

# **A Protocol Mechanism for Solving the “Right” Strategic Problem**

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## **Abstract:**

Solving the wrong strategic problem, sometimes referred to as a Type III error, is a common and costly occurrence in organizations. Unfortunately, little research offers theory-based mechanisms for reducing the likelihood of Type III errors, which is a canonical strategic management problem. In response, this article develops a novel theoretical framework drawing on multiple disciplines to hypothesize when Type III errors are likely to occur in strategic contexts. It develops three criteria derived from our hypotheses to normatively design a protocol mechanism to reduce the likelihood of Type III errors. We then offer a protocol that satisfies these conditions and provide a case study to illuminate how to employ the protocol as well as illustrate its potential for reducing Type III errors. In sum, this article offers the first theoretical assessment of individual-level impediments to “solving the right strategic problem” as well as a mechanism and associated conditions for future theoretical and empirical research.

## 1. Introduction

Scholars widely acknowledge that decision-making in organizations can be rife with biases that undermine decision efficacy (e.g., Tversky and Kahneman, 1974). Efficacy therefore can be enhanced by accounting for these biases, which requires integrating more realistic assumptions into theories of decision-making. The fields of behavioral economics, psychology, and strategic management, focusing on the decision as the unit of analysis, have offered various approaches to avoid, counteract, or nudge decision-making biases (for a recent summary see Sibony (2020)). Unfortunately, no matter how successful these approaches for mitigating decision biases might be, they do little to respond to what might be the canonical problem of strategic decision-making biases – what Mitroff and Featheringham (1974) called Type III errors; situations in which the wrong problem is solved. Indeed, other decision biases are largely immaterial if the underpinning decision premise (e.g., Simon, 1976) is too narrowly or inappropriately representing the context.<sup>1</sup>

Recent literature on strategic decision-making in organizations is shining a new light on the importance of problem finding and problem solving (PFPS) as well as advocating to formulate the “right” problem to solve as a means to avoid Type III errors, which also can mitigate some decision-making biases (Nickerson and Argyres, 2018; Nickerson, Silverman, and Zenger, 2007; 2012; Nickerson and Zenger, 2004; Sibony, Lovallo, and Powell, 2017). Research maintains that the likelihood of avoiding Type III errors is positively associated with comprehensively formulating a challenge before trying to solve it (Baer, Dirks, and Nickerson, 2013; Lyles and Mitroff, 1980; Rittel and Webber, 1973; Volkema and Gorman, 1998). Too narrow or inappropriate problem formulation not only increases the likelihood of solving the wrong problem but also is associated with a variety of biases in follow-on

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<sup>1</sup> An alternative and competing perspective to Kahneman and Tversky’s bias and heuristic approach is presented by Klein’s (1998) naturalistic decision-making approach. Klein states that poor decisions, those situations in which the decision maker could have known better, are caused by lack of experience, lack of information, and lack of mental simulation because of explaining away signs of a problem (p. 274). Type III errors are neither recognized nor considered in this approach.

decision-making (Baer *et al.* 2013; Benschmidt and Carpenter, 2020; Mitroff and Featheringham, 1974; Nickerson and Argyres, 2018; Sibony *et al.* 2017). A lack of attention to problem formulation thus reduces the efficacy of problem solving, in general. Hence, developing a comprehensive formulation of a problem is a central means by which to avoid Type III errors.

Research has made little headway on supplying a microfoundational theory for when and why decision makers are likely to make Type III errors, especially in those strategic contexts that display complexity and ill-structuredness.<sup>2</sup> Early research did offer process steps aimed at reducing the likelihood of Type III errors (Mitroff, Emshoff, and Kilmann, 1979; Niederman and DeSanctis, 1995; Volkema, 1983). While offering practical advice, these articles do not rely on microfoundations that would enable a theoretical assessment of the efficacy of proposed process steps. More recently, Baer *et al.* (2013) responded to this lacuna by introducing a microfoundational theory of impediments to strategic problem formulation in teams. They used a theory to design and assess a process-based mechanism to engender the sharing of information and knowledge, and to unify and consolidate motivations among team members to more comprehensively formulate a strategic situation characterized by complexity and ill-structuredness. While useful for theoretically understanding the impediments in teams for solving the right problem, the extant literature still lacks a microfoundational theory of the cognitive impediments that decision makers face, especially for solving the right problem in the context of strategic situations in organizations.

This article develops a model that predicts three conditions when Type III errors are likely to occur for a decision maker within an organization. We bring organizations into the analysis because a substantial literature in management indicates that organizations are rife with anxiety, fear, and threat

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<sup>2</sup> We use the term “microfoundations” in the spirit of studying how specific features of brain science aggregate to a collective level of thinking, and in our case in the context of an organization (e.g., Baer, Dirks, and Nickerson 2013; Barney and Felin 2013). Additionally, these microfoundations, which are not purely additive and instead reflect aggregate, interactional and emergent effects, enable the design of protocols that can be used in practical day-to-day activities.

(Colligan and Higgins, 2006; Motowidlo, Packard, and Manning, 1986), which generates stress that can affect problem formulation and the likelihood of Type III errors. Our theory synthesizes a variety of dual process models of thinking found in the management and psychology literatures (Epstein, Pacini, Denes-Raj, and Heier, 1996; Healey and Hodgkinson, 2017; Healey, Vuori, and Hodgkinson, 2015; Hodgkinson and Healey, 2011; Hodgkinson and Healey, 2014; Hodgkinson *et al.* 2009; James, 1890; Kahneman 2011; Laureiro-Martínez, Brusoni, and Zollo, 2010; Lieberman, 2007) to introduce a model of three modalities of thinking that spans these alternatives. Drawing on research in basic brain science, physiology, and psychology, our model incorporates “triggers” that cause shifting of thinking from one modality of thinking to another, a consideration not featured in dual process models. The final feature of our model is that it draws on construal theory (Lieberman and Trope, 2008; Trope and Liberman, 2010), which can increase the abstractness of thinking to increase the likelihood that an actor will conceptualize the “forest” (i.e., a strategic problem) through the “trees” (i.e., many alternative problem formulations) to increase the likelihood of discovering the “right” strategic problem.

This tri-mode model of thinking produces four hypotheses with respect to Type III errors. The likelihood of Type III error increases when (1) the sympathetic nervous system is activated, (2) the problem context involves complexity and ill-structuredness and the decision maker perceives familiarity with the strategic context, or (3) abstract problem synthesis mechanisms are not naturally stimulated by the context. A fourth hypothesis maintains that in the absence of specific mechanisms that address all three impediments, the likelihood of a Type III error increases the more the context is strategic, and the organization is stressful.

We use these hypotheses as criteria to normatively design a practical protocol mechanism – what we call *Triple-tier Brainstorming* – to decrease the likelihood of Type III errors. To illustrate the practicality of the protocol, we apply it to a case study of a community health center where a Type III error occurred, and the wrong strategic problem was solved. The example illustrates how Triple-tier

Brainstorming can lead to a more comprehensive problem formulation (Baer *et al.* 2013), reduce the likelihood of Type III errors, and produce a superior strategic decision.

Our theory and normative protocol create value in three ways. First, our model introduces theoretically derived and necessary criteria to reduce the likelihood of Type III errors that can arise in strategic contexts within organizations. Prior literature offers no such microfoundations. Second, while many processes for formulating problems exist, to our knowledge Triple-tier Brainstorming is the first normatively designed to satisfy a set of theory-based criteria for reducing the likelihood of Type III errors. Importantly, we acknowledge that other processes might be designed that also satisfy the theoretically defined criteria. Third, our model of three thinking modalities provides a tractable framework upon which to build additional brain science, physiological, and psychological mechanisms that impact thinking, especially corresponding to problem-finding and problem-solving (Nickerson, Yen, and Mahoney 2012) that may enable a more comprehensive model to examine other aspects and contexts of thinking.<sup>3</sup> As a result, the current article launches the potential for a stream of research to not only design additional process-based mechanisms for problem formulation and problem solving based on microfoundations but also engage in empirical assessment of these mechanisms.

This article proceeds by providing a sufficient background on Type III errors and dual process theories to generate three modalities of thinking. Furthermore, we consider the role of construal theory in formulating strategic problems conditional on the application of reasoning and executive thinking. We then assess the three modalities for their ability to affect the comprehensive formulation of the decision premise and generate hypotheses on the factors that increase the likelihood of Type III errors. The hypotheses lead to a set of necessary and sufficient conditions to design a protocol mechanism for

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<sup>3</sup> A prior version of this work referred to the model as “TPN rationality.” TPN stands for Task Positive Network, which is a recently established terminology in brain science that represents regions and networks of the brain (which are involved with all three modes of thinking highlighted in our model) that interact in response to attention-demanding cognitive tasks.

decreasing the likelihood of Type III errors. A case study illustrates how to apply the protocol in a strategic context. Finally, we propose a research program to further explore our motivating question both theoretically and empirically.

