful experience we can have."[74] Importantly, Einstein emphasizes the need to accept a certain subjectivity in examining these complex systems, arguing "the mysterious…is the fundamental emotion that stands at the cradle of true art and science."[75]

Clearly, these types of problems are incredibly difficult to navigate—and these are precisely the types of problems tasked to U.S. presidents. As Obama describes it; "no decision that landed on my desk had an easy, tidy answer."[76] In discussing his experience dealing with his administration's response to the 2009 financial crisis, Obama mentions his "emphasis on process" when dealing with these complex systems.[77] Obama's process consisted of "empty[ing] his ego" and listening to stakeholders and experts in an attempt to let facts and

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[73] "Complexity | Definition, Theory, & Facts | Britannica."
[74] "The World As I See It: An Essay By Einstein," accessed March 17, 2023, https://history.aip.org/exhibits/einstein/.
[75] "The World As I See It."
[76] Barack Obama, "How I Approach the Toughest Decisions," *Medium* (blog), December 9, 2020, https://barackobama.medium.com/how-i-approach-the-toughest-decisions-dc1b165cdf2d.
[77] Barack Obama, *A Promised Land* (New York: Crown, 2020), 293.

logic guide his choices.[78] But even when deploying these processes in an attempt to structure these difficult issues, Obama discusses how he "was constantly dealing with probabilities."[79] To reduce the paralysis that could emerge while seeking a perfect solution and to ensure these choices did not heavily burden Obama's conscious, he "created a sound decision-making process—one where [he] really listened to the experts, followed the facts, considered my goals and weighed all of that against my principles."[80]

There are downsides to Obama's process—especially in the realm of national security. In his 2008 campaign against Senator John McCain, Barack Obama was often derided as lacking foreign policy experience and a robust grasp of national security issues. This belief permeated throughout the Obama presidency. As the President was conducting a review of his Administration's Af-Pak (Afghanistan and Pakistan) strategy, comments from military officials at the Pentagon led journalists to question "whether [Obama] had the intestinal fortitude to lead a nation during wartime."[81] While Obama may have lacked the military experience that some of his predecessors may have held, Obama's adherence to his process helped keep him navigate these novel situations, perhaps almost to a fault. John Podesta, a democratic insider who worked with the Clintons, Obamas, and Bidens, "believed that 'Obama's approach was so intellectual' and that 'was also an Achilles' heel.'"[82] Moreover, Obama's "Defense Secretary Bob Gates would recount that 'one quality I missed in Obama was passion.'"[83] That said "Gates also

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[78] Obama, 294.
[79] Obama, 294.
[80] Obama, "How I Approach the Toughest Decisions."
[81] Obama, *A Promised Land*, 2020, 434.
[82] David Garrow, *Rising Star: The Making of Barack Obama* (William Morrow, 2017), 1057.
[83] Garrow, 1057.

appreciated how Barack's 'White House was by far the most centralized and controlling in national security of any [Gates, who had a 40 year-long military career] had seen since Richard Nixon.'"[84] Broadly speaking these comments serve as an indication of the belief Obama held in his own abilities to serve as proxy for the American people, as well as his confidence that his process could help him resolve any problem, expected or unexpected.

Obama's belief in his process was evident in one of the most unique and novel challenges of his first term in office. Late on the night of April 20th, 2010, an explosion suddenly rocked the Gulf Coast. Located about 50 miles off the coast of Louisiana, an oil rig named the *Deepwater Horizon* experienced a collection of missteps and faults that later enabled a massive ball of gas to enter the rig's engine room and ignite, creating a massive inferno that burned for the following 36 hours.[85] In the months that followed, this explosion later proved to be an absolute disaster—beyond taking the lives of eleven people, the undersea infrastructure of the rig left an opening for crude oil to gush out from the sea floor, laying the groundwork for perhaps the most damaging environmental disaster in American history.

Oil companies, like BP (who was leasing the *Deepwater Horizon* at the time of its explosion), often have contingency plans for these types of devastating situations. In this instance, BP's plan was heavily reliant on the piping infrastructure remaining in place and preventing any type of blowout or leakage. Unfortunately, that plan failed—miserably. After several inspections, the BP team determined that the blowout preventor failed and there were three leaks, leading to an estimated total of 20,000-50,000 barrels of oil a day to leak out into

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[84] Garrow, 1057.
[85] Obama, *A Promised Land*, 2020, 558.

the Gulf (over the course of the crisis a total of 210 million barrels of oil leaked into the Gulf of Mexico).[86] [87] [88] Therefore, with no backup plan, a rapidly expanding environmental disaster, and a collection of BP engineers that "don't know what they're dealing with."[89] With these looming consequences, the Obama administration was tasked with plugging the leaking well, cleaning up the aftermath, and designing a fund that would hold BP financially responsible. All this in addition to the present challenges the Obama administration was facing: a slumping global economy, a continued U.S. military presence in Iraq and Afghanistan, and many other pervasive issues. Simply put, the *Deepwater Horizon* crisis was far from a predictable occurrence, but Obama's reliance on a process helped guide him through it.

He follows this process with an almost religious devotion. He regularly listened to experts, placing his Secretary of Energy Steve Chu, a Nobel laureate in physics, in charge of working with BP to resolve the issue. Obama describes Secretary Chu's placement as "the second good decision" he had made in dealing with the crisis.[90] While listening to the experts, as leader, Obama had a responsibility and commitment to learning and following the facts—the second key condition to his process. For the entirety of the crisis, Obama held regularly scheduled meetings, conducted visits to New Orleans and other afflicted areas, and met with members of the community to understand their concerns. Essentially, Obama used these stories and facts to undergird his administration's response to the crisis. Finally, throughout the

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[86] Obama, 563.
[87] Obama, 569.
[88] Agnes Walton and Jana Lerner, "The Biggest Environmental Disaster in U.S. History Never Really Ended," *Vice* (blog), April 21, 2020, https://www.vice.com/en/article/884z93/the-biggest-environmental-disaster-in-us-history-never-really-ended.
[89] Obama, *A Promised Land*, 2020, 572.
[90] Obama, 572.

crisis, Obama remained in check with his principles, most notably protecting the American people. His administration helped to coordinate a government-wide response, involving at least 11 different departments.[91] Additionally, Obama mentions that pushing BP to set up a fund to resolve financial disputes from those afflicted by the disaster as a decision "that ultimately got us through the crisis."[92]

In summary, the *Deepwater Horizon* crisis was an unpredictable and complex problem that the public tasked the Obama administration with addressing. In bestowing this responsibility, the public turned to the Obama administration for leadership during such a crisis. The public's reliance on those in the White House has dictated public discourse for years, as the president is often the first to receive blame in these instances. For this reason, an essential function of these political leaders is accurately predicting and anticipating complex problems to ensure they mitigate as much blame as possible. But, in dealing with these unstructured and unpredictable problems, the Obama White House must effectively assess the future, especially as it relates to its possible solutions for these problems. This is a job tasked to the president. Broadly speaking, the problems a president faces require consideration of their temporality, causality, and complexity. These three components are essential for comprehending prediction. Therefore, keeping these three attributes in mind is key as we begin to uncover how the brain engages in prediction.

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[91] President Barack Obama et al., "President Obama on the Recovery of the Gulf Coast," The White House, accessed March 17, 2023, https://obamawhitehouse.archives.gov/node/11887.
[92] Obama, *A Promised Land*, 2020, 572.

The Neuroscience of Probability

As we discussed in the previous chapter, the brain is a messy place to conduct research. Uncovering correlation between brain and behavior is immensely difficult, and even when discovered, it is challenging to prove that the correlation amounts to causation. Moreover, any causal relationships likely involve a variety of different components within the brain. The human brain truly is an elegantly integrated machine, particularly in how it can only function, and thus be observed, in a singular environment (the body). Basically, the brain is a small part that plays a major role while being contained in a large system. We can only study the brain as it exists within that system. Therefore, any process constrained within that system is essentially reliant on the integrated variety of relationships within that system.