## **2. Problem Formulation, the Decision Premise, and Type III Errors**

A core presupposition during the founding of strategic management is that complex and ill-structured opportunities and problems first must be formulated before strategies can be identified and decided upon to tackle the challenge (Mintzberg, Raisinghani, and Theoret, 1976; Shrivastava and Grant, 1985; Witte, Joost, and Thimm, 1972). Indeed, strategies are essentially solution approaches for responding to and addressing strategic challenges and opportunities. Without developing a problem formulation, no objective criteria exist for generating or selecting a strategy (Nickerson and Argyres, 2018).<sup>4</sup> Thus, the notion of problem solving is first comprised of the act of problem formulation (Baer *et al.* 2013), the output of which is the problem to be solved, defined as the decision premise hereafter, followed by developing solution approaches to respond to the decision premise. Decision guidance offers an assessment of alternatives solution approaches (i.e., strategies) and is followed by the decision, which is a go or no-go determination based on the decision guidance and other factors like preference and beliefs. Therefore, solving the “right” problem crucially depends on problem formulation and the decision premise. An overview of common terms in the article and corresponding definitions is summarized in Table 1.

### **Insert Table 1 Here**

Despite concrete evidence that problem formulation poses a considerable obstacle to strategic decision-making in organizations (Lyles, 1981; Nutt, 1999), the vast majority of strategic decision-making research focuses on decision-making along with attendant mechanisms with little attention

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<sup>4</sup> Von Hippel and von Krogh (2016) offer a different point of view arguing that in informal problem solving, both a need and solution—a need-solution pair—can be discovered together and call for research on this possibility.

given to how to formulate or improve problem formulation for which the efficacy of decision guidance and decision-making relies. In essence, the focus has been on mitigating Type I (false positive) and Type II (false negative) errors with little relevant theory and research on the presence of, and mitigation strategies for, Type III errors (solving the wrong problem) (Mitroff and Featheringham, 1974; Van de Ven, 2007). Lack of focus on problem formulation – and Type III errors – is, in part, because disciplinary research typically focuses on mechanisms that by-in-large assume a problem formulation existed (Baer *et al.* 2013).

Despite a lack of theory and research focus on problem formulation, several scholars began cataloguing potential impediments to comprehensive problem formulation. For example, Volkema (1983) identified four potential factors that affect problem formation: problem complexity, individual problem formulation capabilities, the problem formulation environment, and the problem formulation process. Thus, attributes of complex and novel (i.e., ill-structured) contexts are likely to interact with cognitive, social, and emotional aspects of human nature to create specific impediments to problem formulation, increasing the potential for Type III errors (Baer *et al.* 2013; Nickerson and Argyres, 2018). For example, research has focused on how group behavior contexts can corrupt comprehensive organizational problem formulation. Groupthink and jumping to a solution (e.g., anchoring of problem formation based on group norms and suppressing alternatives), the degree to which individuals share unique views or knowledge, and the likelihood a problem will be formulated based on differing and unarticulated criteria all are ways in which group behavior can corrupt problem formulation (Baer *et al.* 2013; Janis, 1972; Nickerson and Argyres, 2018). In combination, these impediments greatly limit the comprehensiveness of group problem formulation. However, this research offers little theory on the impediments to improving problem formulation at the individual level.

Given the potential consequences of Type III errors, protocols have been viewed as mechanisms that may be constructed to alter the likelihood of their occurrence (Volkema, 1983).<sup>5</sup> Although no one protocol is likely to apply to all problem formulation scenarios (Nickerson and Argyres, 2018), any viable strategic problem formulation protocol must rely on a more fully illuminated set of impediments that are likely to arise when considering strategic contexts. By using the term “strategic” we mean situations needing decisions that (1) possess a degree of irreversibility or incur a substantial loss from irreversibility whether it is economic or reputational (e.g., a sunk cost, loss of reputation, loss of trust), and (2) involves uncertainty such that the situation premise as well as corresponding decision alternatives and their outcomes are not known with certainty (Dixit, 1989; Mintzberg *et al.* 1976; Rosenzweig, 2013; Schwenk, 1984). We aim to build upon the strategic problem formulation research by extending and synthesizing potential impediments decision makers encounter in solving the right problem. Only then can a protocol be designed to counter these impediments and substantially reduce Type III errors. For theory development, we set aside individual differences in heuristics, knowledge, and triggers to produce a general model. Consideration of how individual differences may affect Type III errors is reserved for the discussion section.

### **3. Dual Process Theories**

The idea that the brain utilizes two modalities of thinking originated with the father of American psychology, William James (1890: 22), who believed that thinking was either “associative,” which is based on heuristics developed from past experiences, or based on “true reasoning,” which relies on rules of analysis and is useful for addressing unprecedented situations. During the 1970s,

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<sup>5</sup> In the context of problem solving, some scholars refer to the term “process” to describe a sequence of steps for thinking. Unfortunately, the word “process” can be confusing because the term has been used in a variety of ways in the management literature (see also Chakraborty, Sheikh, and Subramanian, 2007; Van de Ven, 1992). To avoid confusion, we adopt the term “protocol” which is defined as a “a system of rules that explain the correct conduct and procedures to be followed in formal situations” (Dictionary by Merriam-Webster, 2021). In this article, the conduct and procedures in question pertain to steps that stimulate and guide thinking or what to think about.

Kahneman and Tversky (Kahneman and Tversky, 1973; Tversky and Kahneman, 1974) built on this foundation by introducing the dual processes of system 1 and system 2 thinking (Kahneman, 2011). System 1 is cognitively low-cost, fast, and instinctive, and offers decision premise inferences and actual decision-making based on associative thinking. A warehouse of heuristics stored in memory are called upon to quickly offer decision guidance. System 2, in comparison, is cognitively costly and slow. It draws upon the brain's reasoning and executive thinking apparatus, which is based on learned rules of analysis and thinking procedures (Perkins, 1995), to develop the decision premise, offer decision guidance, and make decisions.

Kahneman and Tversky's critical contribution is that they identified many systematic errors or biases in decision-making. These errors, they maintained, arise from the recognition that decision-makers commonly used system 1 heuristics for making decisions (Kahneman, 2011), even when system 2 may generate a more adaptive decision premise and ultimate decision in many contexts. Kahneman and Tversky's foundational insights not only impacted psychology and social psychology but also influenced the field of economics leading to the development of behavioral economics by encouraging scholars to categorize systematic biases and look for ways to mitigate them.

We highlight two prevalent classes of dual processing theories central to our model developed in subsequent sections. First is the characterization of decision-making as "hot" versus "cold," which refers to the degree of affect or emotion involved (Healey and Hodgkinson, 2017; Hodgkinson and Healey, 2014). Second is the characterization of decision-making as "fast" versus "slow," which refers to automatic versus deliberate decision-making (Kahneman, 2011). These two dual process characterizations are not synonymous as it is possible to have both cold and fast decisions as well as cold and slow decisions. (Hot and slow decisions, which we discuss in the next section, are much less likely.) For example, decision-making may be automatic with or without primary guidance from "hot" affect or emotion or, in contrast, deliberate without primary guidance from affect or emotion.

Overlaying these two dual processing characterizations provides the intuition that three rather than two modalities may better characterize thinking, suggesting the potential for hot-fast, cold-fast, and cold-slow thinking. Some research indicates that not only does the resulting decision-making diverge between these modalities but so too can the problem's decision premise (Simon, 1976; Volkema, 1983); both hot-fast and cold-fast modalities are less likely to reflect on and assess the decision premise. Importantly, the strength and presence of biases are likely to differ systematically when guided by hot-fast, cold-fast, and cold-slow thinking (Jahedi, Deck, and Ariely, 2017; Jetter and Walker, 2017; Kahneman, 2011; Kocher and Sutter, 2006; Owens and Roach, 2018; Tversky and Kahneman, 1974). With this intuition, we aim to characterize the basis for and potential importance of a three-mode model of thinking that has important consequences for developing a problem's decision premise as well as for making a decision. In the next section, we explore the science behind the possibility of three modes of thinking as well as investigate known mechanisms that might shift from one thinking mode to the next. If the necessary or sufficient conditions exist for the activation of one mode versus another then these conditions may provide a basis for normative organization protocol design that can support developing a superior decision premise and set of alternative strategies.

#### 4. **Theoretical Preliminaries**

Suggesting that three modalities of thinking exist instead of two represents a substantial break from a paradigm first established almost 130 years ago. Yet, we maintain that research in various areas of brain science and psychology already provide the building blocks for a theory with three modes of thinking and with sufficient conditions for predicting when each mode serves as the primary guide for identifying the decision premise and providing decision guidance. Each mode is primarily associated with the cognitive processing network responsible for evaluating alternative responses to stimuli, commonly referred to as the task positive network (TPN) (Fox *et al.* 2005). In what follows, we introduce these building blocks starting with automatic decision-making processes and followed by

deliberate thinking processes. We then use them to assemble a schematic model of thinking that informs the nature of the decision premise and decision guidance that is likely to emerge from each mode of thinking.