The nervous system is incessantly bombarded by incredible amounts of information. As we discussed earlier regarding uncertainty, it is up to the nervous system to sort through this data and decide which stimuli are relevant and which can be disregarded. To deal with such immense amounts of information, many researchers and scientists now believe that the brain crafts probability distributions to help categorize and comprehend sensory input. In a 2021 paper, Lindskog and colleagues assessed the brain's ability to build these probability distributions.[93] The authors discuss that evidence indicating the brain's ability to construct probability distributions is indicated by demonstrated by abilities like "language acquisition, memory, intuitive physics, intuitive statistics…, visual perception, auditory perception,

[93] Marcus Lindskog, Pär Nyström, and Gustaf Gredebäck, "Can the Brain Build Probability Distributions?," *Frontiers in Psychology* 12 (2021), https://www.frontiersin.org/articles/10.3389/fpsyg.2021.596231.

sensorimotor learning, and statistical learning."[94] However, Lindskog et al. argue that previous experiments fail to examine the integration of data emerging in the form of "complex, global patterns, such as distributional features."[95] This type of data is especially unique because in order to properly derive its patterns, the brain assess it over "longer time-scales."[96] Therefore, Lindskog et al. designed experiments that focused on the brain's ability to craft probability distributions for complex, global patterns presented over a longer duration. More specifically, they focused their experiments on "whether the brain can build probability distributions to represent experienced data and use this global representation to evaluate the likelihood of new information."[97] In all, these researchers set out to understand how the brain is integrating and experiencing new information, as well as crafting these causal relationships.

To accomplish such a daunting task, the researchers explained that there were three essential pieces of neural evidence needed to conclude that the brain builds probability models for complex events: indexing, correspondence, and flexibility. These three conditions represent a mutually exclusive, yet exhaustive set of requirements needed to assess the emergence of neural representations of probability distributions. As measured in this experiment, indexing is the metric that assesses whether there are neural responses to unexpected events. The brain's ability to successfully index new information has been confirmed in previous studies, yet, for this study, it was important for the authors to discern whether the neural responses indicating indexing varied by the degree to which stimuli are unexpected. Therefore, a more unexpected

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[94] Lindskog, Nyström, and Gredebäck.
[95] Lindskog, Nyström, and Gredebäck.
[96] Lindskog, Nyström, and Gredebäck.
[97] Lindskog, Nyström, and Gredebäck.

event will generate a more novel indexing event and will repeat that indexing event should it occur in the future. The second key part of the researcher's criterion is correspondence assessed as the brain's ability to have neural responses that "*correspond* [emphasis theirs] to the distribution of the presented data."[98] For example, the researchers describe that if the stimuli presented a normal distribution curve, then the neural responses should fit along a similar curve as well. This condition is essential to determining whether the neural responses can adequately represent the presented data. Put together, the first two criterion are essential in determining whether the brain can effectively create neural representations of probability distributions, but it leaves out a critical question: is the brain using heuristics (or shortcuts) to create the neural responses akin to the expected probability distributions or can the brain adequately represent these probability distributions without the use of heuristics? To assess this, the researchers introduced the third and final criterion: flexibility. By measuring the flexibility of neural responses to these probability distributions, the researcher can more effectively discern whether the brain is able to represent these probability distributions without the use of heuristics. To accomplish such a task, the researchers would assess the extent to which the brain is able to update existing representations of its probability distributions to include new information. Essentially, introducing flexibility as such a mechanism reduces the possibility of missing heuristics.

Results of the experiment indicated that the three conditions put forth were confirmed. The authors state that their results "provide evidence for the biological plausibility…that the

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[98] Lindskog, Nyström, and Gredebäck.

brain builds probability distributions."[99] Most importantly, this paper provides a broad indication of how the brain analyzes sensory input. While this has profound implications on how the body conceptualizes and engages uncertainty, this type of information analysis is also relevant for understanding prediction.

The Neuroscience of Prediction

Prediction is derived from the word predict, which, according to the Cambridge Dictionary,[100] is "to say that an event or action will happen in the future, especially as a result of knowledge or experience." A prediction is the forecast emerging from the act of predicting, it is what you say will happen. Essentially, a prediction is a thought of what might happen in the future, as dictated by knowledge, beliefs, and judgements. In respect to biology, particularly for humans, the purpose of prediction is "to facilitate inference about the state of the world and thereby optimize an organism's interaction with it."[101]

For years, philosophers, researchers, and scientists have sought to understand how the brain can take in and sort through immense amounts of information and then go onto make inferences and predictions from that information. Many theories and models about prediction have been proposed, yet few have withstood the rigor of the scientific method. Today, most researchers believe that the brain develops predictions based on probabilistic models—this is called predictive coding (also known as predictive processing).

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[99] Lindskog, Nyström, and Gredebäck.
[100] "Predicting," March 15, 2023, https://dictionary.cambridge.org/us/dictionary/english/predicting.
[101] Christoph Teufel and Paul C. Fletcher, "Forms of Prediction in the Nervous System," *Nature Reviews Neuroscience* 21, no. 4 (April 2020): 231–42, https://doi.org/10.1038/s41583-020-0275-5.

Predictive coding models are largely derived from a section of Bayesian statistics. Bayesian statistics is an area of statistics that allows for the combination of "prior information about a population parameter with evidence from information contained in a sample."[102] More specifically, they involve Bayesian inference, which is "the process of forming beliefs about the causes of sensory data," relying on "the combination of prior beliefs…and [new] beliefs about how these causes give rise to sensation."[103] Fittingly, these models are generally categorized under a broad conceptual framework entitled the Bayesian Brain Hypothesis. Without getting too far into the depths of the neurobiology, the Bayesian Brain Hypothesis "assumes that the brain encodes beliefs (probability states) to generate predictions about sensory entries, and then uses prediction errors to update its beliefs."[104] The interaction of these two beliefs (which is neurologically represented by a constructed probability distribution) creates an updated belief that represents an integration of both prior expectations and new evidence.[105] Essentially, this means that neural circuitry, which emerges from one's previous experiences, embodies the initial (or a priori) belief, while new information comes in the form of sensory information and is used as prediction errors. The interaction of these new errors with already established neural connections creates an updated form of circuitry, one that then incorporates the novel data. This level of processing serves to demonstrate that, broadly speaking, "predictive processing refers to any type of processing which incorporates or generates not just

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[102] "Bayesian Analysis | Statistics | Britannica," accessed March 17, 2023, https://www.britannica.com/science/Bayesian-analysis.
[103] Thomas Parr, Geraint Rees, and Karl J. Friston, "Computational Neuropsychology and Bayesian Inference," *Frontiers in Human Neuroscience* 12 (2018), https://www.frontiersin.org/articles/10.3389/fnhum.2018.00061.
[104] H. Bottemanne, Y. Longuet, and C. Gauld, "The predictive mind: An introduction to Bayesian Brain Theory," *L'Encéphale* 48, no. 4 (August 1, 2022): 436–44, https://doi.org/10.1016/j.encep.2021.09.011.
[105] Parr, Rees, and Friston, "Computational Neuropsychology and Bayesian Inference."

information about the past or the present, but also future states of the body or the environment."[106] This interplay of past beliefs with updated current ones shows how reliant the brain is on past experience. This is best exemplified by an aspect of predictive processing known as hyperpriors. Hyperpriors are "more abstract and fundamental," with an example being the "constraints imposed by space and time."[107] These hyperpriors serve as an ingrained set of priors that are often unchallenged and lay a foundational framework for the brain to build its beliefs about the world. Challenges to hyperpriors are especially salient, as exemplified by the fact that babies have been found to learn more effectively and efficiently when they are surprised.[108] This example hints at probability distribution that infants are crafting, and, when those distributions are challenged, the stimuli become especially salient. Bubic, Cramon, and Schubotz sum it up best, describing that "these approaches show how, given the levels of ambiguity and noise which is always present both in the environment and our neural system, such prior biases become crucial for facilitating and optimizing current event processing, regardless of whether it concerns recognizing objects, executing movements or scaling emotional reactions."[109] The reliance on prior expectations demonstrates the need to assess how initial beliefs and heuristics impact one's perception of the world and provide further proof of the need for explication on predictive coding.

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[106] Andreja Bubic, D. Yves von Cramon, and Ricarda I. Schubotz, "Prediction, Cognition and the Brain," *Frontiers in Human Neuroscience* 4 (March 22, 2010): 25, https://doi.org/10.3389/fnhum.2010.00025.
[107] Link R. Swanson, "The Predictive Processing Paradigm Has Roots in Kant," *Frontiers in Systems Neuroscience* 10 (October 10, 2016): 79, https://doi.org/10.3389/fnsys.2016.00079.
[108] Olga Khazan, "Baby Geniuses; How Surprises Help Infants Learn," The Atlantic, April 2, 2015, https://www.theatlantic.com/health/archive/2015/04/babies-learn-through-being-surprised/389420/.
[109] Bubic, von Cramon, and Schubotz, "Prediction, Cognition and the Brain."