*Creating and Recalling Heuristics for Decision-Making:* The concept of associative thinking, first introduced by James (1890), is the basis for more recent research investigating the brain's automatic responses. Scholars believe neural networks in the brain store declarative memory, which include both innate and learned rules of response – what Simon (1979) and psychologists call heuristics – of how to behave and what to decide and do in response to various stimuli (Gigerenzer and Gaissmaier, 2011; Tversky and Kahneman, 1974).<sup>6</sup>

Each neural network is not separate and isolated. Instead, neural networks are typically interconnected and overlapping because a single neuron (a brain cell) may connect with up to 10,000 other neurons through its synaptic connections. Heuristics are grouped by the brain into categories and activated when a stimuli is perceived as pertaining to the same category based on actual or inferred association with that category (Gentner, 1983; Rosch, 1978). When novel situations are associated with a category, our brains respond to these situations in a similar fashion to all other situations that fit into that category whether it is adaptive or not (e.g., Krueger and Clement, 1994). Interconnections across and among neural networks mean that the activation of one neural network can link to, and cascade the activation of, many other interconnected networks through electro-chemical signals; however, the level of activation will vary depending on the strength and pathways of the connections and the degree to which the stimulus ultimately cascades to a particular network. Heuristics do not equate to the

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<sup>6</sup> Encoding, storing, and retrieving declarative memory, likely occurs through a process called long-term potentiation in which synaptic connections form between neurons and create patterns or networks of interconnections among the cells (e.g., Purves *et al.* 2008). An important aspect of these networks is that synaptic connections can vary in their strength with respect to transmitting electro-chemical signals. These networks are formed and strengthened through simultaneous activation of cells, which gave rise to the expression “neurons that fire together wire together” (Hebb, 1949).

common definition of problem formulation and decision guidance based on reasoning and executive thinking with respect to cognitive goals. Hence, neural networks provide pre-encoded learned responses to various stimuli. These responses reflect one or more implied decision premises (in the sense that the decision premise may not be articulated in memory) and decisions based on what the thinker may have learned and encoded in past experience or learning. We therefore refer to the use of heuristics to guide problem formulation and decision-making as the compound term of “associative thinking” introduced by James (1890).

Importantly, heuristics are likely to differ in intensity based on the circumstances in which they are formed. While any heuristic can be encoded, memories associated with stressful events are more readily encoded and, when triggered, have a strong activation. In what follows, we discuss how a brain region called the amygdala plays an important role in the development of heuristics.

*Amygdala and the Threat Detection System.* The amygdala is a central region of connections in the TPN and plays several important roles in storing and retrieving of memory as well as thinking.<sup>7</sup> The amygdala can be activated with a wide range of valences and intensities from positive to negative (Garavan *et al.* 2001; Winston *et al.* 2005) and commonly associated with the regulation of emotions.<sup>8</sup> While the amygdala has been shown to respond to both positive and negative information (e.g., Cunningham and Brosch, 2012), much of the literature focuses on activation with negative information

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<sup>7</sup> While commonly referenced in the singular, the amygdala is actually comprised of a pair of regions (amygdalae). Some researchers, like Swanson and Petrovich (1998), maintain that the amygdala does not exist as a separate anatomical structure and instead consists of regions associated with other structures or systems of the brain. Our focus is on specific functions that involve this region, which makes the question of structure irrelevant for our purposes. Therefore, we will refer to this region as the amygdala for convenience.

<sup>8</sup> Psychologists view emotions as a conscious experience based on interpreting the extant situation which is the result of activating various brain circuitry. The amygdala is part of the circuitry that activates and leads to emotions. Nonetheless, researchers commonly use the term emotion to refer to this circuitry and memory associated with it.

from perceiving physical or ego threats to an individual because this activation corresponds with anxiety, fear, and threat response (Davis, 1998; Gendolla and Richter, 2005).<sup>9</sup>

We maintain that this negative activation distinguishes one of our three modalities of thinking from the other two. To explain this differentiation in modalities, consider how the brain's threat detection system responds to an external stimulus. Activation of the amygdala with a negative valence fundamentally changes the nature of associative thinking because of the way memory is stored. Events for which no threat response is activated, learning is stored in declarative memory.<sup>10</sup> In this scenario, associative thinking draws on those heuristics stored in memory to quickly provide decision guidance. When the amygdala is activated, however, learning is stored simultaneously in both declarative and emotional memories with each component of memory storing different information (e.g., Debiec, LeDoux, and Nader, 2002). For example, the declarative system remembers facts but not the emotional content of the situation. Therefore, when a threat response is activated and decision guidance is needed quickly, declarative memory and emotional memory are both drawn upon and the corresponding information or heuristics combined. Combined memories from both sources can have a profound effect on and alter, perhaps dramatically, the heuristics or memories stored only in declarative memory (e.g., Debiec *et al.* 2002). Put simply, actors draw upon a different and potentially smaller set of heuristics when the amygdala is activated with negative valence and therefore is likely to provide an associative decision guidance that differs from those that lack such activation.

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<sup>9</sup> The sensing of a stimulus is brought into the brain and its signal reaches the amygdala in two ways. The first way is through a circuitry pathway that LeDoux (1995) calls a "quick-and-dirty reaction mechanism," which is fast because it essentially has one neural link to the amygdala. If the amygdala perceives a threat when comparing the stimulus to its emotional memory, albeit only through coarse recognition from the signal, then it initiates a physiological and cognitive response. The second way, which is slower but offers more thorough processing and fine-grained recognition of the situation, involves various sensory cortexes (like the auditory, occipital, or olfactory) and brain structures that compare the signal to memories of anxiety, fear, and threat, and finally the amygdala. Either system pathway can spark a threat response to focused on physical or ego preservation.

<sup>10</sup> Declarative memory, along with spatial memory, is stored in the hippocampus and the hippocampal region whereas emotional memory is located in the amygdala (see Redondo *et al.* 2014).

Activation of the amygdala with negative valence also affects decision guidance by influencing decision making goals, reducing the level of reliance on the reasoning and executive functions of the brain that can be used for identifying, assessing and reformulating the decision premise and increasing reliance on satisficing in problem solving. When the amygdala activates with negative affect, the brain shifts from cognitive goals to so-called *emotional goals*; the greater the amygdala activation the more the goals shift from cognitive, to a mix, to eventually emphasizing emotional goals. We use the term “emotional goals” as a shorthand to convey a set of autonomic goals associated with physical as well as ego preservation stimulated by the amygdala (Gendolla and Richter, 2005; Knoch *et al.* 2006).<sup>11</sup>

While the shift toward emotional goals does not necessarily imply maladaptive decision guidance, emotional goals do lead to an orientation toward short-term adaptations (e.g., Gray, 1999) that respond to perceptions of anxiety, fear, and threat.<sup>12</sup> The extreme case where emotional, short-term goals dominate is popularly referred to as “amygdala hijack” (e.g., Goleman, 1996). In essence, as amygdala activation with negative valence increases, the brain increases the salience of short-run, emotional goals compared to cognitive goals, which dramatically affects the extent to which the implicit decision premise is evaluated.

Recent research indicates that a wide variety of factors may spark amygdala activation with negative valence. Some activations seem to be innate and subconscious especially with respect to physical or ego threat stemming from predators, aggressive individuals, pain, dangerous features of the

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<sup>11</sup> Cognitive goals are associated with long-term problem formulation and decision-making relatively free of affect considerations while emotional goals are associated with optimal short-term affect related decisions. Emotional goals seek to attenuate or protect against either physical or ego-related anxiety, fear, or threat all of which are related to stress. These two types of goals often are in conflict with each other. For example, a shy student will have both types of goals competing when needing to present in front of the class: a cognitive goal to make the speech and pass the class and an emotional goal to avoid the ego-related embarrassment of presenting. However, cognitive and emotional are not always in conflict.

<sup>12</sup>Damasio and colleagues (Bechara and Damasio, 2005; Damasio *et al.* 1994; Seo and Barrett, 2007) examined decision making when emotional regions in the brain were damaged and concluded the emotions are essential for making informed decision. Our model acknowledges this view and explores the effects of valence and activation on which mode of thinking is utilized under such conditions.

environment (e.g., Blanchard and Blanchard, 1989), and even the way in which someone looks at you (LeDoux, 1995; Phillips and LeDoux, 1992). Other activation is a learned response based on experience with how people interact with each other and how these interactions might cause physical or ego-related harm. In other words, actors may have common innate and unconscious activations and common learned and conscious activations if they have faced similar experiences – often described using terms like anxiety, fear, and threat – but also may have person-specific activations if they have experienced idiosyncratic threatening experiences.

*Amygdala Activation and SNS:* The TPN is coupled with the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS), which together are component nerves of the autonomic nervous system. Activation of the SNS, which is stimulated by a set of chemicals including dopamine, norepinephrine, acetylcholine, serotonin in the brain and hormones like adrenalin and cortisol in the body, is triggered by the amygdala's activation (e.g., McGaugh, Cahill, and Roozendaal, 1996). This release of chemicals and hormones has a swift and wide-ranging effect on the body and brain. For example, blood sugar (glucose) increases and blood flow throughout the body is redirected to assist muscles for fight, flight, or freeze, dilate pupils to enhance vision, activate sweat glands to cool the body, increase heart rate, convert more oxygen in the lungs, and affect in some way just about every organ through the body. The release of these chemicals affects the brain's threat detection system in that the amygdala becomes more sensitive with its attention system searching for additional stimulus of potential threats. In essence, once the SNS is activated it affects how the brain processes information and is more likely to find additional threats even if the external environment remains unchanged (e.g., Roelofs, 2017). Research has shown that this activation can have a long-lived impact by affecting how future events are appraised (e.g., Lerner and Keltner, 2001). Therefore, an important aspect of the SNS is that while it activates quickly, it deactivates slowly and can remain energized for extended periods

(e.g., days and even longer when memory of a stimulus is recalled) even after the threat has been addressed, neutralized, or withdrawn.<sup>13</sup>

*PNS Activation and SNS Deactivation:* Whereas the SNS is sometimes referred to as the fight, flight, or freeze system, the PNS is referred to as the “rest and digest” or “cool, calm, and collected” system. These two nervous systems interconnect in an important way: studies indicate that while the SNS snaps to attention in response to a perceived threat, activating the PNS attenuates and eventually deactivates the SNS, albeit at a much slower speed. Like the SNS, the PNS is connected to many parts of the human body including the muscles, eyes, sweat glands, heart, and lungs. Physiological stimulation of these same organs can activate the PNS and deactivate the SNS, although more slowly and from many possible sources. Heuristics formed during heightened SNS activation are likely to be stronger compared to heuristics formed during lower levels of SNS activation. In addition to the more likely use of heuristics during SNS activation, heuristics formed under stress and SNS activation may differ in strength from heuristics formed in instances of lower SNS activation. Consequently, activating the PNS can shift the associative thinking from ones that derive from combined declarative and emotional heuristics and information to declarative ones alone. Indeed, research shows that SNS-PNS activations cause the brain to modulate decision-making accordingly (e.g., Bush, Luu, and Posner, 2000).

Research indicates that through regular stimulation, the PNS can be conditioned to delay or lower the sensitivity of SNS activation as well as deactivate it more quickly. Regular deep breathing, exercise, meditation, mindfulness, and relaxation (Amano *et al.* 2001; Busch *et al.* 2012; Ditto, Eclache, and Goldman, 2006; Greeson, 2009; Jerath *et al.* 2006; Mueller, 2007; Roveda *et al.* 2003; Streeter *et al.*

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<sup>13</sup> Research indicates that hormone differences between genders result in different sensitivities to activation and attenuation of the SNS (Hinojosa-Laborde *et al.* 1999). On average, women experience the firing of broader neural networks, which results in more sensitive and hence easier SNS activation than men; although, once activated, men have on average a higher SNS activation intensity due to the extent of the neural networks activated by the amygdala (Canli *et al.* 2002). Women, on average, also have demonstrated the ability to regulate and deactivate the SNS, on average, faster than men.

2012; Tang, Li, and Yang, 2009) as well as the ability to self-regulate emotional activity based on feedback (e.g., Zotev *et al.* 2011) are physiological mechanisms that can stimulate the PNS and provide this type of conditioning.

*Mindware and Cognitive Load:* Thus far, the features of brain science we examine illuminate how associative thinking – Kahneman’s (2011) fast thinking – actually is comprised of two distinct modes of thinking we can think of as “hot” versus “cold” based on amygdala and SNS activation versus PNS activation. We also introduced factors that regulate which mode of associative thinking is activated. We now consider the mode of thinking that involves reasoning and executive thinking – Kahneman’s (2011) slow thinking – to characterize it and identify the factors that activate this mode of thinking. Two features of this mode of thinking are particularly salient for our model.

First, slow thinking calls upon the reasoning and executive thinking apparatus found principally in the pre-frontal cortex region of the brain. Cognitive science maintains that the efficacy and outcome of this mode of thinking in terms of rationality relies on the “mindware” that has been learned and is accessible to an actor. Mindware, a term coined by Perkins (1995), refers to the rules, data, procedures, strategies, and other cognitive tools like knowledge of probability, logic, and scientific inference. Mindware is learned through education and experience and forms the basis of reasoning. Because of the need to learn it, individuals can and often do have differing mindware that can manifest as differences in perspective and ability in developing the decision premise and making a decision.

Second, whether subscribing to the parallel-competitive or the default-interventionist view<sup>14</sup>, somehow the brain must shift one modality of thinking to another. Put differently, the brain needs

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<sup>14</sup> Parallel-competitive theories maintain that both automatic and deliberate processes are active in parallel and compete for control when cognitive conflicts arise (Barbey and Sloman, 2007; Epstein and Pacini, 1999; Sloman, 1996; Smith and DeCoster, 2000). In contrast, default-interventionist theories view brains as “cognitive misers” that default to the less costly automatic processing and call upon deliberate thought only based on necessity or resulting from some type of intervention (Evans, 2007; Evans and Stanovich, 2013; Stanovich and West, 2000; Tversky and Kahneman, 1981).

some mechanism(s) to activate, shift, or increase use of its reasoning and executive thinking resources versus associative thinking resources. Recent research has developed a theory for such a mechanism, which is our theoretical gateway for predicting access to an actor's mindware.

*Conflict-monitoring Hypothesis:* Botvinick, Cohen, and Carter (2004) propose the conflict-monitoring hypothesis to explain when the brain engages its reasoning and executive thinking resources. The hypothesis proposes that a principal function of the anterior cingulate region of the brain is to facilitate the resolution of absent, conflicting, or inconsistent heuristics or guidance generated from associative thinking by focusing, allocating, and utilizing the brain's reasoning and executive thinking resources.

From a neurological perspective, associative thinking triggers cascades of firing neurons (e.g., Rolls, 1987). One cascade can stimulate many additional cascades because neurons are highly interconnected; for example, a single neuron can have thousands of connections each of which can launch a new cascade (e.g., Drachman, 2005). Ultimately, these cascades can produce a multitude of heuristics of varying strength. The conflict-monitoring hypothesis maintains that if one heuristic or guidance dominates all the others in terms of strength then mindware need not be accessed to generate guidance as no conflict or inconsistency exists. However, if these heuristics and guidance are absent, conflicting, or inconsistent in that no one heuristic dominates then the decision guidance is unclear. In such situations, cognitively costly mindware is increasingly engaged to analyze and resolve the decision challenge (Botvinick *et al.* 2004; Bush *et al.* 2000; Etkin *et al.* 2006; Miller and Cohen, 2001). Engaging mindware opens up the possibility of identifying, assessing and reformulating what is otherwise an implicit decision premise. An explicit decision premise that has been identified, assessed, and reformulated may change the formulation as well as solution of the problem, overcome Type III errors, and transform the nature of the decision.

*Construal Level Theory*: If we assume that strategic problems reflect high levels of complexity and ill-structuredness then we propose that accessing mindware to formulate and solve these challenges is necessary but not sufficient to avoid Type III errors. The way in which actors think depends on their level of “construal.” Construal level theory (Liberman and Trope, 2008; Trope and Liberman, 2010) derives from social psychology and captures the idea that thinking can be more concrete and contextualized (low-level of construal) or more abstract and decontextualized (high-level of construal). Wiesenfeld, Reyt, Brockner, and Trope (2017) describe that the former tends to contract people's mental horizons, “it focuses their attention on the unique and idiosyncratic demands of present circumstances” while the latter “works to expand people's mental horizons, helping them connect to their broader, more distant goals and desirable end-states.” Ill-structuredness relates to the former type but this latter mode of thinking is vital for strategy.<sup>15</sup> Moreover, low-level construal can become problematic by formulating a problem incompletely or incorrectly if the complexity of an ill-structured context exceeds boundedly rational thinking capabilities. In contrast, higher levels of construal seek more abstract representations that reduce the cognitive load and makes confronting the bounds of rationally less likely and eases the use of mindware. Indeed, a study in strategic management concludes that for those managers reacting to the same exogenous shock, a higher level of construal corresponded with more attention to opportunities (i.e., more distant goals and desirable strategic end-states) and less attention to threats (i.e., demands of present circumstances) than those with a lower level of construal (Barreto and Patient, 2013).

Research demonstrates that construal level is not random. Construal level can be manipulated (e.g., Mueller, Wakslak, and Krishnan, 2014) and actors have the ability to self-regulate their level of

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<sup>15</sup> Interestingly, while abstract thinking may indeed be vital for strategy, concrete thinking is vital for the communication of strategic goals (Carton, Murphy & Clark, 2014).

construal (e.g., Steinbach, Gamache, and Johnson, 2019: 875).<sup>16</sup> Therefore, activating a high level of construal is important for strategic challenges that benefit from broader, more distant goals and desirable end-states and for overcoming the constraints of bounded rationality when confronted with complex and ill-structured problems. Doing so when reasoning and executive thinking resources are accessed increases the likelihood of avoiding Type III errors.

In sum, with PNS activation the brain can focus reasoning and executive thinking resources to formulate and solve strategic problems by utilizing reasoning and executive thinking to identify, assess, and reformulate a decision premise in response to stimulus when heuristics conflict, are inconsistent, or lack activation. Without these triggers the brain is likely to use pre-learned heuristics to guide decision-making without a clear or accurate decision premise. Activating a high-level of construal increases the likelihood of thinking abstractly with broader, more distant goals and desirable end-states.

## **5. Hypotheses for Likelihood of Type III Errors for Strategic Contexts**

With an overview of these brain science and psychological concepts in hand, we propose a schematic model of a decision-maker based on two background assumptions. First, we assume that the problem context encompasses strategic elements characterized as complex and ill-structured. Second, our hypothesis development holds constant the attributes of the individual strategic decision-maker (i.e., we set aside variations ascribed to individual difference in heuristics, knowledge, and triggers to develop a base line case), which we revisit in the discussion section. With these assumptions, we identify and map three thinking modalities and the level of construal thinking to the conditions that increase the likelihood that the decision premise and resulting decision guidance leads to a Type III error.