Predictive coding theories describe two distinct means of neurological processing: bottom-up and top-down. Recent neurobiological models, which I will only briefly touch upon, highlight "multiple [cortical] layers in a stacked structure" with each consisting of "a single vector of value, or activity, neurons and a single vector of error neurons."[110] These layers are contained within specific areas in the brain, and "are reciprocally connected with each other in a complex way."[111] While there may be variation amongst species and individuals, "there is convergence around a…simple scheme where the six cortical layers can be decomposed into an 'input layer'…two distinct processing streams…and feedback…stream."[112] These physiological streams manifest into a wider conceptual framework that adequately describes the processes involved in predictive coding. Importantly, it exemplifies the embodied bidirectional interaction amongst various areas within the brain. The physical manifestation of these processes also highlights the challenge in delineating between top-down and bottom-up processes. Because these processes are constantly receiving information and feedback from the other it becomes difficult to assess how predictions can emerge. One of the proposed ways in which the brain puts forth predictions is, after the interplay of these two processes, the brain selects an expectation. When the brain receives feedback from the external environment regarding that expectation (via both processes), the neural circuitry aims to update its wiring to reduce a measurement called prediction error, which is the difference between expectation and reality.

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[110] Beren Millidge, Anil Seth, and Christopher L. Buckley, "Predictive Coding: A Theoretical and Experimental Review" (arXiv, July 12, 2022), http://arxiv.org/abs/2107.12979.
[111] Millidge, Seth, and Buckley.
[112] Millidge, Seth, and Buckley.

While the specific delineation between two types of predictive processing is in its infancy, there is a level of conceptual value in utilizing the dichotomy. Put more simply, bottom-up processing focuses on the impact of sensory input in generating expectations that are later applied to future scenarios. Alternatively, top-down processing, which is much more ambiguously defined, can describe a wide swath of modulations.[113] Regardless, the differences between these two levels of processes are important to note because they interact with one another to help construct predictions. By reducing the amount of error within its model, the predictive processing framework suggests that the brain subsequently aligns its predictive model with the outside environment. In addition to the error reduction, the predictive processing model relies on certain levels of inference that are enabled by the "top-down" approach, and vice versa.[114] Such modelling demonstrates that the process through which the brain constructs these mental models can be modulated by a framework that impacts a person's proprioception capabilities.

Thus far, while most of our discussion has centered around low-level, less complex predictions, it is time to briefly pivot to the more complex aspect of prediction. There are several factors that influence how the brain engages with prediction: "timescale (short vs. long term), type (probabilistic vs. deterministic), specificity (high vs. low), level (explicit vs. implicit), and domain (motor vs. perceptual vs. cognitive)."[115] This multifactorial approach highlights how there is the involvement of a variety of neurological processes whilst someone makes a

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[113] Karsten Rauss and Gilles Pourtois, "What Is Bottom-Up and What Is Top-Down in Predictive Coding?," *Frontiers in Psychology* 4 (2013), https://www.frontiersin.org/articles/10.3389/fpsyg.2013.00276.
[114] Swanson, "The Predictive Processing Paradigm Has Roots in Kant."
[115] Bubic, von Cramon, and Schubotz, "Prediction, Cognition and the Brain."

prediction. While all of these characteristics of prediction have varying degrees of sway over the ultimate outcome of a prediction, the final integration of prior belief with novel sensory information relies upon the architecture designed to support predictive coding. Noting this co-option is extremely important as it serves to highlight how the brain is susceptible to biases and heuristics that may impact processing at the earliest level of information integration. This is a concerning concept we will discuss more in depth at the end of the chapter.

To summarize this past section, one way in which the brain examines the world is through crafting probability distributions. These distributions are then used to construct Bayesian-like beliefs that are updated by neural interactions triggered by stimuli (bottom-up). Simultaneously, these distributions are modulated by higher, potentially more goal-oriented processes within the brain. These have a bidirectional relationship, creating a complex situation characterized by two dynamic processes that inform one another. This complex relationship which is applicable to low-level stimuli or actions and can be co-opted for more complex forms of prediction (like the consequences and logistics of determining how many troops to deploy). The feedback these processes receive is largely in the form of predictive errors, which neural circuity preemptively attempts to correct in accordance with the predictive processing theory. In all, the neural model of the Bayesian Brain Hypothesis and predictive coding is especially important in assessing two key components of predictions:

1. This model enables an explanation for how the brain crafts causal relationships.
2. While this model describes very low-level sensory mechanisms, the same sensory integration capabilities are co-opted to be used in predictive circumstances.

Importantly, the models we've discussed in the past few pages will serve us well as we delve into Obama's Af-Pak strategy and predictions.

The Art of Prediction: Obama's Af-Pak Odyssey

Throughout the entirety of the Af-Pak strategic review sessions, the concept of goals continuously came up. Obama, committed not to have the U.S. undergo another chaotic nation-building experience as they had in Iraq, resolved to establish a firm timeline of troop deployment. This timeline would be complete with key milestones and mechanisms to ensure that troop draw down occurred in a timely manner. The specific goals Obama and his team focused on included a renewed focus on protecting the U.S. homeland and U.S. interests abroad all the while securing Pakistani nuclear weapons and "forg[ing] a hard-earned peace in Afghanistan."[116] [117] By committing themselves to achieving these goals, the president and his teams could form predictions about the tangible steps needed to reach those aspirations. Importantly, as seen throughout this chapter, utilizing such goals as means to craft predictions may have ultimately played a counterintuitive role that may have inhibited the process.

In this case, while goals provide an organized structure for dealing with complex problems, without proper vigilance they also may lead to confirmation bias in crafting predictions.[118] System 1, the type of thinking characterized with making automatic judgements and assessments likely serves as a means to inform the Bayesian form of predicting ingrained in

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[116] Woodward, *Obama's Wars*, 187.
[117] Woodward, 75.
[118] Kahneman, *Thinking, Fast and Slow*, 81.

the brain. This is to say that these goals set forth initial expectations for successful steps that achieve the goal, regardless of whether the goal is the priority. Essentially, decision-makers are more inclined to follow plans and predictions that align with the goals they set, regardless of the individual merits of the other plans.

A key example of this is Vladimir Putin's war in Ukraine. In late February of 2022, Russian dictator Vladimir Putin launched an invasion of neighboring Ukraine with the goal of capturing the capital, Kyiv, in a matter of days.[119] In the time since, the Ukraine people have vigorously fought back against the invaders and thusly Russia and Ukraine are presently at a standstill. Nonetheless, despite the immense losses the Russian side is taking on, Putin, Russia's chief military leader, presses on in an attempt to successfully accomplish his goal.[120] Such a trend is indicative of the role that confirmation bias may play in leaders' decisions. Because Putin sought out the capture of Ukraine, it appears as if he will stop at nothing to achieve that goal. This comes at the expense of other potentially valid solutions that may offer Russia, and Putin, a better future.

In all, the process through which goal setting and prediction-forming interface presents decisions-makers with an area that is ripe for producing biases and relying upon dangerous heuristics. To combat such challenges, institutions need to adopt decision-making frameworks that eliminate these possibilities.

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[119] Jeffrey Mankoff, "Russia's War in Ukraine: Identity, History, and Conflict," April 22, 2022, https://www.csis.org/analysis/russias-war-ukraine-identity-history-and-conflict.
[120] "Ukraine: Conflict at the Crossroads of Europe and Russia," Council on Foreign Relations, accessed March 17, 2023, https://www.cfr.org/backgrounder/ukraine-conflict-crossroads-europe-and-russia.

Chapter Three: Social Context

The White House—A Seat of Power and a Prison

Hawaii is a tropical paradise—and even those words don't fully capture the state's natural beauty, serenity, and wonder. The state, distinct from the contiguous U.S., offers a sense of detachment, a place to get away from incessantly polarizing political dialogue. That separation, both literal and political, makes Hawaii a unique birthplace for the 44th President. Born in Hawaii in 1961, Barack Obama always endeavored to return to his home state. This was especially true during his years in public office. The historic beauty of the U.S. Capitol and the ornate elegance of the White House offer a stark contrast to the natural environment of Obama's youth. For that reason, throughout his political career, Hawaii offered Obama a sense of anonymity and familiarity that he often struggled to find in the nation's capital.

In the weeks prior to his inauguration, Obama and his family set out to Hawaii in hopes of "catch[ing] [his] breath."[121] While he could not fully escape his duties (even before being inaugurated), Obama did have a chance to bodysurf. Amongst the waves and bubbling surf, Obama quickly realized his time in the ocean was no longer akin to his carefree days as a young child. Swimming around him were "several wet-suited Navy SEALs," a level of security that would ultimately become ever-present during his administration.[122] As one of his security agents Dave Beach said, as he left the water, "I hope you enjoyed that, 'cause it's the last time

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[121] Barack Obama, *A Promised Land* (New York: Crown, 2020), 220.
[122] Obama, *A Promised Land*, 2020, 221.

you'll be able to do it for a long, long while."[123] This loss of autonomy and freedom characterized the entirety of Obama's presidency.