To begin, assume that a stimulus with respect to a decision context sparks a perceived threat to physical or ego preservation to a strategic decision-maker and requires a decision (like the arrival of

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<sup>16</sup> For a recent application of construal theory in strategic management and decision-makers willingness to invest in novelty, see Mount, Baer, and Lupoli (2021).

an unanticipated innovation shock by a competitor that threatens the firm's strategic position, the reputation of the decision maker's leadership ability, and invites a strategic response). In such situations, the SNS activates corresponding to the magnitude of the perceived threat. We refer to this modality of thinking as Sympathetic Associative Thinking or SAT. SAT triggers three corresponding effects. First, SAT is likely to generate short-run emotional goals instead cognitive and long-run goals needed for strategic decision-making. To the extent that reasoning and executive thinking resources are engaged, mindware responds to short-run emotion-based goals, which may have a low-satisficing threshold. Second, a complex and ill-structured context increases the need for assessing and developing the decision premise. Yet, SAT draws on an existing and selective set of heuristics to provide decision-making guidance, which avoids identifying, assessing, and reformulating the implicit decision premise. Third, heuristics from SAT are based on past experiences and unlikely to be adaptive to a complex and ill-structured problem context. Individually as well as in combination, these explanations indicate that SAT increases the likelihood of Type III errors for strategic problems. This modality is depicted as SAT in Figure 1 and yields the following proposition:

**Hypothesis 1:** Assuming the presence of a stimulus from a strategic context requiring a decision, the greater a decision-maker's SNS is activated, the more likely the resulting strategic decision guidance generates a Type III error.

### Insert Figure 1 Here

Now assume that the stimulus does not activate the SNS and, instead, the PNS is active.<sup>17</sup> With PNS activation, a broader range of heuristics are available compared to when the SNS is activated, which we call Parasympathetic Associative Thinking or PAT. If the stimulus projects onto a dominant heuristic, then the problem context will seem familiar, and PAT will provide clear decision-making

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<sup>17</sup> Even though the current stimulus may not activate the SNS, a recent prior stimulus that activated the SNS may affect the current situation because the SNS could remain activated, leading to SAT. For example, a meeting filled with conflict can spillover and affect thinking and decision-making in a meeting that immediately follows. For the purpose of developing the schematic model, we set this possibility aside.

guidance. PAT likely will be adaptive if the stimulus has occurred many times before and poor outcomes (i.e., errors) triggered executive thinking to update the heuristic. That said, for a strategic problem context with complexity and ill-structuredness, this stimulus, by definition, has not developed adaptive heuristics. Therefore, relying on PAT for strategic decisions is likely to be maladaptive and produce a Type III error. In other words, the strategic decision-maker may perceive that the decision premise is familiar when, in actuality, it is not, which invites decision guidance that produces a Type III error. This modality is depicted as PAT in Figure 1 and yields the following hypothesis:

**Hypothesis 2:** Assuming the presence of a stimulus from a strategic context requiring a decision and PNS activation, the more the decision-maker perceives the decision premise as familiar, the more likely the resulting strategic decision guidance generates a Type III error.

Continuing with the assumption that the PNS remains activated, if associative thinking yields no heuristic or multiple conflicting or inconsistent heuristics with no dominant one, then the conflict monitoring hypothesis predicts that the Reasoning and Executive Thinking or RET mode is activated. RET increases the likelihood of identifying, assessing and reformulating the decision premise by making explicit and assessing the decision premise, establishing long-term and strategic goals, and developing and evaluating the performance implications of alternative solution approaches. As a result, RET can reduce the likelihood of Type III errors compared to SAT and PAT. Importantly, RET activation does not guarantee perfect rationality in the economic sense because time limitations may constrain the application of cognitive resources and that concepts, appropriate cognitive structures, or mindware useful for thinking may not yet exist in a thinker's brain.

Potential for Type III errors is not eliminated by RET because complexity and ill-structuredness of the strategic problem context may generate high cognitive load that reaches limits of bounded rationality impairing the use of mindware. Put metaphorically, the decision-maker may not be able to see the forest through the trees. This limitation in thinking can be relaxed if a high level of construal can be activated that seeks a more abstract representation of the problem context, which reduces

cognitive load. Hence, while activating RET is likely to improve a strategic decision-maker's identification, assessment, and reformulation of an explicit decision premise, which reduces the likelihood of solving the wrong problem compared to SAT and PAT, the potential for Type III errors can be reduced even further by activating high level construal thinking within RET. The effect of activating RET and then stimulating high levels of construal with RET are depicted in Figure 1 and yields the following two hypotheses:

**Hypothesis 3a:** With low perceived threat and an increasing likelihood that a stimulus activates no heuristics or multiple inconsistent or conflicting heuristics of similar strength, the lower the likelihood of Type III errors compared to either PAT or SAT for strategic contexts.

**Hypothesis 3b:** The likelihood of Type III errors declines with a higher level of construal thinking activated.

Organizational environments potentially have a profound effect on which modality is used to provide strategic decision-making. For example, organizational environments are rife with stressors that provoke the perception of threat to ego and, sometimes, physical preservation. Examples of ego-related threats include situations that are likely to stimulate anxiety and fear and include decisions that may signal incompetence within a group or lead to negative evaluation (e.g., Motowidlo *et al.* 1986) or time pressures, which lead to stress (e.g., Parker and DeCotiis, 1983), lack of job role clarity (Brief and Aldag, 1976; Lang *et al.* 2007), and overload in workload (Schlotz *et al.* 2004; Schulz *et al.* 1998) as well as interpersonal conflict, feelings of responsibility, concern for job security, unclear decision-making rights, and office politics (e.g., Motowidlo *et al.* 1986).

Such threats need not be severe or great in magnitude to trigger perceived threat and activate the SNS. In essence, as stress and the concomitant anxiety, fear, and perception of threat are fundamental aspects of organizational life, perceived threats to physical and ego preservation exist almost continuously, at least at low levels and maybe even at higher levels (Colligan and Higgins, 2006; Cortina *et al.* 2001; Sonnentag and Frese, 2003). Organizations also create episodic situations of heightened stress. Strategic decisions, for instance, may temporarily heighten the likelihood of

triggering the SNS. By definition, strategic decisions involve some degree of irreversibility combined with potential loss and uncertainty (Dixit, 1989; Mintzberg *et al.* 1976; Rosenzweig, 2013; Schwenk, 1984), not only for the organization but also for the decision-maker because outcomes can redound to the decision-maker's reputation.

Our theory assumes that strategic decision contexts arise related episodic situation within organizations when the context involves complexity and ill-structuredness, especially with respect to discovering the decision premise in strategic decision-making (Lyles, 1981; Lyles and Mitroff, 1980; Mintzberg *et al.* 1976; Mitroff and Featheringham, 1974; Nutt, 1984; Simon, 1979). Ill-structuredness implies that the situation has some type of novelty and complexity indicating the context has many aspects or dimensions to it. Whereas simple or structured situations can be resolved with adaptive guidance derived from associative thinking (so long as appropriate heuristics are present), we maintain complex and ill-structured decision contexts benefit from using RET with high levels of construal to develop adaptive decision-making guidance. As described above, organizations with a background level of stress make accessing needed RET and high levels of construal difficult, which implies that decision-makers may face particularly poor or maladaptive decision guidance when attempting to address within organizations the complex and ill-structured challenges of strategic contexts.<sup>18</sup> In other words, confronting a strategic problem under stress may stimulate associative thinking and biases like jumping to a solution (Baer *et al.* 2013; Schwenk, 1988), framing the situation from its initial presentation (e.g., Hodgkinson *et al.* 1999), and anchoring in a heuristic before other aspects of the situation are discovered (Schwenk, 1984; Tversky and Kahneman, 1974).

Without organizational mechanisms to increase the likelihood of RET, our theory implies that decision-makers may unknowingly fail to make decisions using adaptive guidance from RET and that

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<sup>18</sup> In practice, poor or maladaptive guidance manifest in terms of decision-makers quickly jumping to a solution or engaging in related associative thinking biases like anchoring and framing that inappropriately simplify the situation and enable activation of PAT.

this failure surprisingly may be more likely for strategic decisions. Ironically, this conundrum arises in precisely those situations (strategic ones) that the fields of economics, organization, and strategic management assume decision-makers in organizations will allocate substantial cognitive resources (RET) to guide decision-making. Our theory thus raises the specter that precisely when a manager needs to rely on long-run adaptive decision premise guidance, such guidance may be short-run, poorly adaptive, or even maladaptive. We therefore predict:

**Hypothesis 4:** In the absence of specific mechanisms to increase the likelihood of RET and high levels of construal, the likelihood of Type III errors are increasingly likely the more the context is strategic and the more the organization is stressful.

## 6. Mechanism design

We maintain that our theory, comprised of three modes of thinking and the use of high levels of construal thinking, is valuable for designing mechanisms to substantially reduce the likelihood of Type III errors. To illuminate the value of our theory, we suggest a class of mechanisms to reduce Type III errors and propose one such mechanism.

Our hypotheses imply that a mechanism must satisfy three conditions to reduce the likelihood of Type III errors for a strategic decision-maker. First, Hypothesis 1 outlines the impediment of heightened SNS activity and creates the first mechanism design condition, which is to activate the PNS. PNS activation is a necessary foundation to activate RET. Second, Hypotheses 2 and 3a imply that activating multiple conflicting or inconsistent heuristics is a necessary condition to activate RET. Hence, the second mechanism design condition is to stimulate multiple or inconsistent heuristics while the PNS is active. Finally, Hypothesis 3b calls for activating a high level of construal to ensure the potential impediment of exceeding cognitive load is avoided, creating the third mechanism design condition. Hypothesis 4 establishes that minimizing the likelihood of a Type III error for a strategic decision is unlikely without a mechanism designed to meet these three conditions.

What might a mechanism designed to satisfy these three conditions and decrease Type III errors look like? Based on these three conditions, this article offers a protocol we call *Triple-tier Brainstorming* (please see Figure 2). The protocol is designed as a normative mechanism to satisfy the three conditions and is based on five concrete sequential steps to substantially reduce the likelihood of Type III errors. While no singular step may be novel in and of itself, the combination and specific sequence of steps combine to form a novel mechanism in the form of an easy-to-follow protocol.

### **Insert Figure 2 Here**

*Step 1:* The first step is *preparing* the decision-maker for thinking by activating the PNS, which has the simultaneous benefit of deactivating the SNS. A variety of specific and practical tactics are offered to accomplish these activations so as to have the PNS activated during the thinking episode. As introduced above when discussing the PNS, regular deep breathing, exercise, meditation, mindfulness, and relaxation are physiological mechanisms that are shown to stimulate the PNS and provide this type of conditioning. Other protocols like focusing on a word like calm or peace (e.g., Richter *et al.* 2010) and showing gratitude and appreciation to others (e.g., vanOyen Witvliet *et al.* 2010) have also been shown to quickly activate the PNS. Activating the PNS and thereby deactivating the SNS before thinking responds to the first condition by avoiding SAT and encouraging PAT, a precondition to activating RET.

*Step 2: Committing* to avoid thinking or expressing a solution until the problem is comprehensively formulated (please also see the fifth step below) is vital because thinking of or expressing a solution, especially to others, before a problem is formulated can easily trigger the impediments the protocol mechanism is trying to avoid.<sup>19</sup> It also avoids PAT in which a dominant

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<sup>19</sup> Research on problem solving (e.g., Harvey and Kou, 2013) highlights that engaging with potential solutions can be beneficial by stimulating and enriching the generation of additional solution ideas. Yet, introducing solutions before a problem has been comprehensively formulated, especially with respect to complex and ill-structured contexts, can spark biases that increase the likelihood of Type III errors (e.g., Baer et al. 2013).

heuristic quickly emerges. This second step of the protocol satisfies part of the first condition as well as part of the second condition: it acts as a kind of safety precaution so that the decision-maker does not make a snap judgement based on a dominant heuristic from PAT.

*Step 3:* The third step launches *Tier 1 Brainstorming*. In this step the decision-maker brainstorms a comprehensive (i.e., large) number of alternative problem formulations. Practically, this step can be accomplished with one of two methods. One method (i.e., the brainstorming perspectives method) is to simply brainstorm a formulation of the strategic challenge, set it aside, and then come up with another formulation that is different. The method involves repeating this brainstorming until a large number of alternative formulations are generated.

A second and more analytic method (i.e., the stakeholder analysis method) requires identifying all relevant stakeholders and then developing several problem formulations from the perspective of each stakeholder. For the purposes of this protocol design, we define relevant stakeholders in a broad context comprised of not only those that control resources or possess decision rights that could block value creation and have the potential to create value (Asher, Mahoney, and Mahoney, 2005) but also those that are likely to appropriate value or otherwise be affected by the organization (Freeman, 1984). The list of potential stakeholders includes not only investors, consultants, managers, and employees but also customers and the broader community. This list of potential stakeholders allows for the generation of problem formulations from a broad set of stakeholders which can increase the diversity and novelty of formulations and subsequently increase RET thinking and reduce the likelihood of Type III errors. Either approach (brainstorming perspectives or stakeholder analysis method) can generate a large number of alternative formulations (e.g., 10-20) that provide different perspectives for looking at and understanding the complexity and ill-structuredness of the problem context.

This third step is designed to satisfy mechanism condition two. Developing a large number of alternative formulations equates to creating problem formulation comprehensiveness (e.g., Baer *et al.*

2013) and increases the likelihood that many heuristics will be activated from these differing perspectives. The more that are activated, the greater the likelihood that heuristics will be inconsistent or in conflict triggering RET. Additionally, a large number of formulations also provides vital alternatives with which mindware can use to identify, assess, and reformulate the decision premise.

*Step 4:* The fourth step is *Tier 2 Brainstorming* in which the decision-maker activates high level construal in search of an overarching decision premise that avoids a Type III error. In essence, the decision-maker synthesizes and writes down a decision premise that encompasses most if not all the individual problem formulations identified in step 3 by using more abstract or high-level concepts. This initial reformulation begins to decontextualize and integrate the differing perspectives and formulations. Once a higher level or more abstract decision premise is found the decision-maker is to take a metaphorical step back to brainstorm yet a higher level and more abstract decision premise. (Asking why the first overarching formulation is occurring offers one path to discover a high level or more abstract formulation.) Once a second overarching decision premise is found the decision-maker is to take one more proverbial step backwards and discover an even higher level and more abstract formulation by again ask why the formulation arises. Repeating this stepping back three times increases the likelihood of decontextualizing, synthesizing, and discovering the critical features of the central strategic problem hence increasing the likelihood of avoiding a Type III error. At the completion of step 4 the decision-maker must decide which among the strategic problems discovered should be solved as not all of them may be feasibly resolved given the decision-maker's authority and resource availability.<sup>20</sup>

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<sup>20</sup> One concern that arises from triggering higher levels of construal is that moving to higher levels of abstraction generalizes and decontextualizes the problem. Doing so may come at the expense of losing accuracy and precision of more concrete and specific problem formulations. In fact, Step 4 is designed to produce exactly this result. Yet, as higher levels of construal (and therefore abstraction) are reached the lower levels of formulation are not lost if the thinker documents them, which is part of the process. As a result, the thinker is asked to consider the formulation discovered at each construal level, which means the forest and the trees are considered together as a formulation before the problem-solving activity is chosen.

This Tier 2 Brainstorming uses the large number of formulations from the first tier of brainstorming as data points to discover and reformulate the overarching strategic decision premise. Taking these proverbial steps back decontextualizes and integrates these data facilitating a higher-level construal (i.e., finding the proverbial forest through the trees). Hence, the step satisfies mechanism design condition three by achieving a high-level construal.

*Step 5:* The final step is *Tier 3 brainstorming*, which employs conventional brainstorming of multiple solution approaches designed to solve the chosen overarching problem formulation. Each solution approach is a strategy (Nickerson and Argyres, 2018). Only when brainstorming is exhausted should strategies be evaluated against the goals of the formulated challenge/decision premise. In the analysis phase, combining and refining solution approaches is encouraged to discover the most beneficial solution approach that simultaneously mitigates the downside risks while retaining as much upside gains as possible and that provides robustness in the face of uncertainty. While the design of step 5 does not respond to a specific mechanism design condition, Tier 3 Brainstorming must be completed in order to offer decision guidance.

In sum, Triple-tier Brainstorming offers a protocol that satisfies the three specified mechanism design conditions and delivers decision guidance for making a strategic decision in a way to reduce the likelihood of Type III errors. Please note that this assessment is not meant to imply that the Triple-tier Brainstorming protocol is optimal. In fact, other protocols can be designed that satisfy the same criteria. If designed, these alternatives protocol could be comparatively assessed in terms of resources consumed to implement the protocol and an empirical assessment of outcomes.

The protocol as explicated thus far remains abstract. So, to help both scholars and practitioners ground their understanding of how to apply Triple-tier brainstorming, we offer an illustration through a case study of a community health center seeking to generate more revenue. We first present the case's strategic context and report the final decision of top management and outcome.

We then apply Triple-tier Brainstorming for the same strategic context to illuminate how the decision premise and decision outcome are likely to differ when utilizing this protocol mechanism.

## 7. Application Case Study

The C-suite of a community health center, which focuses on hourly workers and the poor, got together to discuss how to generate more revenue. Quickly the team decided to extend the center's hours to include Saturdays, a day of the week in which the center historically had been closed, as they concluded more patients equals more revenue. The C-suite team implemented their strategy of opening on weekends, which consumed substantial resources and involved new hiring commitments. Unfortunately, few of their clientele used services on Saturdays because as hourly workers, they work on Saturdays. The decision led to substantial losses for the community health center. They had to close the center Saturdays, letting newly hired staff go. We maintain that the decision premise, decision guidance, and ultimate decision may have produced a different outcome if the Triple-tier Brainstorming protocol had been applied. The following represents a hypothetical application of Triple-tier Brainstorming to illustrate how the protocol is applied and the way in which it may have substantially reduced Type III errors.

We assume that a single decision-maker is applying the protocol. (Alternatively, assume that each member of the C-suite applies this protocol before they meet.) Furthermore, we assume that the decision-maker engages in step 1 to prepare their mind for thinking and step 2 in terms of committing to forestall thinking about solutions. We thus apply the protocol beginning with Tier 1 Brainstorming.