Such a perspective is best exemplified by an unscheduled stroll the president took in the Spring of 2014.[124] Walking from the White House to the Department of the Interior, the president eagerly interacted with many unsuspecting passerby's, even quoting that "the bear is loose."[125] While this video shows an unrestrained and unstructured Obama, it reflects that the presidency is, by design, secluded away from a natural social life.

Even before he became president, then-Senator Obama experienced a similar loss of anonymity. In his first summer as an Illinois' Senator, Obama decided to take his two daughters to the zoo. Hoisting on a hat designed to block out the sun just as much as it did the crowds, Obama and his daughters trotted around the zoo. It took an hour before a constituent recognized the future president and he was immediately flocked by supporters. The influx of people ultimately ruined the Obamas' trip to the zoo and his young daughters suggested he adopt an alias to hide from the crowds, taking up a persona of someone by the name of "Johnny McJohn John."[126]

While this story presents quite a cute interaction between a father and his daughters, it highlights a side of public office that is much more sinister. When you become a political leader, your personal life, is thrust into the limelight. This is because, suddenly, upon your election or appointment, all aspects of your life become a matter of national security. Therefore,

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[123] Obama, *A Promised Land*, 2020, 221.
[124] *Raw Video: The President Takes a Surprise Walk*, 2014, https://www.youtube.com/watch?v=gZR1CvSQntE.
[125] *Raw Video*.
[126] Obama, *A Promised Land*, 2020, 60.

presidents, as connected as they may seem, are largely secluded. For this reason, this chapter is all about social context. Presidents are required to navigate an entirely new social sphere, one that is severely limited and prohibitive. First, we will discuss humans' essentially social nature, then lead into a discussion on the social context in the Obama White House. From there, we will discuss the role of the Bureaucratic Actors model and touch upon social psychology, before ending with a discussion of how Obama's Af-Pak decision was impacted by his social context.

A Note on Sociality: From College to the White House

Have you ever been asked, what were you like before I met you? How do your childhood friends view you? What are you like when you're amongst your co-workers as opposed to your friends? If so, you're not alone. The gist is that people differ based on their social surroundings. This is an almost universal truth. People are incessantly dynamic, and such change creates a constantly shifting social landscape.

The comedy duo Key and Peele may have missed this aspect. In a satirical video representing Barack Obama's college years at Occidental, Key and Peele depict Obama partying amongst his friends, while maintaining his unique voice and irrepressible commitment to bringing people together.[127] Though this social commentary is a testament to Obama's buoyant personality and optimism, Key and Peele fail to recognize that Obama, too, was different before he was a favorite amongst voters. In fact, Obama described himself as a "monk," and he "didn't socialize much" during his first few months as a new transfer student at Columbia University in

[127] *Key & Peele - Obama - The College Years*, 2012, https://www.youtube.com/watch?v=vlxkcewBEe0.

New York City.[128] Despite such isolation, in a letter to a friend, Obama describes how he was "comfortable in his solitude."[129] Nonetheless, Obama maintained unwavering relationships with those he had become friends with during his time at Occidental and his few new friends at Columbia. All this is to show that Obama was continuing to grow during college—as is the case with most people—and demonstrates the impact from social environments.[130] Obama was acutely aware of the influence from social context and his decision to transfer from Occidental College to Columbia University was a direct result of Obama making "a conscious decision: [he] want[s] to grow up." [131] [132] In all, Obama's social experience in his late teens and early twenties is indicative of the wide-ranging impacts his relationships, and lack thereof, had on the development of his political philosophy and personal beliefs. Simply put, as he grew from Barry to Barack to Barack Obama, the 44th President of the U.S. is the product of his surroundings.

As we discussed in the first chapter, humans are the contemporary expression of evolution. Importantly, the selective pressures imposed onto the ancestors of our species have pushed humans to be a fundamentally social species. In fact, many organisms experience some form of social relationships.[133] The essential nature of socialization highlights a key attribute of a human life. Whether its hunting, conversing, or having sex, much of human life is impacted, and often benefited, by our social relationships.[134] Importantly, this means humans seek

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[128] David Garrow, *Rising Star: The Making of Barack Obama* (William Morrow, 2017), 143.
[129] Garrow, *Rising Star: The Making of Barack Obama*, 148.
[130] Garrow, *Rising Star: The Making of Barack Obama*, 144.
[131] Obama, *A Promised Land*, 2020, 11.
[132] Garrow, *Rising Star: The Making of Barack Obama*, 132.
[133] Simon N. Young, "The Neurobiology of Human Social Behaviour: An Important but Neglected Topic," *Journal of Psychiatry & Neuroscience : JPN* 33, no. 5 (September 2008): 391–92.
[134] Debra Umberson and Jennifer Karas Montez, "Social Relationships and Health: A Flashpoint for Health Policy," *Journal of Health and Social Behavior* 51, no. Suppl (2010): S54–66, https://doi.org/10.1177/0022146510383501.

sanctuary in our relationships, and in seeking sanctuary we are subsequently influenced by those around us. The same is true for U.S. Presidents.

As we suggested at the beginning of this chapter, because of the power granted to them, political leaders are immediately placed into a new social class. Placement into this class can oftentimes bring a completely new social situation for individuals. Take, for example, one of Obama's initial experiences as a U.S. Senator from the state of Illinois. As he bluntly puts it, Senators "fly a lot."[135] Because of the extent to which Senators need to fly, they are often able to use private planes at a discounted price.[136] Yet, as Obama later discusses, the exclusivity and luxury of flying on a private jet prohibits the kinds of interactions and social relationships that one develops flying commercial.[137] In all, this serves as a broad demonstration that once a candidate is in elected office, especially those at the national level, they are often swept away from their constituents, and suddenly surrounded by aides, campaign officials, and Washington insiders that begin the process of skewing their perspective.

The consequence of Obama's social surroundings only become more impactful throughout his presidency. In accordance with the belief that everyone wants to have the President's ear, Obama found himself in a unique situation—his social environment comprised of various bureaucrats, experts, aides, and friends. This setting essentially funneled the information that would reach the president's ear, with Peter Baker for the *New York Times Magazine* describing "that Barack 'rarely reaches outside the tight group of advisors,' led by

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[135] Barack Obama, *The Audacity of Hope: Thoughts on Reclaiming the American Dream* (Crown, 2006), 137.
[136] Obama, 137.
[137] Obama, 194.

[Valerie] Jarrett [a Senior Advisor to the President]; 'he's opaque even to us,' a top White House aide told Baker. 'Except maybe for a few people in the inner circle, he's a closed book.'"[138] This lesson demonstrated the power that a few individuals held in monitoring the amount and type of information that would reach the Oval Office. Because of this type of regulation, the president suddenly became extremely susceptible to bias. Therefore, the social context within in the White House inhibits the resilience of the president's decision-making, namely because of the susceptibility to bias.

The inherent distortion of incoming information was not just limited by structure of the White House, another journalist "wrote that Barack's problem was that 'there's too much hero worship around him' and that 'if his aides weren't so in love with him and wrapped up in the idea of him as a transformational president, they might have seen this coming.'"[139] This suggestion that Obama's aides lost their criticality because of the president's stature, highlights another major consideration in thinking about how the president receives his information.

Importantly, the biased information a president receives is not necessarily bad; in fact, such distortion is necessary for a president to comprehend the most salient pieces of an event. That said, it is nonetheless vital to remain mindful of how and from who the president receives information. In doing so, the president can remain cognizant of their decisions' susceptibility to potential biases, and how, and in what way, those biases may influence a particular decision.

Nonetheless, these journalistic reports highlight a significant concern—the president is at the whim of those he surrounds himself with. Such an observation can have considerable

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[138] Garrow, *Rising Star: The Making of Barack Obama*, 1057.
[139] Garrow, 1057.

consequences for elected officials. The strategic review in Afghanistan provides a good foundation off which we can examine the impacts of limited access to differing perspectives.

The Bureaucratic Politics Model

In a seminal paper titled *A Bureaucratic Politics Analysis of the Decision to Order a Troop Surge in the Afghanistan War*, Dr. Kevin Marsh explores the extent to which the bureaucratic political machine influenced then President Obama's decision to send troops into Afghanistan in 2009.[140] In all, the author provides a wide-ranging assessment of the various actors involved in the Afghanistan strategic review. He sets out to prove the notion that bureaucratic politics at the highest levels of the government dictated most of the decisions that Obama made involving the pathway forward in Afghanistan. To properly analyze the situation, Marsh relied on various foreign policy models that were initially elaborated on by Graham Allison in a 1969 paper analyzing the Cuban Missile Crisis. Specifically, the author delves into three models that can help explain foreign policy decisions, with the third specifically addressing the bureaucratic politics model, which is the main focus of this paper:

1. Model I (Rational Actor Model)—This model is built off the foundation of rational choice theory and describes "foreign policy decisions as the resultants of unitary states conducting objective cost-benefit analyses."[141] This model suggests that actors within governments operate rationally with the intention of optimizing utility for the state.

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[140] Kevin Marsh, "Obama's Surge: A Bureaucratic Politics Analysis of the Decision to Order a Troop Surge in the Afghanistan War," *Foreign Policy Analysis* 10, no. 3 (July 1, 2014): 265–88, https://doi.org/10.1111/fpa.12000.
[141] Marsh.

2. Model II (Organizational Process Model)—This model incorporates the impact of "organizational mission and essence, as well as standard operating procedures, on foreign policy."[142] More specifically, this model emphasizes the role that the broader intentions of the government can have on contemporary foreign policy decisions.
3. Model III (Bureaucratic Politics Model)—This model suggests that foreign policy actors are, to a large degree, influenced by the roles they fill within the bureaucracy. The model suggests that an amalgamation of factors influence these actors. These include an actor's future bureaucratic role as well as the area of government they represent, among many other factors. Most notably, this model serves to suggest that a cost-benefit analysis of the situation is not a comprehensive enough tool to assess these actors' various choices. It further explicates that many of these decisions should be viewed in the light of how it helps each bureaucracy.

It is this final model that outlines the role of social influence and context in a decision. Marsh elaborates that the influence of bureaucratic politics emerges through three key areas: coalition building, logrolling, and compromise. Ultimately, Marsh argues, the presence of these aspects throughout the Afghan strategic review represents the extent to which bureaucratic politics dictated Obama's final decision. Importantly, Marsh highlights that the model includes aspects regarding the autonomy of the president's decision-making. Specifically, the bureaucratic politics model provides evidence that when the president is closely involved in a

[142] Marsh.

foreign policy matter, they subsequently gain more autonomy in the decision put forth by the government. This coincides with a loss of influence from bureaucratic actors.

Finally, Marsh elaborates on the foundational hypotheses of the bureaucratic politics model. The first is predicated on the notion that a bureaucrat's policy beliefs can be predicted by "their position within government."[143] The second surrounds a bureaucrat's bargaining capabilities, suggesting that with greater bargaining advantages comes increased influence in foreign policy decisions. The third and final hypothesis surrounds the notion of compromise. Here, the model argues that with more "political pulling and hauling" amongst actors, the greater the likelihood of a compromise emerging as the final decision.[144]

Importantly, while this paper offers a robust argument pushing for the deployment of the bureaucratic politics model, the theoretical construct fails to fully acknowledge the president's considerable agency in the Afghanistan review sessions. Furthermore, Marsh provides the dichotomy between a president that is heavily involved in a particular foreign policy decision versus one that is not. In this distinction, Marsh subsequently implies that the president acts as the sole top-down mechanism of the foreign policy decision-making process. Additionally, this implies that in the absence of presidential involvement, the bottom-up process, or the bureaucratic actors involved, dictate the solution. This study takes it a step further and argues that bureaucrats play an outsized role in the final decision of this strategic review. The author highlights that the presence of coalition building, logrolling, and compromise serve as proof of the outsized role these bureaucratic actors play.

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[143] Marsh.
[144] Marsh.

Marsh implies the president's final decision is mostly dictated by his attempts to appease each of his bureaucratic advisors. He goes further to elucidate the notion that foreign policy outcomes can be predicted based on the application of the bureaucratic politics model. Such thinking ignores the bidirectional relationship that the president has with the various bureaucratic actors. Moreover, the goals of bureaucrats oftentimes translate to initiatives benefitting the public. Additionally, the U.S. president largely defines who comprises their cabinet and close circle of advisors, and, subsequently, outlines their administration's agenda. This enables the president to have considerably more agency than Marsh's theory suggests. Moreover, Marsh fails to address the notion that the president has the capability to override these bureaucratic actors. Such power provides the president with considerable agency to act on his own beliefs, regardless of the advice from various bureaucratic actors. The president and his decisions are not constrained by the bureaucracy, but rather enabled by the system.

While Marsh did not explicitly make this distinction, the notion the president inhabits the role of top-down mechanisms versus bureaucratic actors' bottom-up role remains an idea that is essential. As the author mentioned, these actors can oftentimes serve as the eyes and ears of the president. While these bottom-up processes can inform the president, ultimately, they do not make the top-down decision. Nonetheless, this model serves as a prime example of how social context informs a president's decisions.

Regardless, the bureaucratic politics model serves as a valuable tool for analyzing decisions. But, as noted in the study, the model contains considerable deficiencies. These limitations highlight the need for a more comprehensive framework, one that incorporates a more holistic understanding of the president's actions, in addition various bureaucratic actors.

The Af-Pak Strategic Review—A Bureaucrat's Dream

The Af-Pak Strategic Review, with its wide swathe of high-level military, intelligence, diplomatic, and political figures jostling to have the greatest sway over the president, is a prime example of the Bureaucratic Politics Model at work. In his book, *Obama's Wars*, Bob Woodward goes as far to list out how "'tribes populated the presidency…the Hillary tribe lived at the State Department. The Chicago tribe…and…the campaign tribe…seemed to flaunt their personal relationships with the president."[145] There was also the military tribe and the Vice President's tribe. In all, these various 'tribes' made for a constantly shifting political dynamic within the White House, an atmosphere comprised of ever-changing alliances and conflicts. Such a notion strikes at the core of the Bureaucratic Politics Model, highlighting how infighting amongst bureaucratic actors ultimately weighs heavily on how the president decides. Interestingly, Obama encouraged his advisors to engage in heavy debate amongst one another. In one instance, the President urged Vice President Biden to act as a voice of dissent. The interplay between unique perspectives is seen throughout the review sessions "because [Obama] think[s] the American people are best served and our troops are best served by a vigorous debate on these kinds of life-or-death issues."[146] Such a strategy reduces the impacts of a limited social context.

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[145] Bob Woodward, *Obama's Wars* (Simon & Schuster, 2011), 145.
[146] Woodward, *Obama's Wars*, 160.

Interestingly, to pursue their interests, bureaucratic actors deploy a variety of measure to incentivize the president to prioritize their initiatives. One of them, as formally described by Secretary of State Henry Kissinger, is a manipulation of choice architecture, or the way in choices are presented to us. Broadly speaking, "the Henry Kissinger model" relies upon three choices two of which are ridiculous and unrealistic, while the third, in comparison to the other two, appeared to be the only logical option.[147] This, as well as other examples of the influence that choice architecture plays, highlight how individuals are susceptible to bias. Nonetheless, choice architecture and the Bureaucratic Politics Model highlight how individuals involved in the decision-making process wield influence over the decision-maker. For this reason, examining the social context of a political leaders is essential to fully understand their decisions.

Chapter Four: Moral Dilemmas

Surprise! Here's the Nobel Peace Prize sprinkled with irony.

In his will, the chemist and weapons-maker Alfred Nobel, who, in his day, was most famous for creating dynamite, outlined a plan to create a series of five annual awards that would recognize the greatest achievements in physics, chemistry, medicine, literature, and peace. These prizes are some of the most highly coveted awards in their various disciplines and receiving a Nobel Prize is a great honor. So, on the morning of October 9th, 2009 why was Obama was surprised and confused to find out he had won the Nobel Peace Prize?[148]

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[147] Woodward, 104.
[148] Obama, *A Promised Land*, 2020, 439.

As he amassed a vast fortune, Nobel, in his will, set aside a part of his wealth "to the person who shall have done the most or the best work for fraternity between nations, the abolition or reduction of standing armies and for the holding and promotion of peace congresses," a fund that created the Nobel Peace Prize.[149] The Norwegian Nobel Committee, a group tasked with selecting the Nobel Peace Prize Laureate, awarded Obama the Nobel Peace Prize in 2009 "for his extraordinary efforts to strengthen international diplomacy and cooperation between peoples" with "special importance to Obama's vision of and work for a world without nuclear weapons."[150] But, this award, for many, including Obama himself, felt undeserved. As Obama notes during his Nobel Lecture, a speech required of all Nobel Laureates, he "would be remiss if [he] did not acknowledge the considerable controversy that your generous decision has generated…this is because [he is] at the beginning…of his labors."[151] Interestingly, the committee's decision to award Obama the Nobel Peace Prize came nine days after his administration announced that it would be sending troops to Afghanistan. It is this bit of irony, so akin to Alfred Nobel's, Obama decided to address head on. In his lecture, Obama argued:

> …that war is both terrible and sometimes necessary; that reconciling these seemingly contradictory ideas requires the community of nations to evolve higher standards for both the justification and the conduct of war; and that avoidance of war requires a just peace,

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[149] "The Nobel Peace Prize," NobelPrize.org, accessed March 8, 2023, https://www.nobelprize.org/events-nobel-prize-summit-solution-session-2023/.
[150] "The Nobel Peace Prize 2009," NobelPrize.org, accessed March 16, 2023, https://www.nobelprize.org/prizes/peace/2009/summary/.
[151] Barack Obama, "A Just and Lasting Peace," NobelPrize.org, 2009, https://www.nobelprize.org/prizes/peace/2009/obama/lecture/.