*Tier 1 Brainstorming:* For the purpose of illustration, we offer a list of formulations from both the brainstorming perspective method and stakeholder analysis method. Figure 3 provides a representative list of formulations developed with each method. The brainstorming perspective method introduces nine differing formulations, and the stakeholder analysis method identifies four stakeholders and produces eleven formulations as shown in Figure 3. Based on our definition of

stakeholders, the stakeholder formulations encompass analysis from the perspective of administrators and employees and the broader community members such as patients and unaffiliated employers. These formulations produced by each method need not be the same but nonetheless are likely to overlap. Notice also that each formulation begins with the clause “How can ...,” which is a simple way to stimulate and pose a question representing a particular point of view.<sup>21</sup>

**Figure 3 about here**

*Tier 2 Brainstorming:* Next, the decision-maker is asked to “take a step back” and synthesize most if not all of the formulations to discover a “big picture” and overarching formulation. Consistent with the metaphor of finding the forest through the trees, each formulation from Tier 1 Brainstorming equates to a tree and now the decision-maker seeks to discover the forest that encompasses all the trees. An overarching formulation that encompasses the formulations in Tier 1 Brainstorming is:

How can the health center sustainably develop new or refine existing activities to cost effectively deliver health- and sick-care services to our target clientele, when and where they need it, in a way that lowers costs or increases our resources for patients, employers, or the community?

Once an overarching formulation is articulated, the decision-maker takes a proverbial step back to discover a bigger picture (i.e., strategic) formulation of the challenge. Asking why the first formulated challenge exists can stimulate the discovery a more strategic reformulation. For example, “why hasn’t the community health center sought out new or refining existing activities ... in a way that lowers costs or increases our resources for patients, employers, or the community?” One plausible response is:

How can the community health center effectively organize and develop a leadership approach to search for ways to sustainably expand our services to the community?

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<sup>21</sup> A more complex problem formulation approach involves identifying all correlated symptoms and discovering their root causes. We opt for the relatively simple approach because the more complex approach requires access to information and knowledge that the decision-maker may not possess.

Whereas the first reformulation illuminates the need for sustainable new or refined activities this second reformulation indicates that the lack of activities flows from a more abstract problem that the community health center is not organized to search for new ways to expand its services. To ensure that this characterization of the problem represents all aspect of the strategic issue, this step is then repeated one more time by seeking an even bigger picture (i.e., more abstract, and potentially more strategic) and overarching reformulation of the challenge. For example, one could ask “why hasn’t the community health center organized or developed a leadership approach to search for ways to sustainably expand services to the community?” This third step back might produce the following formulation:

How can we find a leader who can lead the community health center to advance its service offerings and sustainability to the next level?

Each successive reformulation synthesizes the formulations of Tier 1 Brainstorming and involves a series of abstractions that discover higher level and hence more strategic formulations of the challenge. Whereas the first reformulation can be viewed as a concatenation of prior formulations, the second formulation discovers a deeper and more strategic characterization of the problem. Likewise, the third reformulation discovers yet a deeper and even more strategic characterization of the problem. At this point in the protocol, the decision-maker is advised to choose the decision premise and hence which strategic problem to solve depending on available decision rights, resources, and persuasive ability. A member of the C-suite who is not the president of the community health center might choose the second reformulation because adopting a formulation that implies that the current organizational leader is no longer a good match for the position may not be politically tenable.

*Tier 3 Brainstorming:* With the decision premise chosen, the decision-maker brainstorms alternative solution approaches and analyzes these alternatives based on the usual factors of comparing cost, risk, feasibility, implementability, and robustness. Four plausible alternative strategies are:

1. Appoint a service R&D leader, reporting to the president, focused on service innovation.
2. Form an ad hoc committee, reporting to the president, focused on service innovation.
3. Create a standing committee, reporting to the president, focused on service innovation.
4. Choose any of these options reporting to the head of medicine.

Without detailed information about the organization, we cannot advance our illustration further to provide a final decision guidance. Nonetheless, the case study reveals that Triple-tier Brainstorming can generate a very different problem formulation and solution strategy than what the C-suite team implemented. While this illustration does not and cannot prove that Triple-tier Brainstorming substantially reduces Type III errors, it nonetheless is suggestive that the protocol can lead to a deeper, overarching, and more holistic strategic decision premise as these potential solution approaches are likely to be more adaptive than the organization's choice of opening on weekends.

## **8. Discussion**

The goal of this article was to address a canonical problem of strategic management by developing an interdisciplinary model of thinking to identify conditions under which a decision-maker in a strategic context is likely to make Type III errors and therefore solve the wrong strategic problem. Following Simon (1996, p.275), this model is necessarily schematic to bring meaningful simplicity to an inherently complex topic of thinking. The article therefore introduced a model of thinking that synthesized and integrated various dual processing models of thinking with aspects of the sympathetic and parasympathetic nervous systems, conflict monitoring hypothesis, and construal theory.

This theory adds value to the strategic management field in four ways. First, the article offers the first microfoundational model to establish necessary conditions for a decision maker to reduce the likelihood of Type III errors. It then uses these conditions as criteria to design a thinking protocol, Triple-tier Brainstorming, that responds to these criteria to help a decision maker reduce the likelihood of Type III errors.

Our protocol design is not the first to help decision-makers in strategic contexts. Perhaps the most well-known process is sensemaking (Weick, 1995). Sensemaking places stimuli into a framework

to help decision makers comprehend, understand, explain, attribute, extrapolate, and predict (for a detailed sensemaking process see Ancona, 2012). Nonetheless, sensemaking processes and Triple-tier Brainstorming differ in approach and purpose. Weick's (1995) approach to sensemaking puts identity and identification center stage where these factors do not play a role in our theory. Sensemaking is retrospective whereas our approach is "real time." Sensemaking is about building narratives whereas our approach focuses on either associative thinking or the analysis that comes from reasoning and executive thinking. Sensemaking also features an ongoing process and the use of social queues to develop plausible narratives over accurate ones. Our approach does not consider or use any of these aspects and instead specifies the necessary conditions to be overcome by protocol mechanisms to engage the fullest abilities of RET to overcome Type III errors. Sensemaking does not consider concerns about Type III errors.

Many other theories display some similarities to our theory or protocol. For example, Gibson's (1979) affordance theory is a sensemaking activity that explores the use of artifacts to solve problems. Dane and Pratt (2007) look to intuition to guide decision making. Gioia, Corley, and Hamilton (2013) offer a rigorous methodology for inductive research that collects and analyzes 1<sup>st</sup> order concepts into 2<sup>nd</sup> order themes and more abstract aggregate dimensions. While each of these perspectives offers value, none consider the possibility of Type III errors let alone the necessary conditions that a protocol mechanism needs to overcome. Furthermore, these other processes are not designed in response to strategic contexts involving complexity and ill-structuredness. We therefore conclude that Triple-tier Brainstorming is a novel protocol that adds value.

Second, our model provides value by offering a tractable framework upon which to build future research. Additional brain science, physiological, and psychological based mechanisms that impact strategic thinking could be incorporated into the model. For example, we developed our model holding the heuristics, knowledge, and triggers of the decision-maker constant. However, individuals obviously

can differ with respect to their “cognitive flexibility” (Laureiro-Martínez and Brusoni, 2018) as well as their problem solving mindware and heuristics, which can cause individuals to offer very different decision guidance when confronted with identical stimuli. Also, individuals may have idiosyncratic perceptions of threat that activate the SNS or different sensitivities to activating the PNS. For **example**, prior experience with similar stimuli, especially when that experience involved SNS activation, is likely to lead individuals to group increasingly distant stimuli together (for better or worse) in our automatic decision-making processes (Helson, 1964). In addition, stimuli may also be recognized differently based on the potential that individuals may have different possibilities (or affordances) with the same stimuli (Gibson, 1979). Thus, future theoretical and empirical research can usefully explore how individual differences in cognitive flexibility, physiology, problem solving capabilities, training, and experience can lead to differences in both the resulting decision premise and decision-making guidance when a strategic context is involved.

Third, our model offers numerous relevant empirical opportunities. For example, novices compared to subject matter experts (SMEs) may activate different thinking modalities when confronted with a strategic context. On one hand, an SME’s associative thinking relying on either SAT or PAT may have speed and quality advantages in coming up with a superior guidance for decision-making compared to a novice if the SME has faced the stimulus many times before and developed an adaptive heuristic. On the other hand, when confronted by a problem with complexity and ill-structuredness, an SME may perceive familiarity with the situation and utilize PAT. If, in fact, the situation is strategic then SMEs may offer poorly adaptive or even maladaptive decision guidance (Dane 2010). Conversely, because a novice is less likely to have any heuristic with respect to complex and ill-structured challenges, the novice may be more likely to utilize RET decision-making, so long as their SNS is not activated. If Triple-tier Brainstorming is adopted, then the novice may be better able to reduce the likelihood of Type III errors more than an SME. These questions are open to empirical investigation and could

provide new insights for normatively designing mechanisms that improve problem finding and problem solving (e.g., Nickerson *et al.* 2012).<sup>22</sup> For example, this model could generate a variety of “protocols of inquiry” that act as mechanisms to comprehensively formulate various kinds of problems and reduce Type III errors (e.g., Nickerson, 2014, 2016; Nickerson and Argyres, 2018; Nickerson, *et al.* 2007).<sup>23</sup>

Fourth, research that develops more specific hypotheses to consider our model, the complexity and ill-structuredness of challenges, and the nature of a decision-maker’s knowledge also seems warranted. This line of research may also bridge to recent research in decision-making overconfidence (Barber and Odean, 2001; Camerer and Lovallo, 1999; Malmendier and Tate, 2005; Malmendier, Tate, and Yan, 2011; Scheinkman and Xiong, 2003). The link between overconfidence and PAT decision-making seems plausible, which may help in developing a deeper understanding of overconfident decision-making and mechanisms to mitigate such decision-making, if desired. Overconfidence may also represent a form of positive valence amygdala activation, of which little research exists.