> founded on a common commitment to political freedom, a respect for human rights, and concrete strategies to expand economic opportunity around the world.[152]

In short, "there will be times when nations—acting individually or in concert—will find the use of force not only necessary but morally justified."[153] The juxtaposition is noteworthy. After receiving an award for his commitment to peace, Obama argues about the need for moral war. Here, he specifically highlights how "as a head of state," he is "sworn to protect and defend [his] nation."[154] Importantly, these heads of state are faced with the nearly impossible task of deciphering when to mete out such morally justified violence. This paradox is precisely the reason why it is necessary to understand how the brain conceptualizes and deals with morals and moral dilemmas. Resolving dilemmas is a key responsibility of political leaders, and a better understanding of the neural processes underlying these decisions can provide insights into how biases might be removed from the process. Before we do so, we must first ask:

What are morals anyways?

Discerning between right and wrong is a notoriously timeless and difficult question—yet it is one of the most basic prerequisites and essential duties of a political leader. [155] Simply put, only the most challenging decisions reach a leader's desk. These dilemmas are riddled with uncertainty, characterized by their future possibilities, and entirely influenced by others—

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[152] Obama.
[153] Obama.
[154] Obama.
[155] Or in the case of more despotic leaders, at least pretending to be the foremost moral authority of a country is perhaps the most basic necessary requirement.

choices that, at their most fundamental, are moral dilemmas. For example, within their first two years, many of the Obama Administration's toughest choices were ultimately moral dilemmas: the solution to the financial crisis, the push to pass healthcare reform, and the decisions on the wars in Afghanistan and Iraq. These decisions demonstrate the necessity to understand how leaders conceptualize and engage with moral dilemmas. Understanding this importance brings us to the core question, what are moral dilemmas? But, before we answer this question, we must define morality.

Defining morality proves to be a thorny task. Therefore, to simplify a broad array of potential definition, in this thesis, morality will be defined as an internal and individual code of conduct (or belief systems) that dictates action.[156] The rationale behind relying upon this definition lies in the idea that adherence to specific morals is not generalized across cultures, communities, and even family members. Such variation serves to suggest that morals are largely individualized, necessitating a definition that is reliant upon individual beliefs. As the *Stanford Encyclopedia of Philosophy* aptly sums up, "if one uses 'morality' in its descriptive sense…one will almost certainly deny that there is a universal morality that applies to all human beings."[157] When an individual acts in accordance with their internal code of conduct, that will be considered a moral action, while the opposite is an immoral action. Importantly, an internal code of conduct can be applied externally to assess others' actions. For example, Barack Obama might find it moral to wear Joe Biden's signature aviators, but Biden might find such an action

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[156] Bernard Gert and Joshua Gert, "The Definition of Morality," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Fall 2020 (Metaphysics Research Lab, Stanford University, 2020), https://plato.stanford.edu/archives/fall2020/entries/morality-definition/.
[157] Gert and Gert.

immoral (no one takes Biden's style).[158] Importantly, a moral dilemma is a problem that involves a choice between two or more belief systems.

Because morality is defined from an individual standpoint, moral philosophers have created constructs, called normative moral theories, that describe and categorize wide swathes of individual codes of conduct. These moral theories offer a means of analysis to better understand decisions involving moral dilemmas. Therefore, in the next section of this chapter we will examine three main types of moral theory: utilitarianism, deontology, and virtue ethics.

Utilitarianism

Utilitarianism is one of the three main normative moral theories that are typically deployed when examining the morality of an action. This specific theory is a subdivision of consequentialism, or a set of theories that focus on justifying an action based on its consequences. Utilitarianism uses utility, or overall good, as metric to assess whether an action is moral because, and, as the Classical Utilitarians (like Jeremy Bentham and John Stuart Mill) put it, "we ought to maximize the good, that is, bring about 'the greatest amount of good for the greatest number.'"[159] The best example to examine the application of utilitarianism is the trolley problem. The scenario goes as follows. Imagine a situation in which a runaway trolley is going to hit three people, who do not see the trolley coming. There is an adjacent track that the trolley could be switched to with only one person on it, who also does not see the trolley

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[158] *Couch Commander*, 2016, https://www.youtube.com/watch?v=OIDEGN4Js40.
[159] Julia Driver, "The History of Utilitarianism," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta and Uri Nodelman, Winter 2022 (Metaphysics Research Lab, Stanford University, 2022), https://plato.stanford.edu/archives/win2022/entries/utilitarianism-history/.

coming. The moral agent (the person facing the moral dilemma) is standing next to the switch that chooses which track the trolley goes down. What does the agent do? From a utilitarian perspective the agent should switch the track to kill the one person as opposed to letting the train hit three people. While the reasons for such a decision become complicated, the gist of utilitarianism becomes clear—save as many lives as possible (as measured by utility), regardless of the means.

Similarly, a separate theoretical moral dilemma, the transplant problem, illustrates a slightly more sinister application of utilitarianism. In the transplant problem, five young individuals require a transplant to survive. Should they survive, these patients would go onto live happy lives. An older patient, diagnosed with a terminal disease, enters the hospital. He has the organs that the younger patients require to survive but giving those organs away would mean the death of the older patient. In this situation the moral agent is a doctor who oversees all six patients. Utilitarians would argue that killing the older individual in order to transplant their organs for later use, is the moral action. Such an ominous action serves to highlight the dangers and limitations for a complete reliance on pure utilitarianism. While there are various derivations, utilitarianism is based on justifying actions on the amount of total utility they create—using the ends to justify the means.

Deontology

In contrast to utilitarianism, deontology offers a different approach to understanding moral action. This theory suggests that moral action is justified by its accordance with inviolable rules. This means that the morality of an action is based on its consequences, rather it is mostly

focused on how the actor conducts that moral action. This moral theory is reliant upon the categorical imperative, which is "a rule of conduct that is unconditional or absolute for all agents, the validity or claim of which does not depend on any desire or end."[160] In short, a moral agent acts morally if they ensure they do not break any rules they believe to be inviolable. An example of a categorical imperative being used can be seen in one of the ten commandments listed in the Old Testament; thou "shall not murder."[161] If this is a categorical imperative then an action cannot be considered moral if one murders another. Importantly, the morality of the action is judged by the action itself, not the consequences.

Within deontological ethics, one of the most well-worn categorical imperatives is to not use people as a means to an end. In comparison to utilitarianism, such a perspective changes the behavior of moral agents in the transplant problem. A doctor acting morally in a situation similar to the transplant problem, under adherence to deontological ethics, would refuse to kill the older patient, because doing so would violate the categorical imperative of not using a person as a means unto an end. In short, deontologists assess the morality of their actions through adherence to inviolable rules—often in the form of the categorical imperative.

Virtue Ethics

The third major moral theory we will explore is virtue ethics. This theory is dominated by figures like Plato, Aristotle, and Confucius, and offers an approach that emphasizes the

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[160] "Categorical Imperative | Definition & Examples | Britannica," accessed March 16, 2023, https://www.britannica.com/topic/categorical-imperative.
[161] "The Ten Commandments," accessed March 16, 2023, https://www.chabad.org/library/article_cdo/aid/2896/jewish/What-Are-the-Ten-Commandments.htm.

development and practice of characteristics called virtues—which is described as "an excellent trait of character."[162] For example, honesty or generosity are seen as virtues. While "every culture is concerned about the moral development of its children….most cultures wrote about virtues that should be cultivated, and many of those virtues were and still are valued across most cultures."[163] In virtue ethics, moral action is seen by practicing virtuous characteristics to develop and embody them to the best of one's ability. Therefore, the morality of an action can be assessed based on the extent to which it exemplifies a virtuous person.

Importantly, these three moral theories do not exist in their pure form. Rather, individuals arrive at a point of considerable intersectionality amongst the various normative theories, with each approach being able to "make room for virtues, consequences, *and* rules."[164] This means that the reality of assessing morals is much more complex than the three clear cut strategies mentioned above. Therefore, it is important to consider the influence these theories have on how people, especially political leaders, make decisions.

The Construction of Morals (the Ultimate and the Proximal)

It is difficult to discern precisely how a sense of morality develops. As Jonathan Haidt describes it, "moral systems are interlocking sets of values, virtues, norms, practices, identities, institutions, technologies, and evolved psychological mechanisms that work together to

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[162] Rosalind Hursthouse and Glen Pettigrove, "Virtue Ethics," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta and Uri Nodelman, Winter 2022 (Metaphysics Research Lab, Stanford University, 2022), https://plato.stanford.edu/archives/win2022/entries/ethics-virtue/.
[163] Jonathan Haidt, *The Happiness Hypothesis: Finding Modern Truth in Ancient Wisdom* (Basic Books, 2006), 288.
[164] Hursthouse and Pettigrove, "Virtue Ethics."

suppress or regulate self-interest and make cooperative societies possible."[165] More practically, this collection of factors demonstrates that moral development is an incredibly complex process. Importantly, they can be sectioned into two distinct groups: the ultimate and the proximate.

The Ultimate

As we have discussed throughout this thesis, nothing makes sense except in the light of evolution. Because of this, it is vital to recognize how the current understanding of morality emerges from behaviors that produce a fitness advantage. For example, altruistic and other similar types of social behaviors that underlie social constructs are evolutionarily ingrained and thus characteristic to the human species. Therefore, it is essential to examine morality, morals, and moral dilemmas from an evolutionary perspective. As Jonathan Haidt appropriately describes it: "The animal part of us follows the laws of nature, just as does a falling rock or a lion killing its prey. There is no morality in nature; there is only causality."[166] This demonstrates that moral behaviors are simply naturally selected behaviors being co-opted for usage in group and societal settings. Nonetheless, it is essential to retain this evolutionary view in assessing the morality of human behavior.

The Proximate

In addition to the foundation laid by the evolutionary perspective of moral behavior, developing a sense of morality occurs throughout an individual's life. The more acute factors in

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[165] Gert and Gert, "The Definition of Morality."
[166] Haidt, *The Happiness Hypothesis: Finding Modern Truth in Ancient Wisdom*, 293.

Haidt's list, like norms, practices, identities, institutions, and technologies, exemplify the role that surroundings play in contributing to an individual's moral development. The psychologist Lawrence Kohlberg organized the various stages of the moral development process into a theoretical construct. In his theory, Kohlberg relies upon the psychologist Jean Piaget's theory of moral judgement to craft a comprehensive framework for how children develop a sense of morality.[167] Before delving into Kohlberg's framework, it is important to note that his construct is largely reliant upon experiments he conducted with mostly young, white boys, potentially introducing a bias that impacts the overall theory.[168] Nonetheless, Kohlberg's model continues to remain influential and can help understand moral development.

Kohlberg's theory consists of three levels of complexity, involving six distinct stages, as displayed in **Figure 2**. The first level, titled the preconventional level, consists of two stages. At this level, "morality is externally controlled" with children conforming to external rules "in order to avoid punishment or receive rewards."[169] The first two stages within the preconventional level are: stage one—"punishment/obedience orientation", and stage two—"instrumental purpose orientation."[170] In these stages, moral behavior is largely dictated by consequences, with children aligning their actions to remain in accordance with the preferred outcome. In the second level, titled the conventional level, there are also two main stages. The

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[167] Gareth Matthews and Amy Mullin, "The Philosophy of Childhood," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta and Uri Nodelman, Spring 2023 (Metaphysics Research Lab, Stanford University, 2023), https://plato.stanford.edu/archives/spr2023/entries/childhood/.
[168] "Lawrence Kohlberg's Stages of Moral Development | Definition & Framework | Britannica," accessed March 17, 2023, https://www.britannica.com/science/Lawrence-Kohlbergs-stages-of-moral-development.
[169] "Lawrence Kohlberg's Stages of Moral Development | Definition & Framework | Britannica."
[170] "Lawrence Kohlberg's Stages of Moral Development | Definition & Framework | Britannica."

first is “good boy/nice girl orientation” and the second is “law and order orientation.”[171] In the conventional level, children seek out to “support rules that are set forth by others,” generally without great concern for oneself, a key difference between the first and second level of moral development.[172] In the final level of moral development, titled the postconventional or principled level, there are also two stages: stage five—social contract orientation and stage six—universal ethical principle orientation.[173] At this level of moral development, a level which some may never reach, “morality is defined in terms of abstract principles and values that apply to all situations and societies.”[174]

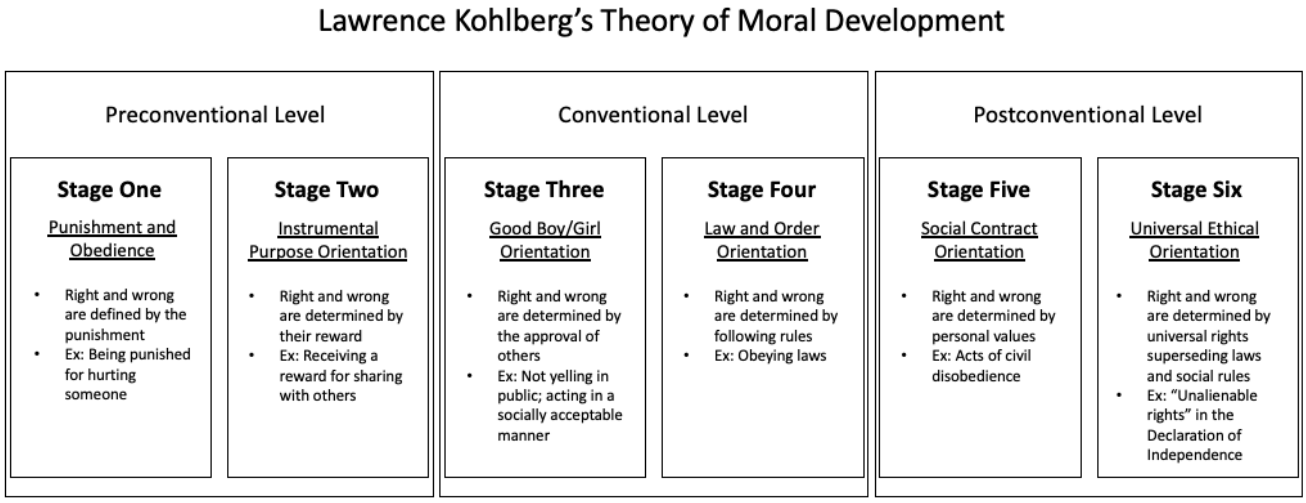

***Figure 2**: This is a diagram of Kohlberg's theory of moral development. The three levels and six stages can be seen, along with examples for each stage.*

[171] “Lawrence Kohlberg’s Stages of Moral Development | Definition & Framework | Britannica.”
[172] “Lawrence Kohlberg’s Stages of Moral Development | Definition & Framework | Britannica.”
[173] “Lawrence Kohlberg’s Stages of Moral Development | Definition & Framework | Britannica.”
[174] “Lawrence Kohlberg’s Stages of Moral Development | Definition & Framework | Britannica.”

In all, while this framework has its issues, it provides a comprehensive picture as to how children develop a sense of morality. Understanding this manner of development remains essential to understanding how people deal with moral dilemmas.

The Neuroscience of Moral Dilemmas

As has been the case throughout this thesis, it is important to recognize that many of the structures we will discuss in this section also serve other functions in the brain. This neural architecture is likely co-opted to solve more abstract problems like moral dilemmas. We must understand that the physiology behind much of the research relies on correlation, with areas that are increasingly active being more closely associated with that specific task during experiments. Importantly, this means that there is no single area of the brain tasked with resolving moral dilemmas. Rather, addressing such complex and challenging problems is the feature of a wide neural network. To that end, recent research has implicated specific areas of the brain that are commonly involved in engaging with moral dilemmas.

Much of the literature on the neuroscience of moral dilemmas is segmented into two distinct types of dilemmas—emotional and rational. While there is considerable intersection between the two, on the emotional side, recent research appears to suggest that the ventromedial prefrontal cortex (VMPC) plays an outsized role in regulating emotion, decision-making, and inception of judgements.[175] Importantly, it is necessary to note that the emotional

[175] Michael Koenigs et al., "Damage to the Prefrontal Cortex Increases Utilitarian Moral Judgements," *Nature* 446, no. 7138 (April 19, 2007): 908–11, https://doi.org/10.1038/nature05631.

responses are more closely associated with 'personal' moral violations.[176] In one particular study, lesions or damage to the VMPC reduces the capacity of a person to differentiate between right and wrong, suggesting that the VMPC plays an integrated role in dealing with moral dilemmas.[177] The authors of that same study highlighted that "in most circumstances, VMPC patients exhibit generally blunted affect and a specific defect of social emotions, but in response to direct personal frustration or provocation, VMPC patients may exhibit short-temper, irritability, and anger."[178] Moreover, the VMPC's association with other areas of the brain (like the basal forebrain and brainstem) seem to suggest that those areas might play a role in making moral decisions. The VMPC's functionality comes alongside additional research that points to the medial prefrontal cortex, posterior cingulate/precuneus, and superior temporal sulcus/temporoparietal junction being implicated with these emotional dilemmas.[179] On the rational end of moral dilemmas, brain regions associated with "abstract reasoning and cognitive" like "the dorsolateral prefrontal cortex (DLPFC) and anterior cingulate cortex (ACC)…are recruited to resolve" moral dilemmas.[180] More explicitly, in dilemmas that involve utilitarian judgements, the DLPFC experienced higher levels of activation. Nonetheless, this is a burgeoning field of research with much more research needed to be conducted in order to craft a more complete understanding of how the brain conceptualizes these moral dilemmas.