What at first glance may seem like an obvious omission in the model is the limited discussion of self-interest, which is the foundational assumption in the economics of human behavior and a variety of models of organization. Self-interest manifests in two ways in the model. First, a strong form of self-interest arises in the triggering of SNS and the innate goal to preserve ego and oneself. Self-interest may manifest differently when the PNS is activated and different still when RET is activated compared to PAT. These thinking modalities, especially RET, reflect situations where cognitive goals are not fixed and therefore can be chosen, which is necessary for adaptive problem solving. While some goals,

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<sup>22</sup> One common manifestation occurs when SMEs reject proposals from novices that eventually turn out to be novel and valuable.

<sup>23</sup> Recipes, formulas, prescriptions, blueprints, procedures, and the like differ from processes and protocols of inquiry because their steps tend to represent executions of past solutions as opposed to decision-making that derives from formulating and solving new problems.

like self-interest, may be inherent or considered a default goal, the model is open to the possibility of a more nuanced and conditional model of self-interest and the goals determined from it. For example, leaders can engage in efforts to socially condition goals beyond narrowly defined self-interest, which provides a theoretical mechanism for many sources of motivation including the importance for and impact of strategic leadership (Foss and Lindenberg, 2013; Lindenberg and Foss, 2011). While this connection to leadership is not pursued herein, the model nonetheless potentially provides a theoretical connection between leadership, goal setting, and decision-making, which may enable novel theoretical contributions to research at the nexus of strategic leadership and executive thinking.

## 9. **Conclusion**

Drawing upon dual process theories of thinking, recent advances in brain science concepts associated with the sympathetic and parasympathetic nervous systems, and the conflict-resolution hypothesis that predicts utilization of the brain's reasoning and executive thinking apparatus, we developed a novel model of thinking. The model identified three modalities of thinking – SAT, PAT, and RET – and the level of construal to predict the likelihood of Type III errors – solving the wrong problem – for decision-making in strategic contexts. We explained that each mode of thinking generates decision guidance that is likely to substantively differ from other modes. Unlike dual process theories from psychology, our model provides insight about the conditions under which one modality of thinking can shift to another modality. We used this theory to establish three conditions to guide the design of a protocol-based mechanism to substantially reduce the likelihood of Type III errors for decision-making in strategic contexts. In essence, this protocol increases the likelihood of discovering a decision premise of the overarching strategic problem instead of making a snap decision based on heuristics or a decision premise derived from surface issues. We then illustrated application of this protocol with a case study of a community health center.

The growing literature in the problem finding and problem solving (PFPS) perspective maintains that avoiding Type III errors (i.e., solving the “right” strategic problem the first time) is paramount to strategic decision-making (Nickerson and Argyres, 2018). Indeed, minimizing the potential of Type III errors has been a canonical problem and concern of the strategic management field since its founding that, until recently, offered only atheoretical suggestions on how to avoid these errors (Baer *et al.* 2013). While other works have explored the microfoundations of strategic problem formulation in teams (e.g., Baer *et al.* 2013), to our knowledge this article offers the first theory-based mechanism designed to help a decision-maker reduce the likelihood of Type III errors in strategic contexts.

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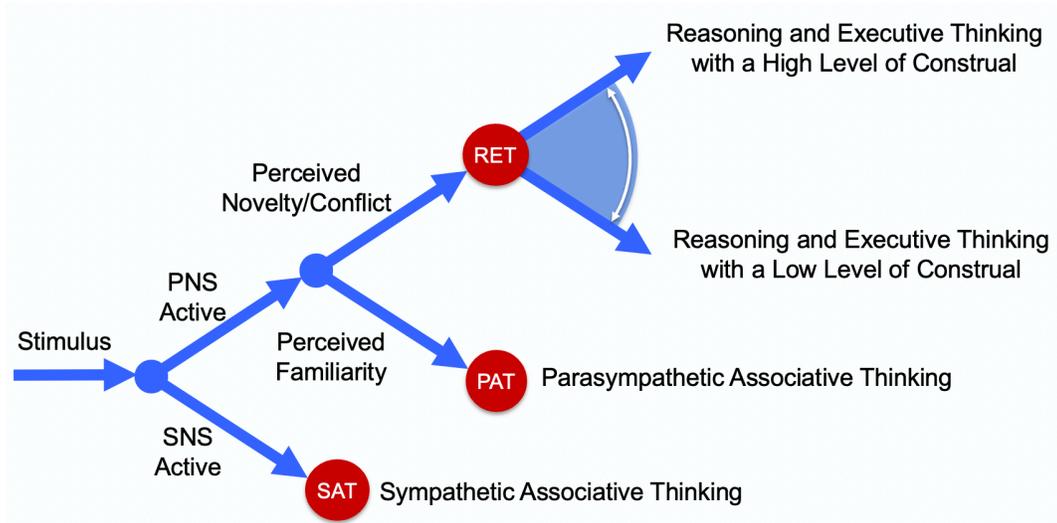
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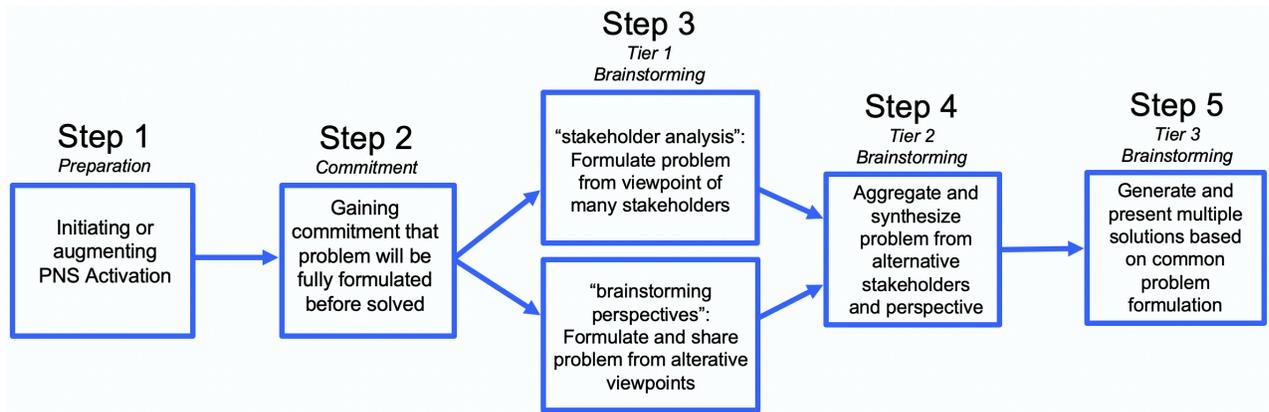
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**Figure 1: Schematic of Three Thinking Modalities**



**Figure 2: Triple Tier Brainstorming Process**



**Figure 3: Tier 1 Brainstorming Example**

**Brainstorm perspective method**

- How can we better support our clientele?
- How can we better serve our clientele?
- How can we figure out what they need, and we are not delivering?
- How can we financially support our organization’s sustainability?
- How can we provide a higher societal return/expenditures?
- How can we attract more clients?
- How can we serve employers who don’t provide insurance?
- How can we attract more resources from donors/funders?
- How can we better serve the community to secure resources?

**Stakeholder analysis method**

- **Administrators**
  - How can we increase revenue?
  - How can we respond to shortfalls?
  - How can we provide better service to our target patients?
- **Employers**
  - How can staff remain healthy and working without paying for insurance?
  - How can we reduce worker absences?
- **Healthcare workers**
  - How can we provide more health care instead of sick care?
  - How can we better support patients?
  - How can we make our jobs easier?
- **Patients**
  - How can we avoid getting sick?
  - How can we get medical help when we can’t afford to take time off for a clinic?
  - How can we afford sick care are sick?

**Table 1: Common Term Definitions**

<b>Term</b>	<b>Definition</b>
Strategic Problem	Problem possessing a degree of irreversibility, uncertainty, complexity, and ill-structuredness (Dixit, 1989; Mintzberg et al., 1976; Rosenzweig, 2013; Schwenk, 1984)
Decision Premise	The problem to be solved (Argyres and Nickerson, 2018)
Solution Approach	A strategic option to respond to the decision premise (Argyres and Nickerson, 2018)
Problem Formulation	The process of developing the decision premise that has profound implications for the quality of the solution approach (Baer et al., 2013)
Decision Guidance	The cognitive process generating and understanding the performance consequences of alternatives in preparation for making a decision.
Decision-Making	Making a decisions based on some type of decision guidance, preference, and beliefs.
Sympathetic Associative Thinking (SAT)	Thinking mode characterized by comparatively high sympathetic nervous system activation compared to PAT and RET and comparatively narrow set heuristics from which to inform decision guidance.
Parasympathetic Associative Thinking (PAT)	Thinking mode characterized by comparatively high parasympathetic nervous system activation compared to SAT and comparatively broad set of heuristics from which to inform decision guidance.
Reasoning and Executive Thinking (RET)	Thinking mode characterized by comparatively high parasympathetic nervous system activation compared to SAT and access to mindware with which to develop, assess, and reformulate a decision premise along with generating and evaluating alternative solution approaches for addressing the decision premise.