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[176] Joshua D. Greene et al., "The Neural Bases of Cognitive Conflict and Control in Moral Judgment," *Neuron* 44, no. 2 (October 14, 2004): 389–400, https://doi.org/10.1016/j.neuron.2004.09.027.
[177] Koenigs et al., "Damage to the Prefrontal Cortex Increases Utilitarian Moral Judgements."
[178] Koenigs et al.
[179] Greene et al., "The Neural Bases of Cognitive Conflict and Control in Moral Judgment."
[180] Greene et al.

The Fragility of Human Thinking

Moral dilemmas are precisely the types of decisions that a political leader regularly faces. Per the last section, these dilemmas are highly reliant on a wide variety of neural architecture, of which, many neural connections serve other functions. Because of dispersed nature of these neural circuits, it is difficult to pinpoint precisely how resolutions to dilemmas emerge. While the past section is an attempt to point out correlations amongst fMRI studies, it is a far cry from robust causal experiments. This brings up a larger point. Because solutions to moral dilemmas are a highly subjective response, it is difficult to analyze the influence of heuristics and rise of biases in answers to dilemmas. Currently, many of the institutional processes that attempt to minimize bias and the use of heuristics requires hypervigilance on part of the moral agent (in this case the political leader). This responsibility becomes difficult to accomplish when biases and heuristics are hidden amongst subjective behavior—like moral dilemmas. This is a major issue in examining the intersection between moral dilemmas, neuroscience, and decision-making. As discussed earlier, many of the ways in which leaders address biases and heuristics is heavily reliant upon the moral agent. This only works if leaders recognize the existence of specific biases and heuristics. Basically, this means leaders can only target biases that they are aware of, while undetected biases will continue creating distortions in the leaders' decisions. This remains a key consideration as we design our institutions and prevent individuals from using immense power irresponsibly or irrationally.

Concluding Thoughts: So, Why Do We Choose War?

War is devastating. It wreaks death, damage, and destruction in the name of a larger cause. Yet, the benefits of war do not necessarily justify the nightmarish horrors it creates. In short, war seemingly defies our humanity. Therefore, war presents leaders a seemingly incalculable calculus, one with grave consequences at stake. So, why do we choose war? As exhibited throughout this thesis—it's complicated. An amalgam of factors ultimately pushes leaders to make specific decisions, even those that seem as unthinkable as war. While it may be difficult, understanding these decisions and how they are made is vitally important. An analysis of the decision-making around war blends into a wider discussion examining how political leaders make consequential decisions.

Throughout this thesis we constructed a framework revolving around four factors involved in those decisions. They include uncertainty, prediction, social context, and moral dilemmas. With these four factors as our guide, we deconstructed various aspects of each variable and examined the interplay between neuroscience, psychology, and decision theory. Finally, in each chapter, we then applied our findings to Obama's Af-Pak strategic review in 2009. Through that application, we assessed where biases and heuristics may emerge in a leader's decision-making process. Importantly, we demonstrated that the inherent nature of and human's relationship with these four dimensions creates a profound impact on how leaders make decisions. In all, this thesis has shown the possible benefits and inherent dangers of granting political leaders immense amounts of power. Understanding leaders' complex relationship with these four factors—and mitigating their effects—will require vigilance from all aspects of society.

As we have demonstrated throughout this thesis, the interplay of psychology, decision theory, and, most importantly, neuroscience, can play an increasingly essential role in enhancing leaders' decisions as well as understanding them. Such interaction begs the emergence of a crucial question to this thesis's foundation: Why is neuroscience important? If it is true that the brain's functioning is oftentimes viewed as opaque, and that the interaction between the output of the brain (in the form of decisions) and the external world can be described by disciplines like psychology, philosophy, economic, and etc,, then why is neuroscience needed? Broadly speaking, this thesis is a direct response to those questions.

Throughout this thesis, we demonstrated instances where the brain's intricate internal interactions had profound impacts on the outside world. In chapter one, we discussed the key role that the mediodorsal thalamus played in crafting understandings of uncertainty. In chapter two, we utilized systems neuroscience to underscore how the brain constructs predictions and engages with probability, all the while highlighting fundamental characteristics of the brain's neural architecture. In chapter three and four, we articulated correlation between parts of the brain and particular social and moral conditions. Importantly, all this serves to demonstrate that neuroscience is essential to the study of decisions. While many other disciplines simply describe the phenomena exhibited in behavior and decisions, neuroscience enables researchers to go a step further, and explain why specific output occurs. Therefore, in constructing a bridge between neuroscience, behavior, and decisions, the value of neuroscience becomes self-evident.

Nonetheless, we cannot rest easy. The possibility of and consequences from bad decisions remain and underscores the importance of utilizing neuroscience to better

understand decisions. While we can remain assured that our current institutions are designed to prevent significant damage from an individual leader, the threat continues to exist. Therefore, as a society, we must commit to continually adapt our governmental institutions in a way that reduces the intrusion of bias and minimizes the danger from affording an individual immense power.

This thesis lays the groundwork for such adaptations. Take, for example the neural architecture behind prediction. As mentioned in Chapter Two, the brain constructs predictions in a manner akin to Bayesian inference. Thus, leaders are susceptible to heuristics resulting in confirmation bias or hypersalience of surprising stimuli. In this instance, to reduce such biases, institutions can introduce procedural measures that require leaders to task a member of their team to act as a dissenter. Much as then-Vice President Joe Biden did throughout the Obama administration's AfPak strategic review, an individual acting as a dissenter would require those involved in the process to question their prior assumptions and earlier expectations. Such a role would help negate the biases and heuristics harbored by leaders and their advisors. Similarly, we can look towards Chapter Four for another example of institutional mechanisms designed to prevent poor decision-making. As discussed in Chapter One with the Expensive Tissue Hypothesis, the brain is bounded by energetic constraints. This means only a select few areas of the brain can be activated at any given time. Because of this challenge, it becomes vital to recognize that the brain, when engaging in moral dilemmas, can only focus on the emotional or rational component of a dilemma at a given time. As described in Chapter Four, the vmPFC and dmPFC, each involved in a different perspective of resolving moral dilemmas, cannot act in concert with one another. For that reason, it is challenging for an individual to fully encompass

and appreciate the full breadth of a moral dilemma. To resolve this challenge, much like the previous example, institutions can create mechanisms that require leaders to have individuals that focus on embodying specific arguments. In doing so, a leader would be able to more fully encapsulate various ethical takes involved in moral dilemmas. Nonetheless, these examples demonstrate how, by further elucidating the capabilities of the brain, we can also discover its deficiencies and limits. Ultimately, these connections serve to exemplify how we can connect neuroscience with institutional restructuring designed to enable leaders make better choices.

While these are two proposed mechanisms to reduce bias, efforts need to be made establish other measures. Nonetheless, this thesis with its examination of biases, outlines a foundation off which an institution can design measures to mitigate bad decisions and remain resilient in the face of dangerous consequences. But more than anything else, this thesis demonstrates how political leaders are human. Thus, they are susceptible to the beauty and flaws in human judgment.

Yet, in the face of such massive challenges, we must persevere. The redesigning of governmental institutions is not burdened onto any single individual or group—it is the task of generations. It is an incessant process. Therefore, it is vital to recognize one's own agency. Perhaps the most important responsibility in society is one's duty as a citizen. The 44th President recognized this. In his farewell address, Obama said he is going to be "right there with [the American people], as a citizen, for all [his] remaining days."[181] So, with the power of the citizenry coupled with the urgency to address our biases, we must commit ourselves to

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[181] "President Obama's Farewell Address," The White House, accessed March 17, 2023, https://obamawhitehouse.archives.gov/node/360231.

improving our institutions. In doing so, we ought to adhere to Obama's words that have inspired a generation and reverberated around the world—"Yes we can."

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